



P R O J E C T M A N U A L

**PUBLIC WORKS SERVICE CENTER
AND FIRE STATIONS # 4 & 6 FUELING IMPROVEMENTS
ROANOKE, VIRGINIA**

Invitation for Bid No. SOL1254

Issue Date: October 31, 2025

Issued by:

**Purchasing Division
Stanley Wells, Senior Buyer
215 Church Avenue, S.W., Room 202
Roanoke, Virginia 24011
(540) 853-1574
Email: stanley.wells@roanokeva.gov**

CITY OF ROANOKE, VIRGINIA

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ROANOKE, VIRGINIA
ITB NO. SOL1254**

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DIVISION 10 - SPECIALTIES:

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NOTICE OF INVITATION TO BID

CITY OF ROANOKE, VIRGINIA

Sealed Bids for:

PUBLIC WORKS SERVICE CENTER AND FIRE STATIONS # 4 & 6 FUELING IMPROVEMENTS ROANOKE, VIRGINIA

ITB NO. SOL1254

This project is generally described as the construction of fueling station with canopy at three locations, above ground fuel island, technology room, employee parking lot, fence upgrades, sidewalk, drainage improvements, stormwater BMP, utility work, parking lot improvements, tree removal, landscaping and milling & overlay. The project consists of three locations (Public Works Service Center – 1802 Courtland Road NE, Fire Station # 4 – 3763 Peters Creek Road SW and Fire Station # 6 – 1833 Jamison Avenue SE. The project limits along Courtland Road and Sycamore Avenue consist of existing variable right-of-way.

Bids, to be considered, must be received by the Due Date and Time, at or before 2:00 p.m., local time, on **December 18, 2025**. All Bids received by the Due Date and Time will be opened at the Open Date and Time, on **December 18, 2025**, at 3:00 p.m., local time and read via conference call using the call-in information listed in the Invitation to Bid.

Bids received after 2:00 pm will not be accepted or considered. The time of receipt shall be determined by the purchasing official who is to open the Bids. The ITB and related documents may be obtained from the City's Oracle Fusion system, at <https://tiny.roanokeva.gov/solicitations>.

Delivery Alert: Bidders are required to submit their bid by the due date and time electronically through Oracle Fusion or a hardcopy may be delivered to the Purchasing Division at 215 Church Avenue, S.W., Room 202, Roanoke, Virginia 24011, in a sealed envelope. Responses received after the due date and time will not be considered. All other references to delivery methods of the bid are not valid.

The Invitation to Bid, Instructions to Bidders, plans, specifications, the Sample Contract, and other Contract Documents may be examined during business hours at the Office of the City Engineer, 215 Church Avenue, S.W., Room 350, Roanoke, Virginia 24011 (Phone: 540-853-2731).

Documents may be viewed and/or downloaded from the City of Roanoke Purchasing Division's Oracle Fusion system at <https://tiny.roanokeva.gov/solicitations>.

A **Non-Mandatory** Pre-Bid conference will be conducted via Microsoft Teams Conference Call on **November 12, 2025**, 10:00 a.m., local time. It is strongly recommended that all bidders attend this conference.

Bids may not be withdrawn for a period of sixty (60) calendar days after the opening of bids unless the bid is substantially lower than the other bids because of a clerical error as defined in Section 2.2 - 4330, of the Code of Virginia (1950), as amended. Pursuant to Section 2.2 - 4330 (B)(1), the bidder shall give notice in writing and shall submit the original work papers with such notice to the City of its claim of right to withdraw the bid within two (2) business days after the opening of bids.

The City expressly reserves the right to cancel this ITB and/or reject any or all bids, to waive any informality or irregularity in the bids received, and to accept a bid which is deemed to be in the best interest of the City.

The City of Roanoke in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will

affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

Stanley Wells, Senior Buyer
Purchasing Division
City of Roanoke, Virginia

INVITATION TO BID
CITY OF ROANOKE, VIRGINIA
**PUBLIC WORKS SERVICE CENTER
AND FIRE STATIONS # 4 & 6 FUELING IMPROVEMENTS
ROANOKE, VIRGINIA**

ITB NO. SOL1254

This project is generally described as the construction of fueling station with canopy at three locations, above ground fuel island, technology room, employee parking lot, fence upgrades, sidewalk, drainage improvements, stormwater BMP, utility work, parking lot improvements, tree removal, landscaping and milling & overlay. The project consists of three locations (Public Works Service Center – 1802 Courtland Road NE, Fire Station # 4 – 3763 Peters Creek Road SW and Fire Station # 6 – 1833 Jamison Avenue SE. The project limits along Courtland Road and Sycamore Avenue consist of existing variable right-of-way.

Bids, to be considered, must be received by the Due Date and Time, at or before 2:00 p.m., local time, on **December 18, 2025**. All Bids received will be opened at the Open Date and Time, on **December 18, 2025**, at **3:00 p.m.**, local time and read via conference call using the following call-in information:

Microsoft Teams [Need help?](#)

[Join the meeting now](#)

Meeting ID: 269 679 980 710 7

Passcode: 9Ta9j8KT

Dial in by phone

[+1 469-480-4192,,811361494#](#) United States, Dallas

[Find a local number](#)

Phone conference ID: 811 361 494#

For organizers: [Meeting options](#) | [Reset dial-in PIN](#)

The Instructions to Bidders, plans, specifications, the Contract, and other Contract Documents are incorporated herein by reference. Copies of these items may be examined during business hours at the Office of the City Engineer, Noel C. Taylor Municipal Building, 215 Church Avenue, S.W., Room 350, Roanoke, Virginia 24011 (Phone: 540-853-2731). Bidders are cautioned to review bid documents thoroughly before submitting a bid.

Copies of the documents may be viewed and/or downloaded from the City of Roanoke's Oracle Fusion system at <https://tiny.roanokeva.gov/solicitations>. If you have any problems accessing the documents, you may contact Stanley Wells, Senior Buyer at (540) 853-8271 or stanley.wells@roanokeva.gov. The City will not be responsible for documents obtained from any other source.

All Contract Documents prepared and/or furnished by the City Engineer shall be the exclusive property of the City of Roanoke, Virginia, and shall not be used for any other project(s).

Each bidder is solely responsible for ensuring that such bidder has the current complete version of the Bid Documents prepared for the project, including any addenda issued by the City, before submitting a bid.

A Non-Mandatory Pre-Bid conference will be conducted via Microsoft Teams Conference Call on **November 12, 2025**, at 10:00 a.m. Click on link below to register for the Pre-Bid Meeting.

PRE-BID MEETING INFORMATION:

You are invited to a Microsoft Teams meeting.
When: November 12, 2025, 10:00 AM Eastern Time (US and Canada)

Register in advance for this meeting:

<https://events.gcc.teams.microsoft.com/event/68b7f8ce-1c53-455b-b796-1edc4b5ddf27@4b5ef942-bd40-4d06-a3df-44ad34270d92>

After registering, you will receive a confirmation email containing information about joining the meeting.

OPTIONAL SITE VISITS:

Optional site visits will be held at the dates, times and locations listed below. Bidders are not required to perform a site visit in order to submit a response to this ITB. The site visits are only being held to allow Bidders the opportunity to survey the site(s). **Bidders shall not propose any questions to City staff during the site visit.** All questions regarding the solicitation shall be submitted to Stanley Wells, Senior Buyer at stanley.wells@roanokeva.gov. **Asking questions or seeking clarifications from anyone other than the buyer on record may render an otherwise qualified Bidder non-responsive.**

DATE	LOCATIONS & TIMES
Tuesday, November 18, 2025	<ul style="list-style-type: none">Public Works Service Center: 11:00 AM – 12:00 PMFire Station No. 4: 12:30 PM – 1:00 PMFire Station No. 6: 1:30 PM – 2:00 PM
Wednesday, November 19, 2025	<ul style="list-style-type: none">Public Works Service Center: 11:00 AM – 12:00 PMFire Station No. 4: 12:30 PM – 1:00 PMFire Station No. 6: 1:30 PM – 2:00 PM
Thursday, November 20, 2025	<ul style="list-style-type: none">Fire Station No. 4: 11:00 AM – 11:30 AMFire Station No. 6: 12:00 PM – 12:30 PMPublic Works Service Center: 1:00 PM – 2:00 PM

Bidders and all subcontractors are required to comply with all applicable city, state, and federal laws, ordinances, and regulations; and are required to be properly licensed under Sections 54.1-1100, et seq., Code of Virginia (1950), as amended, prior to award of any bid to Successful Bidder. If applicable, Bidders shall deposit with their bid a Bid Security executed in the amount and form stipulated in the Instructions to Bidders.

The City expressly reserves the right to cancel this ITB and/or reject any or all bids, to waive any informality or irregularity in the bids received, and to accept a bid from the lowest responsive and responsible bidder which is deemed to be in the best interest of the City.

If an award of a contract is made, notice of the award, or the announcement of the decision to award, will be made by posting a notice of such award or announcement in the City of Roanoke Purchasing Division's Vendor Self-Service system at <https://tiny.roanokeva.gov/solicitations>.

To determine the lowest responsive and responsible bidder who may be awarded a Contract for the Work, the criteria set forth in or requested pursuant to the Instructions to Bidders or in the Bid Documents may be considered.

By submitting a bid, each bidder agrees that this is a solicitation of bids and each bidder agrees to be solely responsible for the cost or expense of its bid and the City shall have no responsibility for such costs or expenses.

If a certain brand, make, item or manufacturer is specifically and exclusively required or called for in the plans, specifications, or other contract documents, then that brand, make, item, or manufacturer shall be used unless otherwise agreed to by the City, in its sole discretion. Otherwise, an equivalent item can be requested as set forth in Section 10 of the Instructions to Bidders, or other Contract Documents.

If the bid by the lowest responsive bidder exceeds available funds, the City reserves the right to negotiate with the apparent low bidder pursuant to Section 2.2-4318 of the Code of Virginia. The conditions and procedures under which such negotiation may be undertaken are set forth in Section 2.2-4318, and Section 14.3 of the Instructions to Bidders. Any such negotiated contract shall be subject to final approval by the City in its sole discretion.

Bids may not be withdrawn for a period of sixty (60) calendar days after the opening of bids unless the bid is substantially lower than the other bids because of a clerical error as defined in Section 2.2 - 4330, of the Code of Virginia (1950), as amended. Pursuant to Section 2.2 - 4330 (B)(1), the bidder shall give notice in writing and shall submit the original work papers with such notice to the City of its claim of right to withdraw the bid within two (2) business days after the opening of bids.

The successful bidder shall comply with the Code of Virginia nondiscrimination provisions of Section 2.2-4311 and the Drug-free workplace provisions of Section 2.2-4312.

Pursuant to Code of Virginia, Section 2.2 - 4343.1, be advised that the City of Roanoke does not discriminate against faith-based organizations.

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CITY OF ROANOKE, VIRGINIA

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CITY OF ROANOKE, VIRGINIA

INSTRUCTIONS TO BIDDERS

SECTION 1. DEFINITIONS

Definitions contained in Section 1 of the General Conditions are incorporated herein by reference. The bidder should refer to the General Conditions for definitions used in the Contract Documents. "Successful Bidder" is defined as the bidder to whom the City makes an award.

SECTION 2. EXAMINATION OF SITE AND CONTRACT DOCUMENTS

- 2.1 Each bidder is responsible for examining carefully the site of the Work and the Contract and Bid Documents relating to the Work. By submitting a bid, the bidder acknowledges and agrees that it has examined and considered the conditions to be encountered at and adjacent to the site, the character, quality, and quantities of work to be performed, the material to be furnished, other requirements of the Contract Documents, and to have waived any claim or objection based thereon. Claims as a result of failure to have done such examination will not be considered by the City. See Section 8 of the General Conditions entitled "Conditions at Site."
- 2.2 Each bidder shall promptly notify, in writing, the Purchasing Division of any ambiguity, inconsistency, or error which may be discovered upon examination of the Invitation to Bid, any Bid Documents, and/or any related documents.

SECTION 3. CLARIFICATION AND ADDENDA

- 3.1 **Questions on Contract Documents:** All questions about the meaning or intent of the Contract Documents shall be directed to Stanley Wells, Senior Buyer via email at stanley.wells@roanokeva.gov. All questions must be submitted before 12:00 p.m. on December 2, 2025. **Questions received after 12:00 p.m. on December 2, 2025, may not be answered.** Bidders may only rely upon written addenda issued by the Purchasing Department and no other communication or interpretation, whether oral or written, shall have any effect or efficacy.
- 3.2 **Addenda:** Any changes, interpretations, or clarifications that may be made to the Contract Documents will be in the form of an addendum. Receipt by the bidder of such addendum shall be acknowledged on the Bid Form. **However, all bidders are solely responsible for making sure that they have received and reviewed any and all addenda that may have been issued for this Invitation to Bid.**
- 3.3 **Interpretation:** All decisions made in good faith by the Purchasing Manager on the meaning or interpretation of the Contract Documents shall be final.

- 3.4 Bidders Responsibility:** All bidders are responsible for ensuring that they have received and examined all bid documents, including all addenda, if any, that may have been issued before submitting their bid. The City is not responsible for any Invitation to Bid documents obtained from any source other than the City. If you have any questions, contact Stanley Wells, Senior Buyer by telephone at (540) 853-1574, or by email at stanley.wells@roanokeva.gov.
- 3.5 Quantities:** Where the bid documents stipulate a unit price, the quantities of the work and material set forth in the bid form or on the plans approximately represent the work to be performed and material to be furnished and are for the purpose of comparing the bids on a uniform basis. Payment shall be made to the Contractor only for the actual quantities of work performed or material furnished in accordance with the plans and specifications and it is understood that the quantities may be increased or decreased as provided in the General Conditions without in any way invalidating the bid prices.

SECTION 4. TIME FOR COMPLETION

- 4.1 Time for Completion:** Unless otherwise stated or a specific time period is set forth on the Bid Form, each bidder shall indicate in the appropriate blank the number of consecutive calendar days required by such bidder to substantially complete the specified Work, with Final Acceptance to be achieved within thirty (30) consecutive calendar days thereafter. However, no such time period may exceed the number of consecutive calendar days set forth in the Bid Form.
- 4.2 Weather:** The bidder, in preparing and submitting its bid, is required to take into consideration normal weather conditions. Normal weather means a range of weather conditions which might be anticipated, based on weather data for the past ten years. Unusual weather is weather which could not be anticipated based on such data. Normal weather conditions shall be determined from the public historical records available from the National Weather Service. The data sheets to be used shall be for the locality or localities closest to the site of the Work. No additional compensation will be paid to the Contractor because of unusual weather conditions; however, an extension of time for unusual weather may be considered by the City as indicated in the General Conditions.
- 4.3 Liquidated Damages:** The amount indicated on the Bid Form as liquidated damages as described in the General Conditions (Section 21) shall be due from and paid by the Contractor to the City and/or, in the City's discretion, shall be withheld from the Contractor's Request for Payment, and/or retainage, for each consecutive calendar day of delay in excess of the stated time required to complete the Work, unless modified by a Change Order.

SECTION 5. CONTRACTORS' LICENSES, PERMITS, FEES, AND TAXES

- 5.1 State License:** Bidders and all subcontractors are required to comply with all applicable city, state, and federal laws, ordinances, and regulations, including, but not limited to,

registration with the Virginia State Corporation Commission if required by law; and are required to be properly licensed prior to Award in accordance with Sections 54.1-1100, et seq., of the Code of Virginia, which presently requires one to be licensed as a "Class A Contractor" when the total value referred to in a single contract or project is One Hundred Twenty Thousand Dollars (\$120,000) or more; or to be licensed as a "Class B Contractor" when the total value referred to in a single contract or project is Ten Thousand Dollars to One Hundred Twenty Thousand Dollars (\$10,000 to \$120,000); or to be licensed as a "Class C Contractor" when the total value referred to in a single contract or project is One Thousand Dollars to Ten Thousand Dollars (\$1,000 to \$10,000). There are also cumulative total amounts which can require a certain class of license and bidders should check these requirements as well. (See also Section 7 of the General Conditions.)

5.2 Other Licenses, Permits, Fees, and Taxes:

- a. Successful Bidder is responsible for paying on time for all licenses, permits, fees, and taxes applicable to the project. Such charges and fees include, but are not limited to the applicable building permits, mechanical and electrical permits, hauling and dumping of material, and such bidder will have to possess a City business license and be responsible for paying City of Roanoke business license taxes, as applicable. See Section 3 of the General Conditions.
- b. Right of Way Excavation Permit – Bidders are advised that all work within the public rights of way requires a Right of Way Excavation Permit from the City's Department of Public Works and/or the City's Department of Planning, Building and Development. The Successful Bidder, at its cost, shall be responsible for obtaining such permit(s) and providing a separate Excavation Permit Bond(s) in accordance with the requirements of the City's Right of Way Excavation and Restoration Standards, Revised July 1, 2020. Any such Bond(s) or other items are in addition to the Performance Security and Labor and Material Payment Security required for this Project.

5.3 Virginia State Corporation Commission: Each Bidder who is a stock or nonstock corporation, limited liability company, business trust, or a limited partnership or other business entity shall be authorized to transact business in the Commonwealth of Virginia as a domestic or foreign business entity if required by law. Each such Bidder shall include in its bid response the Identification Number issued to it by the Virginia State Corporation Commission (SCC) and should list its business entity name as it is listed with the SCC. Any Bidder that is not required to be authorized to transact business in the Commonwealth as a domestic or foreign business entity as required by law shall include in its bid response a statement describing why the Bidder is not required to be so authorized. (See Va. Code Section 2.2-4311.2).

SECTION 6. PREPARATION AND SUBMISSION OF BIDS

6.1 Bid Form: Bids shall be submitted on the Bid Form furnished, or copy thereof, and shall be completed and signed in ink. A copy of the Bid Form is provided in these specifications for the information of bidders only. Except as may be otherwise stated, all blank spaces in the Bid Form should be filled in and no changes shall be made to the

Bid Form. Erasures or other changes in a bid amount must be explained or noted over the initials of the bidder. Bids containing any conditions, omissions, unexplained erasures, alterations or items not called for in the bid documents, or irregularities of any kind, may be rejected by the City as being incomplete and/or non-responsive.

- 6.2 Escrow:** In accordance with Section 2.2 - 4334, of the Code of Virginia, for bids of \$200,000 or more for construction of highways, roads, streets, bridges, parking lots, demolition, clearing, grading, excavating, paving, pile driving, miscellaneous drainage structures, and the installation of water, gas, sewer lines and pumping stations, the Bid Form will include a space for the bidder to indicate an option to use the escrow account procedure in order to have retained funds paid to an escrow agent. Otherwise, unless stated in the Supplemental General Conditions, no escrow will be provided.
- 6.3 Signatures:** Each bid must give the full business address of the bidder and be signed by bidder with its usual signature. Bids by partnerships must furnish the full name of all partners and must be signed in the partnership name by one of the members of the partnership or an authorized representative, followed by the signature and designation of the person signing. Bids by corporations must be signed with the legal name of the corporation followed by the name of the state in which they are incorporated and by the signature and designation of the president or other person authorized to bind it in the matter. The name of each person signing shall also be typed or printed below each signature. A bid by a person who affixes to his signature the word "President," "Authorized Agent," or other designation without disclosing such principal firm or employer, may be held to be the bid of the individual signing. Satisfactory evidence of the authority of the president or authorized agent signing on behalf of the corporation shall be furnished upon request by the City.
- 6.4 Bid Amounts: Bidders** shall indicate in the appropriate blank spaces on the Bid Form the amounts for the base bid and any alternates, written with ink or typed, in both words and figures. In the event of a discrepancy between the words and figures expressed in the base bid or alternates, the word amount shall govern. Any unit prices for separate items as called for on the Bid Form shall be written with ink or typed in figures in the appropriate blanks.
- 6.5 Bid Package Checklist:** Bidders should include with their bid the documents or information set forth in the Bid Package Checklist. See Section 16.

SECTION 7. RECEIPT AND OPENING OF BIDS

- 7.1 Delivery of Bid:** It is the responsibility of the bidder to assure that its bid is delivered to the place designated for receipt of bids and prior to the time set for receipt of bids. No bids received after the time designated for receipt of bids will be considered.
- 7.2 Receipt of Bid:** The Bid Form, the Bid Security, and all other documents required to be submitted with the bid shall be submitted electronically through Oracle Fusion or a hardcopy may be delivered to the Purchasing Division at 215 Church Avenue, S.W., Room 202, Roanoke, Virginia 24011, in a sealed envelope. Responses received after

the due date and time will not be considered. All other references to delivery methods of the bid are no longer valid.

- 7.3 Opening of Bid:** Bids will be opened and read at the time and place stated in the Invitation to Bid. The contents may be made public in accordance with Section 2.2-4342 of the Code of Virginia. The officer or agent of the City, whose duty it is to open them, will decide when the specified time has arrived. No responsibility will be attached to any officer or agent for the premature opening of a bid not properly addressed and identified.
- 7.4 Withdrawing Bid:** After the date of opening of bids, no bid may be withdrawn for at least sixty (60) calendar days after such opening date, except as provided in Section 12 of these Instructions to Bidders.

SECTION 8. BID SECURITY

Each bid of \$100,000 or more must be accompanied by a Bid Security in an amount equal to five (5%) percent of the maximum possible bid price in accordance with Sections 2.2-4336 and 2.2-4338 of the Code of Virginia. The Bid Security shall be furnished in one of the following forms:

- a. Bid Bond, in a form substantially similar to the one provided in the Contract Documents, made payable to the City of Roanoke and properly executed by the bidder as Principal and a Corporate Surety authorized to transact business in the Commonwealth of Virginia. Attorneys-in-fact who execute Bid Bonds must file with the bond a certified copy of their Power of Attorney.
- b. Certified check, cashier's check, or cash escrow deposited with the City of Roanoke Treasurer in the face amount required for the Bid Security and made payable to the City of Roanoke.
- c. Personal Bond or Letter of Credit issued by an authorized financial institution in the face amount required for Bid Security, made payable to the City of Roanoke. These forms of security shall be submitted for review and must be approved by the City Attorney, in his/her sole discretion, at least three (3) business days prior to receiving bids. Approval will be based upon a determination that the form of security offered will adequately protect the interests of the City as equivalent to a corporate surety's bond.
- d. For return of Bid Security, see Sections 13 and 14 of these Instructions to Bidders.

SECTION 9. INTENT

- 9.1 Work Required:** The City requires that the Successful Bidder perform a complete and satisfactory job in accordance with the Contract Documents.
- 9.2 Conflicts in Contract Documents:** Anything called for by one of the Contract Documents and not called for by the others shall be of like effect as if required or called for by all Contract Documents. In the case of conflict between the Contract Documents, the Contract Documents shall take precedence in the following order: The Contract Documents; addenda starting with the last issued addendum; the Supplemental General

Conditions; the General Conditions; the Special Conditions; the specifications with attachments; and the drawings.

- 9.3 Work Not Described:** All work not specifically described in the Contract Documents, yet required to produce a fully functional and properly operating project shall be provided even though every item or minor detail for the proper installation or successful operation of the entire Work is not mentioned in the Contract Documents.
- 9.4 Completion of Work:** The Successful Bidder acknowledges and agrees that it has taken into account in its bid the requirements of the bid and Contract Documents, local conditions, availability of material, equipment, labor, and any other factors which may affect the performance of the Work. The Successful Bidder agrees and warrants that it will complete the Work not later than the time period or date indicated for completion.

SECTION 10. MATERIAL AND WORKMANSHIP

- 10.1 "Or Equal" Clause:** The particular brand, make of material, device, or equipment described in the Contract Documents establishes a standard of required function, economy of operation, dimension, appearance, and quality to be met by any proposed substitution. **No substitution will be considered unless a written request for approval has been submitted by the bidder and has been received by the Purchasing Division before 12:00 p.m. on December 2, 2025.** Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance and test data, and any other information necessary or required by the City for an evaluation. A statement setting forth any changes in other material, equipment, or work that incorporation of the substitute would require shall be included. The burden of proof of merit of the proposed substitute is upon the bidder. **Request for substitution must be submitted with appropriate documentation to stanley.wells@roanokeva.gov.**
- 10.2 Approval of Substitution:** The City's decision of approval or disapproval of a proposed substitution shall be in his sole discretion and shall be final. If the City approves any proposed substitution, such approval will be set forth in an addendum issued to all recorded bidders. Bidders shall not rely on approvals made in any other manner.
- 10.3 Adaptation Due to Substitution:** The Successful Bidder shall be responsible for making all changes in the Work necessary to adapt and accommodate any equivalent product or item which it uses. The necessary changes shall be made at the Successful Bidder's sole expense.

SECTION 11. STATEMENT OF QUALIFICATIONS

Each bidder shall be prepared to submit evidence of qualifications, experience, and financial ability to perform the Work set forth in the Contract Documents, should such be required by the Contract Documents or requested by the City Engineer. Furthermore, each bidder must notify the Purchasing Division and Engineering Division if bidder has been terminated from any contract or job in the last three (3) years and/or if bidder has been during the last three (3) years debarred from bidding on or performing any federal, state or local procurement or job. If so, bidder must supply details of such matters by separate written statements included with bidder's response. Any bidder who is currently debarred will not be eligible to bid on this project.

SECTION 12. ERRORS IN BIDS

- 12.1 Withdrawal of Bid:** A bidder may withdraw its bid from consideration if the price bid was substantially lower than the other bids due solely to a mistake therein, provided the bid was submitted in good faith, and the mistake was a clerical mistake as opposed to a judgment mistake, and was actually due to an unintentional arithmetic error or an unintentional omission of a quantity of work, labor, or material made directly in the compilation of a bid, which unintentional arithmetic error or unintentional omission can be clearly shown by objective evidence drawn from inspection of original work papers, documents, and material used in the preparation of the bid sought to be withdrawn.
- 12.2 Withdrawal Procedure:** The bidder shall give notice in writing and shall submit the original work papers with such notice to the City of its claim of right to withdraw its bid within two (2) business days after the conclusion of the opening of bids as set forth in Section 2.2 - 4330 (B)(1), of the Code of Virginia.
- 12.3 Withdrawal Requirements:** Other applicable provisions of Section 2.2 - 4330 of the Code of Virginia shall apply to any errors in bids or any requested withdrawal due to errors in bids.

SECTION 13. REJECTION OF BIDS

- 13.1 Rejection of Bids:** The City reserves the right to cancel the Invitation to Bid, to reject any or all bids, to reject the bid of a bidder who is not in a position to perform the contracts, or to waive any informalities in any bid.
- 13.2 Bid Security Return for Rejected Bids:** The Bid Security will be returned to all rejected bidders after the City has issued and posted an Award.
- 13.3 Bid Security Return for Unsuccessful Bids:** Should a bid not be accepted by the City within sixty (60) consecutive calendar days after the opening of bids, or within such other time specified in the Bid Documents, each bidder may obtain its Bid Security from the City.

SECTION 14. ACCEPTANCE OF BIDS, EVALUATION OF BIDS, AWARD OF CONTRACTS, AND SECURITY REQUIREMENTS

- 14.1 Acceptance of Bids:** Each bidder should submit with its bid documentation the bidder's legal name and indicate the type of business entity bidder is operating under; i.e., if a corporation, bidder should enclose a copy of the Certificate of Incorporation issued by the State Corporation Commission; if a partnership, bidder should enclose a copy of the relevant portions of the Partnership Agreement; if a limited liability company, bidder should enclose a copy of the Certificate of Organization.
- 14.2 Evaluation and Award to Lowest Responsive and Responsible Bidder:** To determine the lowest responsive and responsible bidder with respect to this bid, the following items may be considered so as to protect the interest of the City:

- a. The total base bid price plus the price of any alternates (aka additive bid item) the City elects to accept, if any. The City reserves the right to accept alternates in any order or combination.
- b. If a unit price contract is requested, the total amount based on the estimated quantities as set forth in the Bid Form will be considered. (The listed unit prices for each item will control and any multiplication errors may be adjusted by the Purchasing Division using the proper estimated quantities.)
- c. The ability, capacity and skill of the Bidder to perform the contract or provide the services and/or items required.
- d. Whether the Bidder can perform the contract promptly and within and within the time specified, without delay or interference.
- e. The character, integrity, reputation, judgment, experience and efficiency of the Bidder.
- f. The quality of performance of previous contracts or services.
- g. The previous and existing compliance by the bidder with laws and ordinances relating to the contract, purchase or service.
- h. The equipment and facilities available to the bidder to perform the contract or provide the services and/or items.
- i. The sufficiency of the financial resources and ability of the bidder to perform the contract or provide the services and/or items.
- j. The quality, availability and adaptability of the supplies, materials, equipment or services to the particular use required.
- k. The ability of the bidder to provide future maintenance, parts, and service for the use of the subject of the purchase or contract, if required.
- l. Bids shall be evaluated based on the requirements set forth in this Invitation to Bid, and other criteria to determine acceptability such as inspection, testing, quality, workmanship, delivery, suitability for a particular purpose and life cycle cost. The City, in its sole discretion, may elect to waive an informality in any bid.

Should a Contract be awarded to a bidder, it will be awarded to the lowest responsive and responsible bidder. If an award of a contract is made, notice of the award, or the announcement of the decision to award, will be made in the City's Vendor Self Services system, <https://tiny.roanokeva.gov/solicitations>.

- 14.3 Negotiation of Bid:** If the bid by the lowest responsive and responsible bidder exceeds available funds, the City reserves the right to negotiate with the apparent low bidder pursuant to Section 2.2-4318 of the Code of Virginia. The conditions and procedures under which such negotiation may be undertaken are that the appropriate City officials shall determine that the lowest responsive and responsible bid exceeds available funds and notify such bidder in writing of its desire to negotiate. Thereafter, negotiations with the apparent low bidder may be held to obtain a Contract within available funds involving discussions of reduction of quantity, quality, or other cost saving mechanisms. Any such negotiated Contract shall be subject to final approval of the City, in the sole discretion of the City.
- 14.4 Contract Execution:** The Successful Bidder shall be required, within fourteen (14) consecutive calendar days after receipt of the Contracts, to return the signed Contracts, and furnish to the City all other documents as enumerated hereinafter:
- a. Performance Security, for each contract (if applicable)
 - b. Labor and Material Payment Security, for each contract (if applicable)
 - c. Certificate of Insurance
 - d. Escrow Agreement (if applicable)
- 14.5 Security:** A Performance Security and a Labor and Material Payment Security each in the amount of one hundred percent (100%) of the contract amount for all contracts in excess of One Hundred Thousand Dollars (\$100,000) in accordance with Sections 2.2-4337 and 2.2-4338 of the Code of Virginia, shall be furnished by the Successful Bidder in one of the following forms:
- a. A Performance Bond and a Labor and Material Payment Bond, on forms as provided in the Contract Documents, made payable to the City of Roanoke, properly executed by the Successful Bidder as Principal and a Corporate Surety authorized to transact business in the Commonwealth of Virginia. Attorneys-in-fact who execute the bonds must file with each bond a certified copy of their Power of Attorney.
 - b. Certified checks, cashier's check, or cash escrow in the face amount required for the Performance Security and the Labor and Material Payment Security each made payable to the City of Roanoke.
 - c. Personal Bond or Letter of Credit issued by an authorized financial institution in the face amount required for the Performance Security and the Labor and Material Payment Security, made payable to the City of Roanoke. These forms of security must be approved by the City Attorney, in his/her sole discretion. Approval will be based upon a determination that the form of security offered will adequately protect the interests of the City as equivalent to a corporate surety's bond.

14.6 Escrow Agreement Form: In the event the Contracts meet the requirements as stipulated in Section 6.2 of these Instructions to Bidders and the Successful Bidder elects to use the escrow account procedure, the Escrow Agreement Form, as provided in the Contract Documents, shall be executed and submitted to the City within fifteen (15) calendar days after receipt of written notification of bid acceptance. If the executed Escrow Agreement Form is not submitted within the fifteen-day period, the Successful Bidder shall forfeit and waive the rights to the use of the escrow account procedure.

14.7 Bid Security Return for Successful Bid: Upon the execution of the Contract Documents and approval of the Performance and Payment Securities, the Bid Security shall be returned to the Successful Bidder. Should the Successful Bidder fail or refuse to execute the Contract Documents or furnish the required Performance and Payment Securities within the stipulated time, the Bid Security shall be due and paid to the City and the City shall be entitled to collect the Bid Security. In addition, the City may pursue any and all other remedies available to it at law or in equity against said bidder.

SECTION 15. ETHICS IN PUBLIC CONTRACTING

The provisions, requirements, and prohibitions as contained in Sections 2.2 - 4367 through 2.2-4377, of the Code of Virginia, pertaining to bidders, offerors, contractors, and subcontractors are applicable to this project. Direct contact with any City employee and/or City's consultant (if applicable) without permission of the Purchasing Manager or her designated representative, on the subject of this bid, is strictly forbidden. Violation of this Instruction may result in disqualification of Bid.

SECTION 16. BID PACKAGE CHECKLIST

The following items must be completed and included in your bid package. Failure to include all required forms may result in rejection of the bid. If any of these documents were not included with your Project Manual, please contact Stanley Wells, Senior Buyer by phone at (540) 853-1574, or by email at stanley.wells@roanokeva.gov.

- a. Completed Bid Form (all pages).
- b. Properly Executed Bid Security (Bid Bond, Certified or Cashier's Check, etc., if applicable).

SECTION 17. PROTESTS

Any bidder who wishes to protest or object to any award made or other decisions made pursuant to the Invitation to Bid may do so only in accordance with the provisions of Sections 2.2-4357, 2.2-4358, 2.2-4359, 2.2-4360, 2.2-4363, and 2.2-4364 of the Code of Virginia, and only if such is provided for in such Code Section. Any such protest or objection must be in writing signed by a representative of the entity making the protest or objection and contain the information required by the applicable Code Sections set forth above. Such writing must be delivered to the City Purchasing Manager within the required time period.

SECTION 18. MISCELLANEOUS

- a. No bidder shall confer on any public employee having official responsibility for a purchasing transaction any payment, loan, subscription, advance, deposit or money, service, or anything of more than nominal value, present or promised, unless consideration of substantially equal or greater value is exchanged.
- b. The City may make investigations to determine the ability of the bidder to perform or supply the services or items as described in this Invitation to Bid. The City reserves the right to reject any bid if the bidder fails to satisfy the City that it is qualified to carry out the obligations of the proposed contracts.
- c. The Successful Bidder must comply with the nondiscrimination provisions of Section 2.2-4311 of the Code of Virginia, which are incorporated herein by reference.
- d. The Successful Bidder must comply with the drug-free workplace provisions of Section 2.2-4312 of the Code of Virginia, which are incorporated herein by reference.
- e. It is the policy of the City of Roanoke to maximize and encourage participation by local, Small, Minority-Owned, Women-Owned, and Service Disabled Veteran-Owned businesses in all aspects of City contracting opportunities.
- f. The Successful Bidder shall comply with all applicable City, State, and Federal laws, codes, provisions, and regulations.
- g. Providers of any outside services shall be subject to the same conditions and requirements as the Successful Bidder in regards to law, code or regulation compliance. The City reserves the right of approval for any subcontract work, including costs thereof.
- h. This Invitation to Bid and all responses are subject to Section 2.2-4342 of the Code of Virginia regarding public inspection of records and the procedures a bidder must follow to protect trade secrets and proprietary information and could also be subject to the Virginia Freedom of Information Act.
- i. Conflict of Interests Act. The provisions, requirements and prohibitions as contained in Sections 2.2-3100, et. seq. of the Code of Virginia are applicable to this Invitation to Bid.
- j. The procurement provisions of the Code of the City of Roanoke (1979), as amended, Sections 23.2-1, et. seq., as well as the City Procurement Manual, apply to this Invitation to Bid, unless specifically modified herein. The City's Procurement Manual can be reviewed at the Purchasing office.
- k. Insurance. Successful Bidder, and any of its subcontractors, shall, at its or their sole expense, obtain and maintain during the life of the resultant contracts the insurance policies and bonds required. Any required insurance policies and bonds shall be effective prior to the beginning of any work or other performance by Successful Bidder, or any of its subcontractors, under any resultant contracts. The policies and coverages required are those as may be referred to in the sample contract and/or the general conditions or other documents of this Invitation to Bid.

- I. Each bidder is to notify in writing the Purchasing Division if any of bidder's owners, officers, employees, or agents, or their immediate family members, is currently, or has been in the past year, an employee of the City of Roanoke or has any responsibility or authority with the City that might affect the procurement transaction or any claim resulting therefrom. If so, please provide the Purchasing Division with the complete name and address of each such person and their connection to the City of Roanoke. Each bidder is advised that the Ethics in Public Contracting and Conflict of Interests Act of the Code of Virginia, as set forth in this Invitation to Bid, apply to this Invitation to Bid. Such information should be provided in writing before the bid opening date or may also be provided with the bid response.

SECTION 19. SUPPLEMENTAL INSTRUCTIONS AND/OR ADDITIONAL INFORMATION FOR BIDDERS

These Supplemental Instructions to Bidders modify, change, and/or add to the Instructions to Bidders as indicated below.

- A. Bidders are advised that this ITB and any information or documents provided pursuant to this ITB are subject to the Virginia Freedom of Information Act and the Federal Freedom of Information Act and the Bidder must comply with the provisions of those Acts to protect any documents the Bidder may want protected from disclosure pursuant to the provisions of those Acts.

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**Adopted on October 3, 2016 by City Council on
Resolution No. 40665-100316**

**Revised Plan for Participation in Public Procurement
Transactions Subject to the Virginia Public Procurement Act of Small, Minority-owned,
Women-owned, and Service Disabled Veteran-owned Businesses**

1. POLICY STATEMENT

It is the policy of the City of Roanoke to encourage participation by small businesses ("SB"), minority-owned businesses ("MB"), women-owned businesses ("WB"), and service disabled veteran-owned businesses ("SDVB") in all aspects of City contracting opportunities. In order to demonstrate the City's commitment to this policy, the provisions of this Plan shall apply to any contracts for goods or services with nongovernmental entities and covered by the Virginia Public Procurement Act.

2. DEFINITIONS

As used in this Plan, the following definitions shall apply:

Virginia Public Procurement Act ("VPPA") means the provisions and requirements set forth in Sections 2.2-4300, et. seq., Code of Virginia (1950), as amended.

Small business ("SB") means a business independently owned and controlled by one or more individuals who are citizens of the United States or legal resident aliens, and together with affiliates, has 250 or fewer employees, or annual gross receipts of \$10 million or less averaged over the previous three years. One or more of the individual owners shall control both the management and daily business operations of the small business.

Minority-owned business ("MB") means a business that is at least 51% owned by one or more minority individuals who are citizens of the United States or legal resident aliens, or in the case of a corporation, partnership, or limited liability company or other entity, at least 51% of the equity ownership interest in the corporation, partnership, or limited liability company or other entity is owned by one or more minority individuals who are citizens of the United States or legal residence aliens, and both the management and daily business operations are controlled by one or more individuals who are minority individuals. Minority individual means an individual who is a citizen of the United States or a legal resident alien and who is African American, Asian American, Hispanic American, or Native American, as these terms are further defined and described in Section 2.2-4310 (E) of the VPPA.

Women-owned business ("WB") means a business that is at least 51% owned by one or more women who are citizens of the United States or legal resident aliens, or in the case of a corporation, partnership, or limited liability company or other entity, at least 51% of

Project: Public Works Service Center And Fire Stations # 4 & 6 Fueling Centers

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the equity ownership interest is owned by one or more women who are citizens of the United States or legal resident aliens, and both the management and daily business operations are controlled by one or more women.

Service disabled veteran-owned business ("SDVB") means a business that is at least 51% owned by one or more service disabled veterans or, in the case of a corporation, partnership, or limited liability company or other entity, at least 51% of the equity ownership interest in the corporation, partnership, or limited liability company or other entity is owned by one or more individuals who are service disabled veterans and both management and daily business operations are controlled by one or more individuals who are service disabled veterans. Service disabled veteran means a veteran who (i) served on active duty in the United States military ground, naval, or air service, (ii) was discharged or released under conditions other than dishonorable, and (iii) has a service-connected disability rating fixed by the United States Department of Veterans Affairs.

3. EMPLOYMENT DISCRIMINATION BY CONTRACTOR PROHIBITED

Every procurement contract subject to the VPPA and of over ten thousand dollars (\$10,000.00) to which the City is a party shall contain the provisions of subparagraphs (a) and (b) herein:

(a) During the performance of this contract, the contractor agrees as follows:

1. The contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the contractor. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.
2. The contractor, in all solicitations or advertisements for employees placed by or on behalf of the contractor, will state that such contractor is an equal opportunity employer.
3. Notices, advertisement and solicitations placed in accordance with federal law, rule, or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.

(b) The contractor will include the provisions of the foregoing subparagraphs (a) (1), (2), and (3) in every subcontract or purchase order of over ten thousand dollars (\$10,000), with regard to the contract with the City, so that the provisions will be binding upon each subcontractor or vendor.

Project: Public Works Service Center And Fire Stations # 4 & 6 Fueling Centers

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4. VENDOR SELF SERVICE ("VSS")

The City's Purchasing Division manages the City's VSS system, which allows businesses to register to do business with the City of Roanoke and receive notification of business opportunities via email. Businesses can register online through the City web site by the commodity description of the services they provide, and inform the City of any SB, MB, WB, and SDVB status for which they are certified.

The Purchasing Division will serve as the primary contact for businesses to request information, instruction, and training in the VSS system.

5. ALL PUBLIC PROCUREMENT CONTRACTS

In procuring goods and services for the City, all City employees shall follow the guidelines and mandates contained in the VPPA and in the City's Purchasing Division's Procurement Manual with regard to solicitation of SB, MB, WB, and SDVB.

When bids or proposals are solicited from potential contractors, solicitations shall include, when possible, appropriate businesses from the VSS system, specifically those businesses registered with the selection of email notification flagged, including, but not limited to, the list from the Virginia Department of Small Business and Supplier Diversity.

All solicitation, addenda, and award actions over \$30,000 shall be posted on the City of Roanoke's web site <http://www.roanokeva.gov>.

Invitation to Bid solicitation notices over \$30,000 and Requests for Proposals estimated to be over \$30,000 shall be advertised in The Roanoke Tribune whenever possible and practicable. Such Invitation to Bid solicitation notices and Requests for Proposals shall also be advertised on Roanoke Valley Television (RVTV-3).

6. FEDERAL, STATE OR OTHER GRANT REQUIREMENTS

In addition to the provisions of this Plan, when the City is using funds subject to federal, state or other grant requirements with regard to SB, MB, WB, and/or SDVB, the City's Department managing the specific solicitation will take all necessary affirmative steps to ensure that the requirements of the grant or program are met.

7. DEBARMENT

Any offeror or bidder, or any principal thereof or person associated therewith, found to have engaged in substantial and intentional misrepresentation concerning either good faith SB, MB, WB, and/or SDVB participation efforts or its status as a SB, MB, WB, or SDVB shall be debarred in accordance with the VPPA and City policies from any City

Project: Public Works Service Center And Fire Stations # 4 & 6 Fueling Centers

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contracting for a period of two (2) years. This debarment shall also extend to any successor firm substantially controlled or managed, whether directly or indirectly, by any debarred individual or entity. This determination shall be made by the City Manager or a designee as set forth above. A debarment shall be reported in writing to City Council.

8. PARTICIPATION INFORMATION

The City Purchasing Division will, upon request, provide reporting of SB, MB, WB, and SDVB business participation from the VSS system.

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Project: Public Works Service Center And Fire Stations # 4 & 6 Fueling Centers

ITB# SOL1254

CITY OF ROANOKE, VIRGINIA

BID FORM

DATE: _____

SUBMITTED BY: _____
(Exact Legal Name of Bidder)

NOTE: ALL PAGES OF THE BID FORM ARE TO BE INCLUDED IN THE COMPLETED BID. ALSO, BIDS CONTAINING ANY CONDITIONS, OMISSIONS, UNEXPLAINED ERASURES, ALTERATIONS OR ITEMS NOT CALLED FOR IN THE BID, OR IRREGULARITIES OF ANY KIND, MAY BE REJECTED BY THE CITY AS BEING NON-RESPONSIVE. NO CHANGES ARE TO BE MADE TO THE BID FORM. ANY CHANGES TO A BID AMOUNT MUST BE INITIALED BY THE AUTHORIZED PERSON SIGNING THE BID FORM.

The undersigned hereby proposes and agrees, if this bid is accepted by the City of Roanoke, to enter into a Contract with the City of Roanoke, Virginia, (hereafter - City or Owner) to furnish all equipment, materials, labor, and services necessary to construct the **Public Works Service Center and Fire Stations # 4 & 6 Fueling Improvements**. The Project includes the construction of fueling station with canopy at three locations, above ground fuel island, technology room, employee parking lot, fence upgrades, sidewalk, drainage improvements, stormwater BMP, utility work, parking lot improvements, tree removal, landscaping and milling & overlay. The project consists of three locations (Public Works Service Center – 1802 Courtland Road NE, Fire Station # 4 – 3763 Peters Creek Road SW and Fire Station # 6 – 1833 Jamison Avenue SE. The project limits along Courtland Road and Sycamore Avenue consists of existing variable right-of-way

The bid form is separated into three project locations (PWSC, Fire Station # 4, Fire Station # 6 and Unit Priced Items). The lowest responsive and responsible bidder shall be the bidder with the lowest combined bid of PWSC, Fire Station # 4, Fire Station # 6 and Unit Priced Items in one contract.

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Base Bid (Parts A + B + C + D)

DESCRIPTION		BID PRICE		
PART A – Lump sum price for the construction within the Public Works Service Center Refueling Plans and all associated work (except for the work in Unit Priced items listed below in Part D),		\$ _____		
PART B – Lump sum price for the construction within the Fire Station # 4 Refueling Plans and all associated work (except for the work in Unit Priced items listed below in Part D),		\$ _____		
PART C – Lump sum price for the construction within the Fire Station # 6 Refueling Plans and all associated work (except for the work in Unit Priced items listed below in Part D),		\$ _____		
PART D – UNIT PRICED ITEMS				
DESCRIPTION	UNIT OF MEASURE	EST QTY.	UNIT PRICE	EXTENDED PRICE
Excavation and Off-Site Disposal of Unsuitable Soil Material	CY	400	\$ _____	\$ _____
Backfill for Unsuitable Soil Material – Flowable Fill (100 psi minimum)	CY	200	\$ _____	\$ _____
Backfill for Unsuitable Soil Material – VDOT 21A,	CY	100	\$ _____	\$ _____
Backfill for Unsuitable Soil Material – Non-expansive structural fill	CY	100	\$ _____	\$ _____
Woven Geotextile Fabric, Mirafi 600X or approved equal	SY	1,500	\$ _____	\$ _____
Geogrid, WINGRID BX11 or approved equal	SY	1,500	\$ _____	\$ _____
Mass Rock Removal and Off-Site Disposal	CY	50	\$ _____	\$ _____
Trench Rock Removal and Off-Site Disposal	CY	250	\$ _____	\$ _____

EXTENDED TOTAL FOR PART D – UNIT PRICED ITEMS				\$ _____
BASE BID TOTAL (PART A + B + C + D)				\$ _____

The undersigned agrees that the Unit Prices listed above will become a part of the Contract and in accordance with the Contract Documents shall be used for the purpose of adjusting the Contract Sum up or down for changes made by the City of Roanoke for increased or decreased quantities of work from the estimated quantities as indicated on the Drawings and/or in the Specifications. The Unit Prices shall include all labor, materials, equipment, services, overhead, profit, insurance, bonds, taxes, etc. to cover the finished work of the several kinds called for in place. There is no maximum or minimum amount of quantities for the materials listed below. Final unit quantities shall be adjusted upward or downward based on measured field installed quantities.

The undersigned hereby acknowledges the receipt of the following addenda to the Contract Documents:

Addendum Number _____	Dated _____
Addendum Number _____	Dated _____
Addendum Number _____	Dated _____

The undersigned hereby agrees, if this bid is accepted by the City, to commence work with an adequate force and equipment on the date stipulated in the written "Notice to Proceed" from the Office of the City Engineer and to substantially complete the work within **Five Hundred (500) consecutive calendar days** from the date stipulated in the written "Notice to Proceed", and to achieve Final Acceptance within 30 consecutive calendar days thereafter, and to pay as liquidated damages the sum of One Thousand Dollars (\$1,000.00) per day to the City of Roanoke for each consecutive calendar day in excess of the time indicated to substantially complete the work as indicated above and then to reach Final Acceptance as set forth above to fully and satisfactorily complete the Work. (See Section 21 of the General Conditions.)

By submitting a bid, the undersigned agrees it will not withdraw its bid during the time period provided for in the Invitation to Bid, except as provided for therein.

The undersigned agrees that if this bid is accepted by the City, the failure or refusal of the undersigned to execute the Contract with the City and furnish to the City the required bonds and certificates of insurance within fourteen (14) consecutive calendar days from receipt of the Contract Documents may result in a payment of the Bid Security to the City as liquidated damages.

The attention of each bidder is directed to Code of Virginia, Sections 54.1-1100, et. seq., which requires certain licenses for contractors, tradesmen, and others. Each bidder is required to determine which license, if any, it is required to have under such sections.

Complete the following:

Bidder _____ does have _____ does not have a Virginia Contractor's License. (Check appropriate blank.)

If bidder has a Virginia Contractor's License, circle the class bidder has and list the number.

Licensed "Class A", "Class B", or "Class C" Virginia Contractor Number _____

Identify Specialty _____

If bidder has another type of Virginia License, please list the type and number:

Type of license: _____ Number: _____

Bidder is a _____ resident or _____ nonresident of Virginia. (Check appropriate blank. See Code of Virginia, Sections 54.1-1100, et. seq.)

The attention of each Bidder/Offeror is directed to Virginia Code Section 2.2-4311.2, which requires a bidder or offeror organized or authorized to transact business in the Commonwealth of Virginia pursuant to Title 13.1 or Title 50 of the Code of Virginia, as amended, or as otherwise required by law, shall include in its bid or proposal the Identification Number issued to such bidder or offeror by the Virginia State Corporation Commission (SCC). Furthermore, any bidder or offeror that is not required to be authorized to transact business in the Commonwealth of Virginia as a domestic or foreign business entity under Title 13.1 or Title 50 or as otherwise required by law shall include in its bid or proposal a statement describing why the bidder or offeror is not required to be so authorized. Please complete the following by checking the appropriate line that applies and providing the requested information:

- A. _____ Bidder/Offeror is a Virginia business entity organized and authorized to transact business in Virginia by the SCC and such bidder's/offeror's Identification Number issued to it by the SCC is _____.
- B. _____ Bidder/Offeror is an out-of-state (foreign) business entity that is authorized to transact business in Virginia by the SCC and such bidder's/offeror's Identification Number issued to it by the SCC is _____.
- C. _____ Bidder/Offeror does not have an Identification Number issued to it by the SCC and such bidder/offeror is not required to be authorized to transact business in Virginia by the SCC for the following reason(s):

Please attach additional sheets of paper if you need more space to explain why such bidder/offeror is not required to be authorized to transact business in Virginia.

The undersigned states that it has made a best or good faith effort to seek the participation of and utilize local, Small, Minority-Owned, Women-Owned, and Service Disabled Veteran-Owned businesses as suppliers and subcontractors whenever possible for this Project.

State the complete legal name of the bidder, exactly as it is recorded with the State Corporation Commission, if recorded there.

LEGAL NAME_____

BY_____TITLE_____
(TYPED NAME:_____)

SIGNED NAME_____

DELIVERY ADDRESS_____

MAILING ADDRESS_____

CITY_____STATE_____ZIP CODE_____

TELEPHONE_____FAX_____

CONTACT EMAIL ADDRESS_____

ESCROW ACCOUNT REQUESTED (if applicable): YES _____ NO _____

DELIVERY OF BIDS: See Section 7 of the Instructions to Bidders.

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CITY OF ROANOKE, VIRGINIA

BID BOND

KNOW ALL MEN BY THESE PRESENTS, THAT WE, THE UNDERSIGNED, _____,
_____, as Principal, and _____,
_____, as Surety, are hereby held and firmly bound unto
_____, as City or Owner, in the penal sum of _____
_____ (\$_____) for the payment of which, well and truly to be made, we
hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and
assigns. Signed, sealed, and delivered this ____ day of _____, 20____.

The condition of the above obligation is such that whereas the Principal has submitted to the
a certain bid, attached hereto and hereby made a part hereof, to enter a contract in writing for the _____

_____.

NOW, THEREFORE, if the bid shall be rejected, or if the bid shall be accepted and the Principal
shall execute and deliver to the City a Contract substantially in the Form of the Contract contained in
the proposed Contract Documents, properly completed in accordance with the bid, and shall furnish
any required bond(s) for Principal's faithful performance of the Contract and for the payment of all
persons performing labor or furnishing materials in connection herewith within the specified time period,
and shall in all other respects perform the agreement created by the acceptance of the bid, then this
obligation shall be void, otherwise the same shall remain in force and effect; it being expressly
understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event,
exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of the Surety
and its bond shall be in no way impaired or affected by any extension of the time within which the City
may accept such bid; and the Surety does hereby waive notice of any such extension.

This Bond shall be governed by, and construed in accordance with, the laws of the
Commonwealth of Virginia, without application of Virginia's conflict of law provisions. Venue and any
actions for any litigation, suits, and claims arising from or connected with this Bond and/or the Contract
referred to herein shall only be proper in the Roanoke City Circuit Court, or in the Roanoke City General
District Court if the amount in controversy is within the jurisdictional limit of such court, and all parties to
this Bond and/or such Contract voluntarily submit themselves to the jurisdiction and venue of such
courts, regardless of the actual location of such parties.

IN WITNESS WHEREOF, the Principal and the Surety have hereunder set their hands and
seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and
these presents to be signed by their proper officers, the day and year first set forth above.

Attest: _____(SEAL)
Principal

By _____
Title

Witness to signature of
Attorney-in-Fact: _____(SEAL)
Surety

By _____
Attorney-in-Fact

(Attorneys-in-fact affix seal and attach current original or certified copy of power of attorney.)

CITY OF ROANOKE, VIRGINIA

ESCROW AGREEMENT

(ONLY IF APPLICABLE)

THIS AGREEMENT ("Agreement"), made and entered into this _____ day of _____, 20____ by, between and among the City of Roanoke, Virginia ("City" or "Owner"), _____ ("Contractor"),

(Name of Escrow Agent)

(Address of Escrow Agent)

a trust company, bank, or savings and loan institution (hereinafter referred to collectively as "Escrow Agent") with its principal office located in the Commonwealth of Virginia ("Commonwealth") and _____

("Surety") provides:

1.

The City and the Contractor have entered into a contract dated _____
with respect to City of Roanoke ITB No. _____, for _____

_____ ("the contract"). This Agreement is pursuant to, but in no way amends or modifies, the contract. Payments made hereunder or the release of funds from escrow shall not be deemed approval or acceptance of performance by the Contractor. Payments should be made to _____ and mailed to _____

(Name and Address of Escrow Agent).

11.

In order to assure full and satisfactory performance by the Contractor of its obligations under the contract, the City is required thereby to retain certain amounts otherwise due the Contractor. The Contractor has, with the approval of the City, elected to have these retained amounts held in escrow by the Escrow Agent. This agreement sets forth the terms of the escrow. The Escrow Agent shall not be deemed a party to, bound by, or required to inquire into the terms of, the contract or any other instrument or agreement between the City and the Contractor.

III.

The City shall from time to time pursuant to its contract pay to the Escrow Agent amounts retained by it under the contract. Except as to amounts actually withdrawn from escrow by the City, the Contractor shall look solely to the Escrow Agent for the payment of funds retained under the contract and paid by the City to the Escrow Agent.

The risk of loss by diminution of the principal of any funds invested under the terms of this contract shall be solely upon the Contractor.

Funds and securities held by the Escrow Agent pursuant to this Escrow Agreement shall not be subject to levy, garnishment, attachment, lien, or other process whatsoever. Contractor agrees not to assign, pledge, discount, sell or otherwise transfer or dispose of his interest in the escrow account or any part thereof, except to the Surety.

IV.

Upon receipt of checks drawn by the City and made payable to it as escrow agent, the Escrow Agent shall promptly notify the Contractor, negotiate the same and deposit or invest and reinvest the proceeds in approved securities in accordance with the written instructions of the Contractor. In no event shall the Escrow Agent invest the escrowed funds in any security not approved, as set forth in Section V. below.

V.

The following securities, and none other, are approved securities for all purposes of this Agreement:

- (1) United States Treasury Bonds, United States Treasury Notes, United States Treasury Certificates of Indebtedness or United States Treasury Bills,
- (2) Bonds, notes and other evidences of indebtedness unconditionally guaranteed as to the payment of principal and interest by the United States,
- (3) Bonds or notes of the Commonwealth of Virginia,
- (4) Bonds of the City of Roanoke, Virginia, if such bonds carried, at the time of purchase by the Escrow Agent or deposit by the Contractor, a Standard and Poor's or Moody's Investor Service rating of at least "A", and
- (5) Certificates of deposit issued by commercial Banks located within the Commonwealth, including, but not limited to, those insured by the Escrow Agent and its affiliates.

- (6) Any bonds, notes, or other evidences of indebtedness listed in Sections (1) through (3) may be purchased pursuant to a repurchase agreement with a bank, within or without the Commonwealth of Virginia having a combined capital, surplus and undivided profit of not less than \$25,000,000, provided the obligation of the Bank to repurchase is within the time limitations established for investments as set forth herein. The repurchase agreement shall be considered a purchase of such securities even if title, and/or possession of such securities is not transferred to the Escrow Agent, so long as the repurchase obligation of the Bank is collateralized by the securities themselves, and the securities have on the date of the repurchase agreement a fair market value equal to at least 100% of the amount of the repurchase obligation of the Bank, and the securities are held by a third party, and segregated from other securities owned by the Bank.

No security is approved hereunder which matures more than five years after the date of its purchase by the Escrow Agent or deposit by the Contractor.

VI.

The Contractor may from time to time withdraw the whole or any portion of the escrowed funds by depositing with the Escrow Agent approved securities as set forth in Section V. above in an amount equal to, or in excess of, the amount so withdrawn. Any securities so deposited or withdrawn shall be valued at such time of deposit or withdrawal at the lower of par or market value, the latter as determined by the Escrow Agent. Any securities so deposited shall thereupon become a part of the escrowed fund.

Upon receipt of a direction signed by the City Manager or Assistant City Manager, the Escrow Agent shall pay the principal of the fund, or any specified amount thereof, to the City or the Contractor as the City may direct. If payment is to be made to the City, it shall be made in cash. However, if payment has been authorized to be made to the Contractor, the Contractor may specify to the Escrow Agent if payment is to be made in cash or in kind. Such payment and delivery shall be made as soon as is practicable after receipt of the direction.

VII.

For its services hereunder the Escrow Agent shall be entitled to a reasonable fee in accordance with its published schedule of fees or as may be agreed upon by the Escrow Agent and the Contractor. Such fee and any other costs of administration of this Agreement shall be paid from the income earned upon the escrowed fund and, if such income is not sufficient to pay the same, by the Contractor.

VIII.

The net income earned and received upon the principal of the escrowed fund shall be paid over to the Contractor in quarterly or more frequent installments. Until so paid or applied to pay the Escrow Agent's fee or any other costs of administration such income shall be deemed a part of the principal of the fund.

IX.

The Surety undertakes no obligation hereby but joins in this Agreement for the sole purpose of acknowledging that its obligations as surety for the Contractor's performance of the contract are not affected hereby.

X

This Escrow Agreement shall be governed by, and construed in accordance with, the laws of the Commonwealth of Virginia, without application of Virginia's conflict of law provisions. Venue and any actions for any litigation, suits, and claims arising from or connected with this Escrow Agreement and/or Contract referred to herein shall only be proper in the Roanoke City Circuit Court, or in the Roanoke City General District Court if the amount in controversy is within the jurisdictional limit of such court, and all parties to this Escrow Agreement and/or such Contract voluntarily submit themselves to the jurisdiction and venue of such courts, regardless of the actual location of such parties.

SIGNATURE PAGE TO FOLLOW

IN WITNESS WHEREOF, the parties hereto have signed this Escrow Agreement by their authorized representatives.

Attest: (if corporation)
Witness: (if individual)

Typed Name of Contractor

President/Vice-President;
Partner or Owner (Seal)

Attest:

Typed Name of Escrow Agent

Bank Officer

Vice President

Witness:

Typed Name of Surety Company

By: _____
Attorney-In-Fact

Attest:

City of Roanoke, Virginia

City Clerk/Deputy City Clerk

City Manager

Approved as to form:

City Attorney/Assistant City Attorney

Approved as to execution:

City Attorney/Assistant City Attorney

CITY OF ROANOKE, VIRGINIA

SAMPLE CONTRACT

FOR

**PUBLIC WORKS SERVICE CENTER AND
FIRE STATIONS # 4 & 6 FUELING IMPROVEMENTS
ITB NO. SOL1254**

THIS CONTRACT No. _____ is dated _____, 20__, between _____, a Virginia Corporation, hereinafter referred to as the "Contractor", and the City of Roanoke, Virginia, a Virginia municipal corporation, hereinafter referred to as the "City" or "Owner";

RECITALS:

WHEREAS, the Contractor has been awarded a contract by the City for furnishing all equipment, materials, labor, and services necessary to complete the Public Works Service Center and Fire Stations # 4 & 6 Fueling Improvements, ITB No. SOL1254, generally described as the construction of fueling station with canopy at three locations, above ground fuel island, technology room, employee parking lot, fence upgrades, sidewalk, drainage improvements, stormwater BMP, utility work, parking lot improvements, tree removal, landscaping and milling & overlay. The project consists of three locations (Public Works Service Center – 1802 Courtland Road NE, Fire Station # 4 – 3763 Peters Creek Road SW and Fire Station # 6 – 1833 Jamison Avenue SE. The project limits along Courtland Road and Sycamore Avenue consist of existing variable right-of-way. Project shall be completed in a proper and timely manner and associated work, all in a proper and timely manner and in accordance with the Contract Documents, hereinafter and in the Contract Documents referred to as the "Work"; and

WHEREAS, the Contractor has entered into a performance and a payment bond, with surety, each in the penalty of One Hundred Percent (100%) of the Contract sum, payable to the City of Roanoke as required by the Contract Documents;

THEREFORE, in consideration of the terms and provisions set forth herein, the Parties agree that the above Recitals are incorporated into this Contract and made a part hereof and the Parties further agree as follows:

ARTICLE 1. WORK TO BE PERFORMED AND DOCUMENTS.

For and in consideration of the sums of money hereinafter specified to be paid by the City to the Contractor for the Work provided for in this Contract and in the Contract Documents to be performed by the Contractor, the Contractor hereby covenants and agrees with the City to fully construct, perform, and complete the Work in a good and workmanlike manner in accordance with this Contract and the Contract Documents to produce a fully functional and properly operating project within the time stipulated, time being made of the essence of this Contract. It is also agreed by the parties hereto that the Contract Documents consist of this Contract and those items set forth in the definition of Contract Documents in Section 1 of the General Conditions and includes the following, all of which are and constitute a part of this Contract as if attached hereto or set out in full herein, viz:

Project Manual ITB# SOL1254 dated October 31, 2025 including:

Invitation to Bid;

Instructions to Bidders;

General Conditions;

Supplemental General Conditions, if any;

Plans and Drawings;

Specifications;

Special Conditions or similar documents, if any;

Bid Form completed by Contractor for this project;

Contractor's Performance Security;

Contractor's Labor and Material Payment Security;

Federal Labor Standards Provisions, or other specific provisions, as contained in the Project Manual.

ARTICLE 2. CONTRACT AMOUNT.

The City agrees to pay the Contractor for the Contractor's complete, timely, and satisfactory performance of the Work, in the manner and at the times set out in the Contract Documents the Contract Amount (or Sum) of _____ Dollars (\$0.00), as provided for in the Contract Documents and as the Contract Amount may be increased or decreased by additions and/or reductions in the Work or as the Contract Amount may be decreased by the City's assessment of liquidated damages against Contractor, or by setoff or as provided for in the Contract Documents or as allowed by law.

ARTICLE 3. TIME OF COMMENCEMENT AND COMPLETION.

The Contractor shall commence the Work to be performed under this Contract on such date as is established and fixed for such commencement by written notice to proceed given by the City Engineer to the Contractor, and the Contractor covenants and agrees to properly construct, perform, and substantially complete the Work within Five Hundred (500) consecutive calendar days after the date of commencement fixed and established by such notice, and to achieve Final Acceptance within thirty (30) consecutive calendar days thereafter. The Contractor further agrees that the Work shall be started promptly upon receipt of such notice and shall be prosecuted regularly, diligently, and uninterruptedly at a rate of progress that will ensure full completion thereof in the shortest length of time consistent with the Contract Documents.

ARTICLE 4. LIQUIDATED DAMAGES.

City and Contractor recognize that time is of the essence in the completion of the Work and that the City will suffer loss or damages if the Work is not completed within the period of time stipulated above, plus any extensions thereof allowed in accordance with the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving the actual loss or damages suffered by City if the Work is not completed on time. Accordingly, if such Work is not fully and satisfactorily substantially completed within the period of time set forth in Article 3, the Contractor agrees it shall owe to and pay to City as liquidated damages for loss of City's full use or occupancy of the Work, but not as a penalty, the sum of One Thousand Dollars (\$1,000.00) for each consecutive calendar day during which substantial completion of the Work is delayed or exceeds the date of substantial completion identified in Article 3 of this Contract to complete the Work and then to reach Final Acceptance as set forth above to fully and satisfactorily complete the Work. Provided, however, if Final Acceptance is not achieved by the Contractor within such additional time period, then the above mentioned sum of liquidated damages shall be due and paid by the Contractor to the City as additional liquidated damages for each consecutive calendar day Contractor does not achieve such Final Acceptance. Liquidated damages are defined in Section 21 of the General Conditions. Contractor further agrees that any liquidated damages City assesses against Contractor may also be withheld by City from any Final Payment, retainage or other sums City may otherwise owe to Contractor. Contractor hereby waives any defense as to the validity of any liquidated damages stated herein on the grounds such liquidated damages could be void as penalties or are not reasonably related to actual damages. All such liquidated damages are in addition to any other damages the City may be entitled to recover from Contractor.

ARTICLE 5. PAYMENT FOR WORK.

Construction estimates for payment, including the final payment request, submitted by the Contractor shall be in accordance with the provisions of Sections 20, 21, and 22 of the General Conditions and such other provisions of the Contract Documents that may be applicable. Final payment will not be made until the Work has been fully and satisfactorily completed, the Contract duly performed, and a Certificate of Final Acceptance has been issued by the City Engineer, all as provided for in the Contract Documents.

ARTICLE 6. NONWAIVER.

Contractor agrees that the City's waiver or failure to enforce or require performance of any term or condition of this Contract or the City's waiver of any particular breach of this Contract by the Contractor extends to that instance only. Such waiver or failure is not and shall not be a waiver of any of the terms or conditions of this Contract or a waiver of any other breaches of the Contract by the Contractor and does not bar the City from requiring the Contractor to comply with all the terms and conditions of the Contract and does not bar the City from asserting any and all rights and/or remedies it has or might have against the Contractor under this Contract or by law.

ARTICLE 7. FORUM SELECTION AND CHOICE OF LAW.

This Contract shall be governed by, and construed in accordance with, the laws of the Commonwealth of Virginia, without application of Virginia's conflict of law provisions. Venue and any actions for any litigation, suits, and claims arising from or connected with this Contract shall only be proper in the Roanoke City Circuit Court, or in the Roanoke City General District Court if

the amount in controversy is within the jurisdictional limit of such court, and all parties to this Contract voluntarily submit themselves to the jurisdiction and venue of such courts, regardless of the actual location of such parties.

ARTICLE 8. SEVERABILITY.

If any provision of this Contract, or the application of any provision hereof to a particular entity or circumstance, shall be held to be invalid or unenforceable by a court of competent jurisdiction, the remaining provisions of the Contract shall not be affected and all other terms and conditions of the Contract shall be valid and enforceable to the fullest extent permitted by law.

ARTICLE 9. NONDISCRIMINATION.

A. During the performance of this Contract, the Contractor agrees as follows:

1. The Contractor will not discriminate against any Subcontractor, employee, or applicant for employment because of race, religion, color, sex, sexual orientation, gender identity, national origin, age, disability, or any other basis prohibited by State law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the Contractor. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.
2. The Contractor, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, will state that such Contractor is an equal employment opportunity employer.
3. Notices, advertisements, and solicitations placed in accordance with federal law, rule, or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.

B. The Contractor will include the provisions of the foregoing Subsections A (1), (2), and (3) in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.

ARTICLE 10. FAITH-BASED ORGANIZATIONS.

Pursuant to the Code of Virginia, Section 2.2 - 4343.1, be advised that the City of Roanoke does not discriminate against faith-based organizations.

ARTICLE 11. COMPLIANCE WITH FEDERAL IMMIGRATION LAW.

Contractor agrees that Contractor does not, and shall not during the performance of this Contract, knowingly employ an unauthorized alien as defined in the federal Immigration Reform and Control Act of 1986.

**ARTICLE 12. COMPLIANCE WITH STATE LAW, FOREIGN AND DOMESTIC BUSINESSES
AUTHORIZED TO TRANSACT BUSINESS IN THE COMMONWEALTH OF
VIRGINIA.**

Contractor shall comply with the provisions of Virginia Code Section 2.2-4311.2, as amended, which provides that a contractor organized as a stock or nonstock corporation, limited liability company, business trust, or limited partnership or registered as a registered limited liability partnership shall be authorized to transact business in the Commonwealth as a domestic or foreign business entity if so required by Title 13.1 or Title 50 or as otherwise required by law. Contractor shall not allow its existence to lapse or its certificate of authority or registration to transact business in the Commonwealth, if so required under Title 13.1 or Title 50, to be revoked or cancelled at any time during the term of the Contract. The City may void the Contract if the Contractor fails to remain in compliance with the provisions of this section.

ARTICLE 13. CONTRACT SUBJECT TO FUNDING.

This Contract is or may be subject to funding and/or appropriations from federal, state and/or local governments and/or agencies and/or from the Council of the City of Roanoke. If any such funding is not provided, withdrawn, or otherwise not made available for this Contract, the Contractor agrees that the City may terminate this Contract on 7 days written notice to Contractor, without any penalty or damages being incurred by the City. Contractor further agrees to comply with any applicable requirements of any grants and/or agreements providing for such funding.

ARTICLE 14 . HEADINGS.

The captions and headings in this Contract are for convenience and reference purposes only and shall not affect in any way the meaning and interpretation of this Contract.

ARTICLE 15. COUNTERPART COPIES.

This Contract may be executed in any number of counterpart copies, each of which shall be deemed an original, but all of which together shall constitute a single instrument.

ARTICLE 16. CONSTRUCTION OF TERMS.

The terms and conditions in all parts of this Contract shall be in all cases construed according to their fair meaning and not strictly for or against any party.

ARTICLE 17. COMPLIANCE WITH VDOT AGREEMENT AND OTHER DOCUMENTS.

N/A

ARTICLE 18. ENTIRE CONTRACT.

This Contract, including any attachments, exhibits, and referenced documents, constitutes the complete understanding between the parties. This Contract may be modified only by written agreement properly executed by the parties.

SIGNATURE PAGE TO FOLLOW

IN WITNESS WHEREOF, the parties hereto have signed this Contract by their authorized representatives.

CITY OF ROANOKE, VIRGINIA

(Contractor)

City Manager or Authorized City Representative

Printed Name and Title

Date _____

Printed Name and Title

Date _____

Approved as to form:

Appropriation and Funds Required
for this Contract Certified:

Assistant City Attorney

Date _____

Director of Finance

Date _____

Approved as to Execution:

Account # _____

Assistant City Attorney

Date _____

CITY OF ROANOKE, VIRGINIA

CONTRACTOR'S PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS:

that _____

(Insert full name or legal title and address of Contractor)

as Principal, (hereinafter referred to as "Contractor"),

and _____

(Insert full name or legal title and address of Surety)

Telephone: _____ Fax: _____

as Surety (hereinafter referred to as "Surety"), are held and firmly bound unto the City of Roanoke, Virginia, a municipal corporation, 215 Church Avenue, S.W., Noel C. Taylor Municipal Building, Room 350, Roanoke, Virginia 24011, as Obligee (hereinafter referred to as "City" or "Owner"), in the amount of _____

Dollars (\$_____), for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents to the terms of this bond.

WHEREAS, Contractor has entered into a Contract with the City dated _____,
20_____, incorporating certain specifications and drawings prepared by:

(Insert full name or legal title and address)

(which Contract, specifications, drawings, and other Contract Documents are hereinafter referred to collectively as the "Contract") for a fully functional and properly operating project, namely _____

all in a proper and timely manner and in accordance with the Contract Documents, which Contract is expressly incorporated herein by reference and made a part of this bond.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Contractor shall promptly and faithfully perform the Contract, in strict conformity with each and every requirement of the Contract, then this obligation shall be null and void; otherwise, this Performance Bond shall remain in full force and effect and is subject to the following conditions:

- a. Any alteration which may be made in the terms of the Contract, including, without limitation, the amount to be paid or the work to be done under it, or the giving by the City of any extension of time for the performance of the Contract or any other forbearance of any nature whatsoever on the part of either the City or the Contractor to the other shall not in any way release the Contractor and the Surety, or either of them, their heirs, executors, administrators, successors, or assigns from their liability hereunder, and notice of such alteration, extension, or forbearance is hereby expressly waived by Surety.
- b. IT IS NOT INTENDED BY ANY OF THE PROVISIONS OF ANY PART OF THIS BOND TO CONFER A BENEFIT UPON ANY OTHER PERSON OR ENTITY NOT A PARTY TO THIS PERFORMANCE BOND OR TO AUTHORIZE ANY PERSON OR ENTITY NOT A PARTY TO THIS BOND TO MAINTAIN A SUIT PURSUANT TO THE TERMS OR PROVISIONS OF THIS BOND OTHER THAN THE CITY OR ITS SUCCESSORS OR ASSIGNS.
- c. This Bond shall be governed by, and construed in accordance with, the laws of the Commonwealth of Virginia, without application of Virginia's conflict of law provisions. Venue and any actions for any litigation, suits, and claims arising from or connected with this Bond and/or the Contract referred to herein shall only be proper in the Roanoke City Circuit Court, or in the Roanoke City General District Court if the amount in controversy is within the jurisdictional limit of such court, and all parties to the Bond and/or Such Contract voluntarily submit themselves to the jurisdiction and venue of such courts, regardless of the actual location of such parties.
- d. Any suit under this bond must be instituted within two (2) years after (i) completion of the Contract, including the expiration of all warranties and guarantees, or (ii) discovery of the defect or breach of warranty, if the action be for such, whichever period is longer.

SIGNED AND SEALED this ____ day of _____, 20____, in the presence of:

WITNESS:

CONTRACTOR

By: _____ (Seal)

(Type Name and Title)

WITNESS:

SURETY

By: _____ (Seal)

Attorney-in-Fact

(Type Name and Title)

(Attorneys-in-fact affix seal and attach original or certified copy of current power of attorney.)

CITY OF ROANOKE, VIRGINIA

CONTRACTOR'S LABOR AND MATERIAL PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS:

that _____

(Insert full name or legal title and address of Contractor)

as Principal, (hereinafter referred to as "Contractor"),

and _____

(Insert full name or legal title and address of Surety)

Telephone: _____ Fax: _____

as Surety (hereinafter referred to as "Surety"), are held and firmly bound unto the City of Roanoke, Virginia, a municipal corporation, 215 Church Avenue, S.W., Noel C. Taylor Municipal Building, Room 350, Roanoke, Virginia 24011, as Obligee (hereinafter referred to as "City" or "Owner"), for the use and benefit of Claimants as herein below defined, in the amount of _____

Dollars (\$_____), for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents to the terms of this bond.

WHEREAS, Contractor has entered into a Contract with the City dated _____, 20____, incorporating certain specifications and drawings prepared by:

(Insert full name or legal title and address)

(which Contract, specifications, drawings, and other Contract Documents are hereinafter referred to collectively as the "Contract") for providing a fully functional and properly operating project, namely _____

all in a proper and timely manner and in accordance with the Contract Documents, which Contract is expressly incorporated herein by reference and made a part of this bond.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Contractor shall promptly make payment to all Claimants, as hereinafter defined, for all material furnished or labor supplied or performed in the prosecution of the work provided for in the Contract, then this obligation shall be void; otherwise this Labor and Material Payment Bond shall remain in full force and effect and is subject to the following conditions:

- a. Any alteration which may be made in the terms of the Contract, including, without limitation, the amount to be paid or the work to be done under it, or the giving by the City of any extension of time for the performance of the Contract or any other forbearance of any nature whatsoever on the part of either the City or the Contractor to the other shall not in any way release the Contractor and the Surety, or either of them, their heirs, executors, administrators, successors, or assigns from their liability hereunder, and notice of such alteration, extension, or forbearance is hereby expressly waived by Surety.
- b. A Claimant is defined as one who has and fulfills a contract to supply labor or materials, or both, to the Contractor or to any of the Contractor's subcontractors, in the prosecution of work provided for in the Contract, labor and material being construed to include, without limitation, public utility services and reasonable rentals of equipment, but only for periods when the equipment rented is actually used at the site, or who may otherwise be allowed by law to file a claim against the Contractor and/or Surety.
- c. The Contractor and Surety hereby jointly and severally agree with City that every Claimant, as defined in paragraph b, **who has a direct contractual relationship with the Contractor and** who has performed labor or furnished material in accordance with the Contract in the prosecution of the work provided for in the Contract and who has not been paid in full therefore before the expiration of ninety (90) days after the day on which such Claimant performed the last such labor or furnished the last of such materials for which Claimant claims payment, or as may otherwise be allowed by law, may bring an action on this payment bond to recover any amount due Claimant for such labor or material, and may prosecute such action to final judgment and have execution on the judgment. The Contractor and Surety expressly agree that City shall not be liable for the payment of any judgment, costs, or expenses resulting from any such suit and that neither Contractor nor Surety shall cause City to be named as a party in any such suit.
- d. The Contractor and Surety hereby jointly and severally agree with City that every Claimant, as defined in paragraph b, who has direct contractual relationship with any subcontractor, but who has no contractual relationship, express or implied, with such Contractor, may bring an action on this bond only if the Claimant has given written notice to the Contractor within **ninety (90)** days from the day on which the Claimant performed the last of the labor or furnished the last of the materials for which payment is claimed, stating with substantial accuracy the amount claimed and the name of the person for whom the work was performed or to whom the material was furnished, or as may otherwise be allowed by law. **Notice to the Contractor shall be given as set forth in Virginia Code §2.2-4341 and Claimants are advised to review such Code Section.** The Contractor and Surety expressly agree that City shall not be liable for the payment of any judgment, costs, or expenses resulting from any such suit and that neither Contractor nor Surety shall cause City to be named as a party in any such suit.

- e. This Bond shall be governed by, and construed in accordance with, the laws of the Commonwealth of Virginia, without application of Virginia's conflict of law provisions. Venue and any actions for any litigation, suits, and claims arising from or connected with this Bond and/or the Contract referred to herein shall only be proper in the Roanoke City Circuit Court, or in the Roanoke City General District Court if the amount in controversy is within the jurisdictional limit of such court, and all parties to this Bond and/or such Contract voluntarily submit themselves to the jurisdiction and venue of such courts, regardless of the actual location of such parties.
- f. Any suit or action hereunder shall be brought within one year after the day on which the person bringing such action last performed labor or last furnished or supplied materials, or within such other time period as may be allowed by law, whichever is longer.

SIGNED AND SEALED this ____ day of _____, 20____, in the presence of:

WITNESS:

CONTRACTOR

By: _____ (Seal)

(Type Name and Title)

WITNESS:

SURETY

By: _____ (Seal)

Attorney-In-Fact

(Type Name and Title)

(Attorneys-in-fact affix seal and attach current original or certified copy of power of attorney.)

CITY OF ROANOKE, VIRGINIA

CERTIFICATE OF SUBSTANTIAL COMPLETION

The Date of Substantial Completion of the Work or designated portion thereof is the Date certified by the City Engineer when construction is sufficiently complete, in accordance with the Contract Documents, so the City of Roanoke, Virginia (City or Owner) can occupy or utilize the Work or designated portion thereof for the use for which it is intended, as expressed in the Contract Documents.

ITB NO.: _____

PROJECT: _____

CONTRACTOR: _____

PROJECT OR DESIGNATED PORTION SHALL INCLUDE: _____

_____.

The Work or portion thereof designated above performed under this Contract has been reviewed and found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above is hereby established as _____. The City will assume possession thereof at _____ a.m./p.m. on that date.

A list of items ("punch list"), prepared by the A/E and/or City Engineer, to be completed or corrected by the Contractor, is attached hereto. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. The Contractor will complete any portion of the Work that is not substantially complete and will complete or correct the work on the punch list in accordance with the Contract Documents.

The establishment of a date of substantial completion and/or the acceptance of the Work or designated portion thereof does not relieve the Contractor of any responsibility for any faulty materials or workmanship or operate to relieve the Contractor or its Surety from any obligation under the Contract with the City or the Performance Bond or Labor and Material Payment Bond.

This Certificate is subject to the terms and conditions of the Contract Documents, including but not limited to Section 20.8 of the General Conditions.

Contractor	By	Date
City of Roanoke, Virginia		
City	By	Date

CITY OF ROANOKE, VIRGINIA
AFFIDAVIT OF PAYMENT OF CLAIMS

By: _____

(Insert Exact Name and Address of Firm)

This day _____ personally appeared before me,
_____, a Notary Public in and for the City (County) of _____, and, being by me first duly sworn states that all subcontractors and suppliers of labor and materials have been paid all sums due them for work performed or materials furnished in the performance of the Contract between the City of Roanoke, Virginia, and _____, Contractor, dated _____, 20____, for _____

_____ or arrangements have been made by the Contractor satisfactory to such subcontractors and suppliers with respect to the payment of such sums as may be due from the Contractor to the subcontractors and suppliers.

CONTRACTOR: _____

BY: _____

PRINTED OR TYPED NAME AND TITLE: _____

COMMONWEALTH OF VIRGINIA

CITY/COUNTY OF _____

I, _____, a Notary Public in and for the Commonwealth of Virginia, do hereby certify that _____, whose name is signed to the foregoing, has subscribed, sworn to and acknowledged the same before me this _____ day of _____, 20_____.

Seal:

Notary Public

Registration #: _____

My Commission Expires: _____

Project: Public Works Service Center And Fire Stations # 4 & 6 Fueling Improvements

ITB# SOL1254

Affidavit of
Payment of Claims
Rev. 5/1/2014

CITY OF ROANOKE, VIRGINIA

**SMALL BUSINESS, MINORITY-OWNED BUSINESS, WOMEN-OWNED BUSINESS,
SERVICE DISABLED VETERAN-OWNED BUSINESS (SB/MB/WB/SDVB)
USAGE STATUS FORM**

FORM TO BE SUBMITTED WITH FINAL REQUEST FOR PAYMENT.

Section I:

ITB No: _____ Date: _____

Project: _____

Prime Contractor: _____

List all SB/MB/WB/SDVB contractors or subcontractors and/or suppliers used on this project / solicitation and indicate what type of entity it is (i.e. SB, MB, WB, or SDVB):

_____ Type: _____ Amount : _____

_____ Type: _____ Amount : _____

_____ Type: _____ Amount : _____

Attach additional sheet(s) if necessary.

Section II:

Total Project Value: _____

Total SB/MB/WB/SDVB Value: _____

Percent SB/MB/WB/SDVB Work: _____

Section III:

I hereby certify that the above figures are true and reflective of the amount of SB/MB/WB/SDVB work used on this project / solicitation.

Legal Name of Contractor

Typed or Printed Name and Title

Signature

Date

Project: Public Works Service Center And Fire Stations # 4 & 6 Fueling Centers

ITB# SOL1254

SB/MB/WB/SDVB
Usage Status Form
Rev. 5/1/2014

CITY OF ROANOKE, VIRGINIA

CERTIFICATE OF FINAL ACCEPTANCE

This Certificate is subject to the terms and conditions of the Contract Documents, including but not limited to Section 20.8 of the General Conditions. The City and Contractor hereby agree that the date fixed for Final Acceptance of the Work by the City is _____.

The establishment of a date of Final Acceptance and/or the acceptance of the Work does not relieve the Contractor of any responsibility for any faulty materials or workmanship or operate to relieve the Contractor or its Surety from any obligation under the Contract with the City, including, but not limited to, any guaranties or warranties, or the Performance Bond or Labor and Material Payment Bond.

ITB NO. _____

PROJECT: _____

CONTRACTOR: _____

_____ Contractor	_____ By	_____ Date
_____ City of Roanoke, Virginia City	_____ By	_____ Date

CITY OF ROANOKE, VIRGINIA

GENERAL CONDITIONS

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CITY OF ROANOKE, VIRGINIA

GENERAL CONDITIONS

SECTION 1. DEFINITIONS

Whenever used in these General Conditions or in the Contract Documents, the following terms have the meanings indicated, which are applicable to both the singular and plural and the male and female gender thereof, and where applicable to any other legal entity such as a corporation, partnership, limited liability company, etc.

The section and paragraph headings are inserted for convenience only.

Architect, Engineer, Architect/Engineer or A/E: The term used to designate the Architect and/or the Engineer who contracts with the City to provide the Architectural and Engineering services for the project. The Architect/Engineer is a separate Contractor and is referred to herein as the Architect/Engineer or abbreviated as A/E. The term includes any associates or consultants employed by the firm to assist in providing the A/E services.

Bidder: The person, firm, corporation, or other entity interested in submitting a bid for the Work to be performed.

Change Order: A document issued by the City Engineer on or after the effective date of the Contract which is agreed to by the Contractor and approved by the City, and which authorizes an addition, deletion, or revision in the Work, including any adjustment in the Contract Price and/or the Contract Time.

City or Owner: The City of Roanoke, Virginia, or its authorized representative.

City Code: Refers to the Code of the City of Roanoke (1979), as amended.

City Engineer: The City Engineer or his authorized representative.

City Manager: The City Manager or his authorized representative.

Code of Virginia: Refers to the Code of Virginia (1950), as amended. (Sometimes referred to as Va. Code or Virginia Code.)

Contract Documents: These documents include, but are not limited to, the Project Manual, Invitation to Bid, the Instructions to Bidders, the Bid Form, the Contract, the Bonds or other Bid Security, the Escrow Agreement, the General Conditions, Supplemental General Conditions, Special Conditions, the Specifications, Addenda or Change Orders, the Plans and Drawings, any Supplemental Drawings, and any additional documents incorporated by reference in the above.

Contract: The written agreement between the parties concerning the performance of the Work and consisting of the Contract Documents.

Contractor: The person, firm, corporation, or other entity entering into a contractual agreement with the City to perform the Work.

Defect, Defective, or Deficient: An adjective or noun which when modifying or referring to the word Work refers to Work or any part thereof that is unsatisfactory, faulty, or does not conform to the Contract Documents, or does not meet the requirements of any inspections, standards, tests, or approvals referred to in the Contract Documents.

Document(s): This term includes, but is not limited to: writings, drawings, items on which words, symbols, or marks are recorded; electronic data of any type; videotapes, recordings, photographs and negatives, digital or otherwise; and any other form of data, writing, or information compilation, however recorded or stored, and regardless of physical form or characteristics.

Field Order: A written order issued by the City Engineer which clarifies the requirements of the Contract by giving a more complete expression of the drawings or specifications or other documents without any change in the design, the Contract price, or the Contract time.

Final Acceptance: The City's acceptance of the project from the Contractor upon confirmation from the City Engineer and the Contractor that the project is apparently complete in accordance with the Contract requirements.

Notice: All written notices, demands, instructions, claims, approvals, and disapprovals required to obtain compliance with the Contract requirements. Any written notice by either party to the Contract shall be sufficiently given if delivered to or at the last known business address of the person, firm, or corporation constituting the party to the Contract, or to his, her, their, or its authorized agent, representative, or officer.

Notice to Proceed: A written notice given by the City at the City's discretion to the Contractor fixing the date on which the Contract time will commence for the Contractor to begin the prosecution of the Work in accordance with the requirements of the Contract Documents.

Project Inspector: One or more individuals employed by the City to inspect the Work and/or to act as Resident Inspector to the extent required by the City. The City shall notify the Contractor of the appointment of such Project Inspector(s).

Provide: Shall mean to furnish and install ready for its intended use.

Subcontractor: A person, firm, partnership, corporation, or other entity having a direct contract with the Contractor or with any other Subcontractor for the performance of the Work. It includes one who provides on-site labor, but does not include one who only furnishes or supplies material for the project.

Submittals: All drawings, diagrams, illustrations, brochures, schedules, samples, electronic data and other data required by the Contract Documents which are specifically prepared by or for the Contractor, Subcontractor, or Supplier, and submitted by the Contractor to illustrate the material, equipment, or layouts, or some other portion of the Work.

Substantial Completion: The date certified by the City Engineer when construction is sufficiently complete, in accordance with the Contract Documents, so the City can occupy or utilize the Work or designated portion thereof for the purposes for which it is intended.

Supplier: A manufacturer, fabricator, distributor, materialman, or vendor who provides only material or supplies for the project, but does not provide on-site labor.

Utilities: Utilities include all public and private lines, cables, conduit, pipelines, and appurtenances, whether underground, on the surface, and/or aerial, that may exist on the project site and/or adjoining public streets and/or rights-of-way for the purpose of providing

communications, gas, petroleum, electricity, water, sanitary sewer, storm sewer, drainage, energy, signals, or lighting service to the site or adjoining properties.

Work or Project: The entire completed construction or the various separately identifiable parts thereof as required by the Contract Documents. Work is the result of performing services, furnishing labor, and furnishing and incorporating material and equipment into the construction.

SECTION 2. INDEMNITY PROVISION

- 2.1 Indemnity:** Contractor shall indemnify and hold harmless City and its officers, agents, and employees against any and all liability, losses, damages, claims, causes of action, suits of any nature, costs, and expenses, including reasonable attorney's fees, resulting from or arising out of Contractor's or its employees, agents, or subcontractors actions, activities, or omissions, negligent or otherwise, on or near City's property or easement or arising in any way out of or resulting from any of the work to be provided under this Contract, and this includes, without limitation, any fines or penalties, violations of federal, state, or local laws or regulations, personal injury, wrongful death, or property damage claims or suits, breach of contract claims, indemnity claims, and any other damages, losses, and/or claims of any type.
- 2.2 Hazardous Material:** While on City's property or easement and in its performance of this Contract, Contractor shall not transport, dispose of or release any hazardous substance, material, or waste, except as necessary in performance of its Work under this Contract and in any event Contractor shall comply with all federal, state, and local laws, rules, regulations, and ordinances controlling air, water, noise, solid wastes, and other pollution, and relating to the storage, transport, release, or disposal of hazardous material, substances or waste. Regardless of City's acquiescence, Contractor shall indemnify and hold City, its officers, agents, and employees harmless from all costs, claims, damages, causes of action, liabilities, fines or penalties, including reasonable attorney's fees, resulting from Contractor's violation of this paragraph and agrees to reimburse City for all costs and expenses incurred by City in eliminating or remedying such violations. Contractor also agrees to reimburse City and hold City, its officers, agents, and employees harmless from any and all costs, expenses, attorney's fees and all penalties or civil judgments obtained against the City as a result of Contractor's use or release of any hazardous substance or waste onto the ground, or into the water or air from or upon City's premises. (See also Section 13.2 of these General Conditions.)
- 2.3 Patents:** The Contractor shall protect, indemnify, and hold harmless the City from any and all demands for fees, claims, suits, actions, causes of action, or judgments based on the alleged infringement or violation of any patent, invention, article, trademark, arrangement, or other apparatus that may be used in the performance of the Contract or the Work.

SECTION 3. LAWS, REGULATIONS, PERMITS, AND IMMIGRATION LAW

- 3.1 Regulations:** The Contractor shall fully comply with all local, state, and federal ordinances, laws, and regulations, including without limitation all applicable building and fire code sections of the Occupational Safety and Health Act (OSHA), and the Virginia Uniform Statewide Building Code, and obtain all required licenses and permits, including business license, building permits, and pay all charges and expenses connected therewith. Contractor further agrees that Contractor does not, and shall not during the performance of this Contract, knowingly employ an unauthorized alien as defined in the federal Immigration Reform and Control Act of 1986.

- 3.2 Permits:** The Contractor shall, at its sole cost, obtain all required permits from the appropriate authorities, including a Right of Way Excavation Permit(s) from the City of Roanoke. Contractor shall obtain an additional separate Excavation Permit Bond(s) in accordance with the requirements of the City's Right of Way Excavation and Restoration Standards. Revised July 1, 2020, together with any other documents and/or items that may be required by the City's Department of Public Works and/or Department of Planning, Building and Development. No delay or extension of time or any claim for additional compensation of any type shall be granted for failure to obtain any required permits.
- 3.3 Litter:** In accordance with the Virginia Anti-Litter Law, receptacles sufficient to contain workmen's litter and construction wastes capable of being spread by wind or water shall be located on the construction site. The number and size of receptacles required shall be determined by the Contractor.
- 3.4 Asbestos License:** The Contractor, if not licensed as an asbestos abatement contractor or a Roofing, Flooring, and Siding (RFS) contractor in accordance with Section 54.1-514, of the Code of Virginia, shall have all asbestos related work performed by subcontractors who are duly licensed as asbestos contractors or RFS contractors as appropriate for the work required.

SECTION 4. CONTRACTOR'S AND SUBCONTRACTOR'S INSURANCE

Neither the Contractor nor any subcontractor shall commence work under this Contract until the Contractor has obtained and provided proof of the required insurance under this Section to the City, and such proof has been approved by the City. The Contractor confirms to the City that all subcontractors have provided the Contractor with proof of insurance, or will do so prior to commencing any work under this Contract. Contractor further warrants that proof of coverage as provided to the City responds on a primary basis in the event of an uninsured or underinsured subcontractor. All such insurance shall be primary and non-contributory to any insurance or self-insurance the City may have in force.

4.1 For All Contracts, the following minimum insurance requirements apply:

a. Workers' Compensation and Employers' Liability:

The Contractor shall obtain and maintain the following limits:

Workers' Compensation: Statutory coverage for Virginia

Employers' Liability: \$100,000 Bodily Injury by Accident each occurrence
\$500,000 Bodily Injury by Disease Policy Limit
\$100,000 Bodily Injury by Disease each employee

b. Commercial General Liability:

Coverage is to be written on an "occurrence" basis and such coverage shall include broad form extension endorsements for both liability and property damage.

Completed Operations coverage will be required to be maintained for the life of the Contract.

For Limits of Liability see Sections 4.2 and 4.3 of these General Conditions.

c. Automobile Liability:

Limits for vehicles owned, non-owned, hired or borrowed shall not be less than:

- \$1,000,000 Bodily Injury and Property Damage combined single limit per occurrence.

d. Additional Insurance Requirements:

Additional specific insurance coverage minimum requirements to be provided by Contractor may include the following or as detailed in the Supplemental General Conditions or in other Contract Documents:

- 1) Builders Risk: At the discretion of the City, the Contractor, at its cost, shall obtain and maintain in the names of the City and the Contractor "all-risk" builders risk insurance (if approved by the City) upon the entire structure or structures on which the Work of this Contract is to be done and upon all material in or adjacent thereto or those that are "off-site" but which are intended for use thereon, to 100% of the completed value thereof.
- 2) Property Coverage: Installation Floater (and Rigger's Form, if applicable) will be required for the installation of contents or equipment, coverage will begin with supplier and continue until equipment/contents has been fully installed. Floater will be valued for the replacement cost value of equipment/contents including all costs. The Contractor shall provide coverage for portions of the work stored off-site after written approval of the City at the value established in the approval and for portions of the work in transit.
- 3) Special Hazards: In the event special hazards are evident in the work contemplated, or if required by the Contract Documents, the Contractor shall obtain and maintain during the life of the Contract a rider to the policy or policies required, in an amount not less than that stipulated under the above Paragraphs. Should any unexpected special hazards be encountered during the performance of this Contract, the Contractor shall, prior to performing any work involving the special hazard, immediately obtain this insurance as instructed by the City. In the event the special hazard requiring the additional coverage was not a part of the original bid, the expense of such insurance shall be reimbursed to the Contractor by the City, otherwise the Contractor shall assume full responsibility for the purchase with no charge back to the City.
- 4) Deductible: Deductible/self-insured retention amounts shall be reduced or eliminated upon written request from City. The insurer's cost of defense (and appeal), including attorney's fees, shall not be included within the coverages provided but shall remain the insurer's responsibility.

- 5) Term: Insurance shall remain in effect until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective work.
- 6) Limit of Liability: Nothing contained in these insurance requirements is to be construed as limiting the liability of Contractor or Contractor's insurance carriers. City does not in any way represent that the coverages or the limits of insurance specified is sufficient or adequate to protect Contractor's interests or liabilities, but are merely minimums. The obligation of the Contractor to purchase insurance herein shall not in any way limit the obligation of the Contractor in any event and/or in the event that the City should suffer an injury or loss in excess of the amount recoverable through insurance.

4.2 Contracts of \$100,000 or More: The following minimum insurance requirements apply in addition to the above requirements:

a. Limits of Liability: For the Commercial General Liability policy:

- \$2,000,000 general aggregate
- \$1,000,000 products/completed operations aggregate
- \$1,000,000 personal and advertising injury
- \$1,000,000 each occurrence

Coverage is to be written on an "occurrence" and "per project" basis and such coverage shall include:

b. Umbrella Liability Insurance:

This coverage shall be written for minimum limit of:

- \$5,000,000 each occurrence for Personal and Bodily Injury and Property Damage

This Policy shall apply in excess and follow the form of employer's liability, commercial general liability, and auto liability.

4.3 Contracts Less Than \$100,000: The following minimum insurance limits apply unless specified otherwise in the Supplemental General Conditions:

a. Limits of Liability: For the Commercial General Liability policy:

- \$1,000,000 general aggregate
- \$1,000,000 products/completed operations aggregate
- \$1,000,000 personal and advertising injury
- \$1,000,000 each occurrence

4.4 Proof of Insurance Coverage: The policies of insurance required by Sections 4.1, 4.2, or 4.3 shall be purchased from a reputable insurer licensed to do business in Virginia and maintained for the life of the Contract by the Contractor. Other insurance requirements include the following:

- a.** The Contractor shall furnish the City with the required certificates of insurance showing the insurer, type of insurance, policy number, policy term, deductible,

and the amount insured for property coverages and the limits for liability coverages.

- b. The Contractor shall notify the City Engineer and Risk Manager in writing within five consecutive calendar days if any of the insurance coverages or policies are cancelled or materially altered and Contractor shall immediately replace such policies and provide documentation of such to the City Engineer and Risk Manager.
- c. The required insurance policies and coverages, excluding those for Workers' Compensation and Professional Liability, shall name the City of Roanoke, its officers, agents, volunteers and employees as additional insureds, and the certificate of insurance shall show if the policies provide such coverage. Waiver of subrogation is required with respect to any policy of workers' compensation and employers' liability insurance required under this Section. The certificate of insurance shall show if the policies provide such waiver. Additional insured and waiver endorsements shall be received by the City's Risk Manager from the insurer with the certificate of insurance unless the City's Risk Manager agrees to another process. The City's Risk Manager may approve other documentation of such insurance coverages.
- d. Insurance coverage shall be in a form and with an insurance company approved by the City which approval shall not be unreasonably withheld. Any insurance company providing coverage under this Contract shall be authorized to do business in the Commonwealth of Virginia.

SECTION 5. EMPLOYMENT AND CONDUCT OF PERSONNEL

- 5.1 City Residents:** The Contractor is encouraged to try to use City residents, and local, Small, Minority-Owned, Women-Owned, and Service Disabled Veteran-Owned businesses, when practical.
- 5.2 Employee Qualifications:** Only skilled and reliable workers shall be employed for the Work. Should any person employed on the Work by the Contractor appear to the City Engineer to be incompetent, unable to perform the Work, or disorderly, such person shall be removed from the Work immediately upon proper notice to the Contractor from the City Engineer and such person shall not again be used for this Contract.
- 5.3 Superintendence:** The Contractor shall have a competent foreman or superintendent, satisfactory to the City Engineer, on the jobsite at all times during the progress of the Work. The Contractor shall notify the City, in writing, of any proposed change in the foreman or superintendent including the reason therefore prior to making such change.
- 5.4 Drug-free Workplace:** During the performance of this Contract, the Contractor agrees to (i) provide a drug-free workplace for the Contractor's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the Contractor that the Contractor maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every

subcontract or purchase order over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.

For the purpose of this section, "drug-free workplace" means a site for the performance of work done in connection with a specific contract awarded to a Contractor, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the Contract.

The Contractor shall post a copy of the policy in a conspicuous place at the jobsite and assure that all Contractor, subcontractor, and supplier personnel entering the jobsite are informed of the policy.

SECTION 6. EMPLOYMENT DISCRIMINATION BY CONTRACTOR PROHIBITED

Every Contract of over \$10,000 to which the City is a party shall contain the provisions in Sections 6.1 and 6.2 herein:

6.1 Nondiscrimination: During the performance of this Contract, the Contractor agrees as follows:

- a. The Contractor will not discriminate against any Subcontractor, employee, or applicant for employment because of race, religion, color, sex, sexual orientation, gender identity, national origin, age, disability, or any other basis prohibited by State law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the Contractor. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.
- b. The Contractor, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, will state that such Contractor is an equal employment opportunity employer.
- c. Notices, advertisements, and solicitations placed in accordance with federal law, rule, or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.

6.2 Nondiscrimination by Subcontractor or Vendor: The Contractor will include the provisions of the foregoing Subsections 6.1 (a), (b), and (c) in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.

SECTION 7. SUBCONTRACTORS

7.1 Licensure: The Contractor shall comply with Title 54.1, Chapter 11, of the Code of Virginia, with respect to licensure of itself and all subcontractors employed to work on the project. The Contractor represents that it has verified that all subcontractors hold all required state and local licenses, including State Contractor's license and City business license. The Contractor shall verify that any additional subcontractors employed to work on the project, subsequent to the initial verification, hold all required state and local licenses, including State Contractor's license and City business license. Upon request

from the City Engineer, Contractor shall provide documentation of compliance with this Section 7.1. Failure to comply constitutes a material breach of the Contractor's Contract with the City.

7.2 Change of Subcontractors: Subcontractors shall not be changed without the written approval of the City Engineer.

7.3 Responsibility for Subcontractors: The Contractor shall not employ for the project any subcontractor that the City may, within a reasonable time, object to as unsuitable. The Contractor further agrees that it is as fully responsible to the City for the acts and omissions of its subcontractors, suppliers, and invitees on the jobsite and of persons either directly or indirectly employed by them, as the Contractor is for the acts and omissions of persons directly employed by it.

SECTION 8. CONDITIONS AT SITE

8.1 Existing Conditions: The Contractor shall have visited the site prior to bidding and is responsible for having ascertained pertinent local conditions such as location, accessibility, and general character of the site, and the character and extent of existing improvements and work within or adjacent to the site. Claims as a result of failure to have done so will not be considered by the City and will be the sole responsibility of the Contractor.

8.2 Hidden Conditions: If, in the performance of the Contract, hidden physical conditions of a building being modified are exposed revealing unusual or materially different conditions than those ordinarily encountered or inherent in work of this nature, or if subsurface or latent conditions at the site are found which are materially different from those frequently present in the locality, from those indicated in the Contract Documents, or from those inherent in work of the character required by the Contract, the Contractor must report such conditions to the City Engineer before the conditions are disturbed. Upon such notice, or upon his own observation of such conditions, the City Engineer will make such changes in the Contract Documents as he finds necessary to conform to the different conditions. Any change in the cost of the Work or the time needed for completion must be requested pursuant to Section 19 of these General Conditions.

8.3 Suspected Hazardous Material: If the Contractor, during the course of the project, observes the existence of any material which it suspects or knows to be hazardous to human health or the environment, the Contractor shall promptly notify the City Engineer. The City Engineer will provide the Contractor with instructions regarding the situation. The Contractor shall not perform any work involving the material or any work causing the material to be less accessible prior to receipt of special instructions from the City Engineer.

SECTION 9. SURVEYS AND LAYOUT

9.1 Surveying Services: All necessary drawings showing the location of property lines, buildings, and other appropriate information shall be furnished to the Contractor through the drawings and specifications. The Contractor shall provide competent surveying and engineering services to verify the given information and to execute the Work in accordance with the Contract requirements and shall be responsible for the accuracy of Contractor's surveying and engineering services. The Contractor shall immediately notify the City Engineer of any discrepancies and confirm such notice in writing within five calendar days.

9.2 Survey Control: Such general reference points and bench marks on the building site as will enable the Contractor to proceed with the Work will be established in the

drawings and specifications. If the Contractor finds that any previously established reference points have been lost or destroyed, Contractor shall promptly notify the City Engineer.

- 9.3 Damage to Survey Control:** The Contractor shall protect and preserve the established bench marks and monuments and shall make no changes in locations without written notice to and approval from the City Engineer. Any of these which may be lost or destroyed or which require shifting because of necessary changes in grades or locations shall, subject to prior approval from the City Engineer, be replaced and accurately located by the Contractor.

SECTION 10. DRAWINGS AND SPECIFICATIONS

- 10.1 Drawings and Specifications:** The general character and scope of the Work are illustrated by the drawings and specifications. Where on any of the drawings a portion of the Work is drawn out and the remainder is indicated in outline, the parts drawn out shall apply also to all other like portions of the Work. If the Contractor deems additional detail or information to be needed, Contractor may request the same in writing from the City Engineer. The Contractor shall carry out the Work in accordance with the drawings and specifications and any additional detail drawings and instructions as issued by the City Engineer. However, Contractor shall immediately notify the City Engineer of any discrepancies in such drawings and/or specifications and confirm such notice in writing within five calendar days.
- 10.2 Discrepancies in Drawings:** In case of difference between small and large scale drawings, the large scale drawings shall govern, unless otherwise directed in writing by the City Engineer.
- 10.3 "Similar":** Where the word "similar" appears on the drawings, it shall be interpreted in its general sense and not as meaning identical, and all details shall be worked out in relation to their location and their connection with other parts of the Work.
- 10.4 Division of Specifications:** The specifications are divided into several parts for convenience only, since the entire specifications must be considered as a whole. The divisions of the specifications are not intended to control the Contractor in dividing the work among subcontractors or to limit the work performed by any trade. The Contractor shall be responsible for the coordination of the trades, subcontractors, and vendors engaged upon this Work.
- 10.5 Dimension Accuracy:** Measurements or dimensions shown on the drawings for site features, utilities, and structures shall be verified at the site by the Contractor. The location of underground utilities indicated on the plans are diagrammatic and were plotted from available records and field survey information and shall be considered approximate only, and the City makes no representations with regard to their accuracy. The Contractor shall not scale measurements or dimensions from the drawings. Where there are discrepancies, the City Engineer shall be consulted. Where new work is to connect to, match with, or be provided for existing work, the Contractor shall verify the actual existing conditions and related dimensions prior to ordering or fabrication, so that such new work will properly fit with existing work.
- 10.6 As-Built Drawings:** The Contractor shall maintain at the site for the City one copy of all drawings, specifications, addenda, approved shop or setting drawings, change orders, field deviations, and other documents or modifications (referred to herein as "As-Built Drawings") in good order and marked to record all changes as they occur during construction. These shall be available to the City Engineer, the Project Inspector, and the City's testing personnel. These "As-Built Drawings" shall be neatly and clearly marked in color during construction to record all variations from the drawings made during construction. The representation of such variations shall include such

supplemental notes, symbols, legends, documents, and details as may be necessary to clearly show the as-built construction.

- 10.7 Record Drawings:** Upon completion of the Work and prior to Final Acceptance, the Contractor shall deliver to the City Engineer, for preparation of the Record Drawings, one complete set of "As-Built Drawings" and documents referred to in Section 10.6 as well as an electronic copy, if available, or if requested by the City Engineer.

SECTION 11. SCHEDULE OF THE WORK

- 11.1 Scheduling:** The Contractor is responsible for the sequencing, scheduling, and coordinating of the Work, for monitoring the progress of the Work, and for taking appropriate action to keep the Work on schedule. The Contractor is responsible for coordinating Contractor's work on the Project with any other work being carried on by the City or by other City consultants or contractors at the site or for the Project. The Contractor shall prepare and submit to the City Engineer a schedule for accomplishing the Work based upon the completion time stated in the Contract and submit such to the City Engineer at the pre-construction conference. No progress payments will be made to the Contractor until after Contractor has submitted a schedule which is acceptable to the City Engineer. All schedules under Section 11 shall be in both paper and electronic form unless otherwise directed by the City Engineer.
- 11.2 Progress:** The Contractor shall review the progress of the Work not less than each month, but as often as necessary to properly manage the project and stay on schedule. The Contractor shall collect and preserve information on Change Orders, including extensions of time. The Contractor shall evaluate this information and update the schedule monthly to finish within the contractually allowed time. The Contractor shall submit the updated schedule with each progress payment request. The scheduled completion date shall be within the period of time allowed by the Contract for completion of construction, except as amended by any Change Orders.
- 11.3 Delay and Recovery Schedule:** Should there be any delay, the City Engineer may require the Contractor to prepare, at no extra cost to the City, a plan of action and a recovery schedule for completing the Work by the contractual completion date. The plan of action and recovery schedule shall explain and display how the Contractor intends to regain compliance with the original schedule. The plan of action and recovery schedule, when required, shall be submitted and approved by the City Engineer prior to Contractor's submission of the next monthly construction estimate. The City may withhold progress payments until such schedule is submitted and approved.

SECTION 12. CONSTRUCTION SUPERVISION

The Contractor shall be solely responsible to supervise and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract. The Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. The Contractor is solely responsible to the City that the finished Work complies with the Contract Documents. The Contractor shall be solely responsible for health and safety precautions and programs for workers and others in connection with the Work. No inspection by, knowledge on the part of, or acquiescence by the City, or any other entity whatever shall relieve the Contractor from its sole responsibility for compliance with the requirements of the Contract or responsibility for health and safety programs and precautions.

SECTION 13. STANDARDS FOR MATERIAL INSTALLATION AND WORKMANSHIP

- 13.1 Material and Equipment:** Unless otherwise specifically provided in this Contract, all equipment, material, and accessories incorporated in the Work are to be new and in first class condition. The Contractor shall furnish to the City Engineer for approval the name of the manufacturer, the model number, and other identifying data and information respecting the performance, capacity, nature, and rating of the machinery and mechanical and other equipment which the Contractor contemplates incorporating in the Work. Machinery, equipment, material, and articles installed or used without required approval may be subject to subsequent rejection by the City.
- 13.2 Hazardous Substances:** Unless specifically approved by the City or required by the specifications, the Contractor shall not incorporate any material into the Work containing asbestos or any material known by the Contractor to contain a substance known to be hazardous to human health. If the Contractor becomes aware that a material required by the specifications contains asbestos or other hazardous substances, it shall notify the City and the City Engineer immediately and shall take no further steps to acquire or install any such material without first obtaining City approval. (See also Sections 2.2 and 8.3 of these General Conditions.)
- 13.3 Workmanship:** The workmanship shall be of the highest quality found in the building industry in every respect. All items of Work shall be done by workmen skilled in the particular task to which they are assigned. In the acceptance or rejection of work, no allowance will be made for lack of skill on the part of workmen. Poor or inferior workmanship (as determined by the City Engineer, the City, or other inspecting authorities) shall be removed and replaced to conform to the highest quality standards of the trades concerned, or otherwise corrected to the satisfaction of the City Engineer, the City, or other inspecting authority all at the Contractor's sole expense.
- 13.4 Instructions for Installation:** Under the various sections of the specifications, where specified items are supplied with the manufacturer's printed instructions, recommendations, or directions for installation, or where such instructions, recommendations, or directions are available, installation of the specified items shall be in strict accordance with the manufacturer's printed instructions unless those instructions contradict the drawings or specifications, in which case the City Engineer will be notified by Contractor for an interpretation and decision.
- 13.5 Installation Procedures Without Instructions:** Where neither the manufacturer's printed instructions are available for installation of specific items, nor are specific code or standards given by reference to govern the installation of specific items; and where there is doubt concerning the installation procedures to be followed or the quality of workmanship to be maintained in the installation of specific items, the Contractor shall consult the City Engineer for approval of the installation procedures Contractor proposes to follow or the specific standards governing the quality of workmanship Contractor proposes to maintain during the installation of the items in question.
- 13.6 Codes and Standards:** Under the various sections of the specifications, where reference is made to specific codes or standards governing the installation of specified items, installation shall in all cases be in strict accordance with the referenced codes and standards. Where no reference is made to specific codes or standards, installation shall conform to the generally recognized applicable standards for first-class installation of the specific item to be installed. Contractors are expected to be proficient and skilled in their respective trades and knowledgeable of the National Fire Protection Association (NFPA), the current edition of the Virginia Uniform Statewide Building Code (USBC) and its referenced technical codes and standards, Occupational Safety and Health Act

(OSHA) and other codes and standards applicable to installations and associated work by its trade and/or that are applicable to the Work.

SECTION 14. SUBMITTALS

- 14.1 General:** The Contractor shall submit for the approval of the City Engineer all submittals required by the specifications or requested by the City Engineer. All such submissions shall be made with such promptness as to cause no delay in this or any other part of the project, and to allow reasonable time for checking, correcting, resubmitting, and recorrecting. No part of the Work dealt with by a submittal shall be fabricated by the Contractor, save at Contractor's own risk, until such approval has been given. The Contractor shall maintain one set of approved submittals at the jobsite at all times.
- 14.2 Format:** Submittals shall be made in such number of copies that two approved copies may be retained by the City Engineer. Each submission shall be accompanied by a letter of transmittal listing the contents of the submission and identifying each item by reference to specification section or drawings. All submittals shall be clearly labeled with the name of the project and other necessary information. Catalog plates and other similar material that cannot be so labeled conveniently, shall be bound in suitable covers bearing the identifying data.
- 14.3 Supporting Material:** Submittals shall be accompanied by all required certifications and other such supporting material and documents, and shall be submitted in such sequence or in such groups that all related items may be checked together. When submittals cannot be checked because the submission is not complete, or because submittals on related items have not been received, then such submittals will be returned without action or will be held, not checked, until the material which was lacking is received.
- 14.4 Coordination:** Submittals shall have been reviewed by the Contractor and coordinated with all other related or affected work before they are submitted for approval, and shall bear the Contractor's certification that it has checked and approved them as complying with the information given in the Contract Documents. Submittals made without such certification and coordination will be returned to the Contractor without action, and will not be considered a formal submission. The Contractor shall be responsible for checking all dimensions and coordinating all material and trades to ensure that the material proposed will fit in the space available and be compatible with other material provided.
- 14.5 Variations:** If the submittals show variations from the Contract Documents because of standard shop practice or other reasons, the Contractor shall make specific mention of such variation in Contractor's letter of transmittal in order that, if acceptable, suitable action may be taken for proper adjustment; otherwise the Contractor will not be relieved of the responsibility for executing the Work in accordance with the Contract Documents even though such submittals have been approved.
- 14.6 "Or Equal":** The drawings and/or specifications may indicate that the City Engineer designed or detailed a portion of the plans around a particular product (most commonly a piece of equipment). Should a different product be proposed by the Contractor and accepted, all modifications, rerouting, relocations, and variations required for proper installation and coordination to comply with the design concept and requirements of the Contract Documents shall be the sole responsibility of the Contractor and shall be made at no extra cost to the City. This naming of a particular product, around which the plans were designed or detailed, is not intended to preclude the use of other products or favor

the product named when a "brand name or equal" specification has been used. (See also Section 10 of Instructions to Bidders.) Rather it is only intended to acknowledge the reality that in many instances the City Engineer must design around the dimensions and characteristics of a particular product.

14.7 Review by City Engineer: The City Engineer will review and respond to the submittals within 14 calendar days. Checking and/or approval of submittals will be for general conformance with the design concept of the project and compliance with the information given in the Contract Documents, and will not include verification of quantities, detailed dimensions, nor adjustments of dimensions to actual field conditions. Approval shall not be construed as permitting any departure from Contract requirements, authorizing any increase in price or time for completion or relieving the Contractor of the responsibility for any error in details, dimensions, or otherwise that may exist.

14.8 The Work shall be in accordance with approved submittals.

SECTION 15. INSPECTION AND INDEPENDENT TESTING

15.1 Inspection and Testing: All material and workmanship shall be subject to inspection, examination, and testing by the City Engineer at any and all times during manufacture and/or construction. The City Engineer shall have authority to reject defective material and workmanship and require its correction. Rejected workmanship shall be satisfactorily corrected and rejected material shall be satisfactorily replaced with proper material without charge therefore, and the Contractor shall promptly segregate and remove the rejected material from the premises. If the Contractor fails to proceed at once with replacement of rejected material and/or the correction of defective workmanship, the City may, by contract or otherwise, replace such material and/or correct such workmanship and charge the cost to the Contractor, and/or may terminate the right of the Contractor to proceed as provided in Sections 26 or 27 of these General Conditions, the Contractor and surety being liable for any damage to the same extent as provided for in those Sections.

15.2 Payment for Inspection, Testing, and Certification:

- a.** Jobsite inspections, tests conducted on site, or tests of material gathered on site which the Contract requires to be performed by independent testing entities shall be contracted and paid for by the City. The Contractor shall promptly furnish, without additional charge, all reasonable facilities, labor, and material necessary for making such tests. Except as provided in Section 15.3 below, whenever such examination and testing finds defective material, equipment, or workmanship, the Contractor shall reimburse the City for the cost of reexamination and retesting.
- b.** Although conducted by independent testing entities, the City will not contract and pay for tests or certifications of material, manufactured products or assemblies which the Contract, codes, standards, etc. require to be tested and/or certified for compliance with industry standards such as Underwriters Laboratories, Factory Mutual or ASTM. If there are any fees to be paid for such tests and certifications, they shall be paid by the Contractor.
- c.** The Contractor shall also pay for all inspections, tests, and certifications which the Contract specifically requires it to perform or pay, together with any inspections and tests which it chooses to perform for its own quality control purposes.

- 15.3 Examination of Completed Work:** Should it be considered necessary or advisable by City or the City Engineer at any time before final acceptance of the entire Work to make an examination of any part of the Work already completed, by removing or tearing out portions of the Work, the Contractor shall on request promptly furnish all necessary facilities, labor, and material to expose the Work to be tested to the extent required. If such Work is found to be defective in any respect, due to the fault of the Contractor or its Subcontractors, Contractor shall pay for all the expenses of uncovering the Work, of examination and testing, and of satisfactory reconstruction. If, however, such Work is found to meet the requirements of the Contract, the actual cost of the Contractor's labor and material necessarily involved in uncovering the Work, the cost of examination and testing and Contractor's cost of material and labor necessary for replacement shall be paid to the Contractor and it shall, in addition, if completion of the Work has been delayed thereby, be granted a suitable extension of time.
- 15.4 Suspension of Work:** The City may suspend the Work when in its judgment the drawings and specifications are not being followed. Any such suspension shall be issued in writing and continued only until the matter in question is resolved to the satisfaction of the City. The cost of any such Work stoppage shall be borne by the Contractor unless it is later determined that no fault existed in the Contractor's Work.
- 15.5 Project Inspector:** Failure of the Project Inspector to note or require correction of improper or defective work does not relieve the Contractor from its responsibility to correct such improper or defective work. The Project Inspector has no authority to and shall not:
- a. Enter into the area of responsibility of the Contractor's superintendent;
 - b. Issue directions relative to any aspect of construction means, methods, techniques, sequences or procedures, or in regard to safety precautions and programs in connection with the Work;
 - c. Authorize or suggest that the City occupy the project, in whole or in part; or
 - d. Issue a certificate for payment.

SECTION 16. USE OF PREMISES AND REMOVAL OF DEBRIS

- 16.1 Jobsite Coordination:** The Contractor shall perform the Contract in such a manner as not to interrupt or interfere with the operation of any existing activity on the premises or with the work of any other contractor.
- 16.2 Storage of Material:** The Contractor shall store apparatus, material, supplies, and equipment in such orderly fashion at the site of the Work as will not unduly interfere with the progress of its Work or the work of any other contractor.
- 16.3 Jobsite Appearance:** The Contractor expressly undertakes, either directly or through its Subcontractor(s), to clean up frequently all refuse, rubbish, scrap material, and debris caused by his operations, to the end that at all times the jobsite shall present a neat, orderly, and workmanlike appearance. No such refuse, rubbish, scrap material, and debris shall be left within the completed Work nor buried on the building site, but shall be properly protected and removed from the site and properly disposed of in a licensed landfill or otherwise as required by law.

- 16.4 Final Cleaning:** The Contractor expressly undertakes, either directly or through its Subcontractor(s), before final payment, to remove all surplus material, false work, temporary structures, including foundations thereof, and debris of every nature resulting from its operations and to put the site in a neat, orderly condition, to thoroughly clean and leave reasonably dust free all finished surfaces including all equipment, piping, etc., on the interior of all buildings included in the Contract; and to thoroughly clean all glass installed under the Contract including the removal of all paint and mortar splatter and other defacements. If a Contractor fails to clean up at the completion of the Work, the City may do so and charge for costs thereof to the Contractor in accordance with these General Conditions.
- 16.5 Erosion Control:** During and at completion of the Work, the Contractor shall prevent site soil erosion, the runoff of silt and/or debris carried by water from the site, and the blowing of dust or debris off the site in accordance with the applicable requirements and standards of the Virginia Erosion and Sediment Control Handbook, latest edition, and of the Contract Documents and the requirements of the City's Department of Planning, Building and Development.

SECTION 17. PROTECTING PERSONS AND PROPERTY

- 17.1 Protection on Site:** The Contractor expressly undertakes, both directly and through its Subcontractor(s), to take every reasonable precaution at all times for the protection of all persons and property which may come on the jobsite or be affected by the Contractor's operation in connection with the Work.
- 17.2 Safety and Health Precautions:** The Contractor shall be solely responsible for initiating, maintaining, and supervising all safety and health precautions and programs in connection with the Work, including but not limited to provision of appropriate sanitation facilities, if applicable.
- 17.3 Protecting the Public:** The Contractor shall in all cases protect the public and the Work, during its execution, by posting and maintaining, at its expense, appropriate signs, barricades, barriers, lights, flagmen, and other safety devices in accordance with the current edition of the "Virginia Work Area Protection Manual".
- 17.4 Protecting the Work and Adjacent Property:** The Contractor shall continuously maintain adequate protection of all the Work from damage and shall protect the City's property from injury or loss arising in connection with this Contract. The Contractor shall adequately protect adjacent property to prevent any damage to it or loss of use and enjoyment by its owners. The Contractor shall provide and maintain all passageways, guard fences, lights, and other facilities for protection required by public authority, local conditions, any of the Contract Documents or erected for the fulfillment of its obligations for the protection of persons and property.
- 17.5 Emergencies:** In an emergency affecting the safety or life of persons or of the Work, or of the adjoining property, the Contractor, without special instruction or authorization from the City Engineer, shall act, at Contractor's discretion, to prevent such threatened loss or injury. Also, should Contractor, to prevent threatened loss or injury, be instructed or authorized to act by the City Engineer, Contractor shall so act immediately, without appeal.

SECTION 18. DAMAGES TO THE WORK AREA

- 18.1 Damage to the Work:** The Contractor shall have charge of and be solely responsible for the entire Work and be liable for all damages to the Work including, but not limited to any of the damages hereafter mentioned, and to any property in the vicinity of the Work, until its completion and acceptance by the City Engineer.
- a. Where the work involves alterations, renovations, or modifications to any existing building, the Contractor shall familiarize itself with the structural condition of such building before proceeding with any work. It shall be the Contractor's responsibility to take all necessary safeguards to protect and maintain all parts of the building in a safe condition at all times during the process of construction and to protect from damage those portions of the building that are to remain.
 - b. Under no condition shall any load be placed on any part of a building, whether new or existing, in excess of the load the structure will safely support, and no structural member(s) shall be cut or altered without the written consent of the City Engineer.
 - c. The Contractor shall conduct all operations in such a manner as to avoid damage to existing work and surfaces within any existing building that are to remain. Any and all damaged work and surfaces shall be repaired, replaced, or restored to their original condition at the time when this work was started, and the expense of such work shall be borne by the Contractor.
- 18.2 Damage to Utilities:** The respective Utility Company shall be given a minimum of 48 hours notice prior to any adjustment of utilities, and the Contractor shall comply with the provisions of the Virginia Underground Utilities Damage Prevention Act, Section 56-265.14 et seq., of the Code of Virginia. Damages that may occur to the utilities during the Work shall be the sole responsibility of the Contractor.
- 18.3 Relocation of Utilities:** Should any utilities require adjustment during the Work, it shall be the Contractor's responsibility to have such utilities relocated as a part of the Work and to contact and cooperate with the respective Utility Company in performance of such operations.
- 18.4 Damage to Other Work and Existing Structures:** The Contractor shall take into account all other work which shall be done by other parties on the jobsite, either now known or which may become necessary during the progress of the Work, and shall be responsible for any damage done to the other work. Damage to concrete curbs, gutters, sidewalks, or any existing facility that may occur during the construction shall be repaired or replaced by the Contractor, at its sole expense, as directed by and to the satisfaction of the City Engineer.
- 18.5 Weather Damage:** Damage with respect to the Work caused by the weather shall be the responsibility of the Contractor.
- 18.6 Blasting:** Any damage that may occur due to blasting shall be the sole responsibility of the Contractor.

SECTION 19. CHANGES IN THE WORK

- 19.1 Changes in Drawings and Specifications:** The City reserves the right to make such changes in the drawings and specifications and in the character of the Work as may be necessary or desirable to ensure completion in the most satisfactory manner, provided

such changes do not materially alter the original plans and specifications or change the general nature of the Work as a whole. Such changes shall not be considered as waiving or invalidating any condition or provision of the Contract and Bonds. Such changes shall be issued by the City Engineer to Contractor.

19.2 Changes in Quantities: The City reserves the right to make changes in the quantities of the Work, as may be considered necessary or desirable, and such changes shall not be considered as waiving or invalidating any conditions or provisions of the Contract or Bonds. The Contractor shall perform the Work as altered, whether increased or decreased, and no allowances shall be made for anticipated profits. Payment to the Contractor for the changes in the quantities of work shall be made only for the actual quantities of work performed and material furnished at the unit prices set forth in the Contract, except as provided below.

- a. When the quantity of work to be done or of material to be furnished under any item of the Contract is more than 125 percent of the quantity stated in the Contract, then either party to the Contract, upon demand, shall be entitled to negotiate for revised consideration on the portion of work above 125 percent of the quantity stated in the Contract.
- b. When the quantity of work to be done or of material to be furnished under any item of the Contract is less than 75 percent of the quantity stated in the Contract, then either party to the Contract, upon demand, shall be entitled to negotiate for revised consideration on the Work performed.
- c. Any consideration after that as set forth above shall be paid for as is hereinafter provided under Section 19.7. The foregoing notwithstanding, the quantity of work to be done or of material to be furnished under any item of the Contract, or the total original Contract shall not be increased more than 25 percent or reduced by more than 25 percent without the written consent of the Contractor and City.

19.3 Changes in the Work: No change with respect to the Work, except in an emergency situation threatening life or property, shall be made by the Contractor without the prior written approval of the City. The Contractor shall deliver any request for a change in the Work, Contract price, and/or completion time in writing to the City Engineer within ten calendar days of the occurrence requiring the change. The Contractor shall be required to certify the cause of the change order and, if appropriate, length of time involved. Payment for such changes approved by the City Engineer shall be as set forth in Section 19.7. This written request is a condition precedent to the consideration of any such request by the City.

19.4 Delays:

- a. In the event a delay is caused by the City, the City Engineer, any other separate contractor employed by the City, or any party for whom the Contractor deems the City responsible, or the agents and employees of any of them, the Contractor shall inform the City and the City Engineer immediately at the time of the occurrence by the fastest means available and shall give written notice within a reasonable time, not to exceed ten calendar days. The Contractor's notice to the City Engineer shall specify the nature of the delay claimed by the Contractor, the cause of the delay, and the impact of the delay on the Contractor's work schedule to the fullest extent possible. The City will within a reasonable time, not to exceed ten calendar days, respond to the Contractor's notice with a resolution, remedy, or direction to alleviate the delay or with a notice rejecting the claim for delay alleged to be caused by the City or parties for whom the City is responsible. If the

delay is not then resolved, the Contractor may then submit a request for change order in accordance with Sections 19.3 and 19.5. In the event of other delays, the Contractor shall give the City and City Engineer written notice within ten calendar days of the occurrence causing the delay.

- b. No extension of time or compensation shall be allowed for a delay if the Contractor failed to give notice in the manner and within the time prescribed in Subsection 19.4 (a). Furthermore, no extension of time shall be given or additional compensation allowed for any delay unless a claim therefore is made in writing to the City, with a copy to the City Engineer, within ten calendar days of the occurrence causing the delay. The claim shall state the cause of the delay, the number of days of extension requested, and any compensation requested by the Contractor. The Contractor shall report the termination of the delay to the City and City Engineer not less than ten calendar days after such termination. Failure to give notice of either the inception or the termination of the cause of delay or failure to present a claim for extension of time and/or monetary compensation within the times prescribed are conditions precedent to the assertion of any such claims by Contractor and shall constitute a waiver by Contractor of any such claims for compensation or extension based upon that cause.
- c. Requests for compensation for delays must be substantiated by itemized data and records clearly showing that the work delayed was progressing according to the approved schedule and that the costs are directly attributable to the delay in the Work claimed. The Contractor shall provide written schedules demonstrating how the Work being delayed affects the approved schedule.
- d. No extension of time, additional compensation, or change in the Contract price shall be allowed for any delays caused in whole or in part by the Contractor, any subcontractors, or any supplier. (For unavoidable justified delays, see Section 19.9 of these General Conditions.)

19.5 Change Orders: All change orders shall clearly define changes to the Work, the Contract amount or price, and the Contract time. Incomplete or partial change order requests may not be considered by the City Engineer. All change orders must indicate that the Contract Time for Completion is not changed or is either increased or decreased by a specific number of days. Any change or requested change in the Contract price shall also be included in the change order request. The Contractor must provide written justification for an extension of the Time for Completion to the City Engineer. The written justification must demonstrate an anticipated actual increase in the time required to complete the Work beyond that allowed by the Contract as adjusted by prior change orders or amendments to the Contract, not just an increase or decrease in the time needed to complete some portion of the total Work. City Engineer approved increases or decreases in time required to complete the Work shall be added or deducted, respectively, to the Time for Completion. The change to time or Contract price allowed by each change order shall include all time and monetary impacts of the change, whether the change order is considered alone or with all other changes during the course of the Project. Failure to include a change to time and/or Contract price in a change order shall waive any claims the Contractor may have for any change to the time and/or Contract price unless the parties mutually agree in writing to postpone a determination of the change to time and price resulting from the change order. However, the Contractor shall continue with the Work as may be directed by the City Engineer and shall not stop work on the Project unless directed to do so by the City Engineer.

19.6 Extra Work: The City reserves the right to make alterations or changes in the Work as the Work progresses. When any work is necessary to the proper completion of the

project which was not provided for in the Contract, the Contractor shall do such work, but only when and as ordered in writing by the City Engineer. Payment for such extra work shall be made as hereinafter provided in Section 19.7.

19.7 Payment Methods for Extra Work: The extra work done by the Contractor as authorized and approved by the City Engineer shall be paid for in the manner hereinafter described; and the compensation thus provided shall be accepted by the Contractor as payment in full for all labor, material, tools, equipment, incidentals, all superintendents' and timekeepers' services, all insurance, bonds, and all other reasonable overhead expenses incurred in the performance of the extra work. Payment for extra work may be made by one of the following methods, as agreed on in writing by the City Engineer and the Contractor before said extra work is commenced, subject to all other conditions of the Contract:

- a. Unit prices; or
- b. Lump sum price; or
- c. The cost of change in work plus ten percent of allowable costs. Allowable costs for purposes of this paragraph shall only include labor, material, sales tax, the rental of power tools and equipment actually used, or a reasonable price for the use of power tools and equipment owned by the Contractor based upon their life expectancy and purchase price, utilities, pro rata charges for foremen, and all payroll charges such as employer's FICA contribution, Public Liability and Workers' Compensation Insurance, but only if all such costs are incurred as the direct result of the changes in the Work. The change in cost for labor and material bonds and for performance bonds relative to the value of the extra work shall be allowable cost but shall not be marked up.

19.8 Disputed Claims for Extra Work: If one of the payment methods set forth in Section 19.7 is not agreed on by the City Engineer, the City may retain either an independent contractor to perform such extra work or use its own forces to perform such extra work and the Contractor shall cooperate fully with the independent contractor or City in its performance of the extra work. However, the City Engineer may also direct Contractor to perform such extra work and any dispute will be handled as set forth in Section 31 of these General Conditions.

19.9 Change in Contract Time or Contract Price: The Contractor may request an extension of time or change in the Contract price should the Work be obstructed or delayed by any justified unavoidable delays not caused in whole or in part by the Contractor, any subcontractor, or suppliers. However, delays caused by weather conditions will not be considered justified unavoidable delays unless they are caused by unusual weather as set forth in Section 4.2 of the Instructions to Bidders, in which case only an extension of time may be considered by City, but no additional compensation will be allowed for unusual weather. Furthermore, Contractor agrees that for any delays not caused by the City or any delays beyond the control of the City, no additional compensation will be due the Contractor and no change in the Contract price will be allowed by the City, only an extension of the Contract time will be considered by the City. The Contractor shall deliver requests for changes in the Contract price and/or completion time in writing to the City Engineer within ten calendar days of the occurrence requiring the change. Approved changes that alter the time of the Contract shall extend the completion time by a period equivalent to the certified time lost by such occurrence. No change in Contract price and/or completion time shall be allowed if the above notice has not been properly given, such notice being a condition precedent to any such request by the Contractor. However, the Contractor shall continue with the

Work as may be directed by the City Engineer and shall not stop work on the Project unless directed to do so by the City Engineer.

SECTION 20. PAYMENT FOR WORK

20.1 Monthly Construction Estimates: Monthly construction estimates shall be submitted to the City Engineer, Noel C. Taylor Municipal Building, 215 Church Avenue, S.W., Room 350, Roanoke, Virginia 24011, no more than once every thirty (30) calendar days.

20.2 Preparing Progress Payment Requests: In preparing construction estimates, the Contractor may request a progress payment based on the actual percentage of work completed during the preceding month. The estimate shall contain a breakdown of the total Contract amount, to include a separate breakdown of all approved change orders, into principal items of construction, showing the estimated quantity, unit price, and total for each item. In preparing progress payment requests, the material delivered on the site and preparatory work done may be taken into consideration, if properly documented, or as may be required by the City Engineer so that quantities can be verified. In addition to material delivered on the site, material such as large pieces of equipment and items purchased specifically for the project, but stored off the site, may be considered for payment, provided prior written approval is given by the City Engineer.

20.3 Progress Payments: The City will make a progress payment to the Contractor on the basis of a duly certified and approved progress payment request for the work performed under the Contract.

In the event that the City disagrees with the monthly construction progress payment request submitted by the Contractor, or in the event the As-Built Drawings are not being kept current, the City may withhold all or a portion of the progress payment until such dispute is resolved to the satisfaction of the City. If there are any objections or problems with the progress payment request, the City will notify the Contractor of such matters. If the progress payment request is approved by the City, payment will be made by the City to the Contractor not more than 30 calendar days after such request has been approved. However, if there is an objection or problem with a progress payment request, the Contractor shall continue with the Work as may be directed by the City Engineer and shall not stop work on the Project unless directed to do so by the City Engineer. Any such disputes shall be handled as set forth in Section 31 of these General Conditions.

20.4 Retainage:

- a. If the City or the City Engineer determines that the Contractor's progress or performance, or both, of the contract is unsatisfactory, the City or the City Engineer will send a notice of unsatisfactory progress and/or performance to the Contractor advising him of such determination. This notification will also advise the Contractor that a withholding retainage for cause of five percent will be withheld from each request for payment. The City will continue to withhold such retainage from payment for each month the Contractor's actual progress and/or performance is determined to be unsatisfactory.
- b. When the City or the City Engineer determines that both the Contractor's progress and performance is satisfactory in accordance with these requirements, the five percent retainage previously withheld because of unsatisfactory progress and/or performance will be released and included in the City's payment of the

Contractor's next request for payment, and the remaining requests for payment will be paid in full provided the Contractor's progress and/or performance continues to be satisfactory.

- c. The Contractor may request that such retainage be paid into an escrow account on certain Contracts, pursuant to Section 2.2-4334 of the Code of Virginia. (See also Sections 6.2 and 14.6 of Instructions to Bidders.)

20.5 Ownership of Material and Work: All material and work covered by progress payments shall become the property of the City. This provision shall not relieve the Contractor from the responsibility for all material and to maintain all completed work and to repair all damaged work. The Contractor shall not deem a progress payment as a waiver to complete the terms of the Contract or shift the risk of loss from the Contractor to the City. The Contractor warrants that Contractor has good title to all material, equipment, and supplies which Contractor uses in the Work or for which Contractor accepts payment in whole or in part.

20.6 Payments to Others by Contractor: The Contractor agrees that Contractor will comply with the requirements of Section 2.2-4354 of the Code of Virginia regarding Contractor's payment to other entities and that Contractor will take one of the two actions permitted therein within seven calendar days after receipt of amounts paid to Contractor by the City. The Contractor agrees that Contractor shall indemnify and hold the City harmless for any claims resulting from failure of the Contractor to make prompt payments to all persons supplying him equipment, labor, tools, or material in prosecution and completion of the Work provided for in the Contract.

20.7 Final Payment: After the Final Acceptance of the Work by the City, and after Final Payment is requested in writing by the Contractor, and the City Engineer has received and approved the items listed below, the City shall pay the Contractor the Final Payment, less all prior payments, damages, setoffs, liquidated damages, any amounts withheld from retainage, or any other amounts Contractor may owe the City for any reason whatever. Such final payment is subject to the City Engineer receiving and accepting all documents to finalize the Work or Project, such as, but not limited to:

- a. As-Built drawings, operation and maintenance manuals, written warranties (if applicable).
- b. Affidavit of Payment of Claims.
- c. Certificate of Final Acceptance.
- d. Such other documents or items as the City Engineer may request in writing from the Contractor.

20.8 Payment and Acceptance: No payment, final or otherwise, nor partial or entire use, occupancy, or acceptances of the Work by the City shall be an acceptance of any work or material not in accordance with the Contract, nor shall the same relieve the Contractor of any responsibility for any faulty material or workmanship or operate to release the Contractor or its surety from any obligation under the Contract or the Performance Bond or the Labor and Material Payment Bond.

20.9 Right to Audit and Maintenance of Records: The Contractor agrees that the City, and any approving Federal or State Agency or any of their duly authorized representatives, shall have access to any books, documents, papers, records, schedules and electronic data of the Contractor which are pertinent to this Project for the purpose of making an audit, examinations, excerpts, copies, or transcriptions and that Contractor will provide copies of such items to City upon City's request, at no cost to City. Contractor shall

maintain all books, records, electronic data, and other documents relating in any way to this Contract or Project for a period of five years after Final Acceptance.

SECTION 21. LIQUIDATED DAMAGES

If liquidated damages are provided for by the Contract, the following provisions shall apply:

- a. Subject to the provisions of the General Conditions for extension of time allowed for completion of the Work, if the Work is not substantially completed by the date required in the Contract, the Contractor shall owe to the City, not as a penalty but as liquidated damages, the sum stated in the Contract for liquidated damages for each and every calendar day of delay in substantial completion.
- b. Once the Work is substantially complete, the accrual of liquidated damages shall stop and the Contractor shall have 30 calendar days in which to achieve Final Acceptance of the Work.
- c. Provided, however, if Final Acceptance of the Work is not achieved by the 30th calendar day after substantial completion, and if any extension of time is not granted by the City, the Contractor shall owe to the City, not as a penalty, but as additional liquidated damages, the sum stated in the Contract as liquidated damages for each and every calendar day of delay in Final Acceptance. All such liquidated damages set forth in this Section 21 are in addition to any other damages the City may be entitled to recover from the Contractor.

SECTION 22. INSPECTION FOR SUBSTANTIAL COMPLETION AND FINAL ACCEPTANCE

- 22.1 Substantial Completion:** The Contractor shall notify the City, in writing, that the Work will be ready for inspection to determine if it is substantially complete and ready for testing on or after a certain date, which date shall be stated in the notice. The notice shall be given at least ten calendar days in advance of said date and shall be forwarded through the City Engineer. Inspection and testing shall take place at a time mutually agreeable to the Contractor, City, and City Engineer. The inspection shall determine if substantial completion has been accomplished. If so, the City Engineer will issue a Certificate of Substantial Completion and attach a written list of unfinished Work and defective Work, commonly referred to as a "punch list", which must be finished and corrected to obtain Final Acceptance.
- 22.2 Request for Final Acceptance:** The Contractor shall notify the City Engineer, in writing, that the Work will be ready for final inspection and testing on or after a certain date, which date shall be stated in the notice. That inspection and any necessary testing shall be conducted in the same manner as the inspection for substantial completion. When the Work is finally and totally complete, including the elimination of all known deficiencies, the Work shall be finally accepted by the City and final payment shall be made in accordance with Section 20.7 of these General Conditions.
- 22.3 Final Inspection:** The City Engineer will conduct the final inspection, and may elect to have other persons of his/her choosing also participate in the inspection. If one or more reinspection is required, the Contractor shall reimburse the City for all costs of reinspection or, at the City's option, the costs may be deducted from payments due to the Contractor.

- 22.4 As-Built Drawings:** No Contract Final Payment or retainage will be released prior to receipt of all approved As-Built Drawings.
- 22.5 Final Acceptance:** Upon successful completion of the final inspection and all Work required by the Contract, including, but not limited to, the delivery of the following documents and items; As-Built drawings; operation and maintenance manuals; written warranties; Certificate of Substantial Completion; Affidavit of Payment of Claims; and SB/MB/WB/SDVB Usage Status Form; the City Engineer will furnish a written Certificate of Final Acceptance of the Work to the Contractor. The City Engineer may accept the Work for occupancy or use while asserting claims against the Contractor, disputing the amount of compensation due to the Contractor, disputing the quality of the Work, its completion, or its compliance with the Contract Documents, and the like.
- 22.6 Release By Contractor:** The acceptance by the Contractor of the final payment or a payment designated as such shall be and does operate as a release by the Contractor of all claims by the Contractor against City and of all other liability of the City to the Contractor whatever, including liability for all things done or furnished in connection with the Work or the Contract.

SECTION 23. WARRANTY OF MATERIAL AND WORKMANSHIP

- 23.1** The Contractor warrants that, unless otherwise specified, all material and equipment incorporated in the Work under the Contract shall be new, in first class condition, and in accordance with the Contract Documents. The Contractor further warrants that all workmanship shall be of the highest quality and in accordance with the Contract Documents and shall be performed by persons qualified at their respective trades.
- 23.2** Work not conforming to these warranties shall be considered defective.
- 23.3** These warranties of material and workmanship are separate and independent from and in addition to any of the Contractor's other guarantees or obligations in this Contract, or that may arise by law.

SECTION 24. GUARANTEE OF WORK

- 24.1 Two Year Warranty:** The Contractor further guarantees and warrants the Work against defects or deficiencies in the Work and as to all material, equipment, and workmanship for a period of two years from the date of Final Acceptance. However, any manufacturer's guarantees or warranties or any other guarantees or warranties required by the Contract Documents shall be for the period of time provided for therein.
- 24.2** The Contractor shall obtain and furnish to the City any available guarantees and warranties from manufacturers, installers, subcontractors, or others and any guarantees and warranties called for in the Contract and have such guarantees and warranties issued to the City, or transfer such guarantees and warranties to the City, in a timely manner. All guarantees and warranties shall be subject to the reasonable approval of the City. However, any such approval or disapproval does not relieve the Contractor of any of Contractor's guarantees and warranties. Contractor shall use its best efforts to ensure that all such guarantees and warranties do not contain any indemnity requirements from the City, any limitation of liability, any reduction of the applicable statute of limitations, any venue or forum selection other than the City of Roanoke,

Virginia, or any requirement for mediation or arbitration. Any such language in a guaranty or warranty shall be deemed to be void and the Contractor along with the entity providing the guaranty or warranty shall be responsible for such guaranty or warranty with any such items being deemed deleted. All such guaranties or warranties shall be provided to the City before or within ten days after Contractor's completion of the Work and the City may withhold payments to the Contractor until receipt of all such guaranties and warranties.

24.3 All guarantees and warranties from the Contractor or others, whether set forth above, in other parts of the Contract or other documents, or that may arise by law, shall be cumulative so as to maximize City's guarantee and warranty protection. The City, by accepting any of the guaranties or warranties provided for in the Contract does not waive, and specifically reserves any legal rights and remedies that the City may have for breach of the Contract and/or breach of any such guarantees or warranties.

24.4 Defective Work: The Contractor agrees it shall repair or replace, at Contractor's sole expense, and to the satisfaction of the City Engineer, any work, material, equipment, or part that is found, by the City Engineer, to be defective.

24.5 Repairs: If, within any guarantee period, defects are noticed by the City Engineer which require repairs or changes in connection with the guaranteed work, those repairs or changes being in the determination of the City Engineer rendered necessary as the result of the use of material, equipment, or workmanship which is defective, inferior, or not in accordance with the terms of the Contract, then the Contractor shall, promptly upon receipt of notice from the City Engineer, such notice being given not more than four weeks after the expiration of any such guarantee period, and without any expense to the City:

- a. Place in satisfactory condition all guaranteed work and correct all defects therein; and
- b. Make good all damage to the structure, site, equipment, or contents thereof, which in the determination of the City Engineer is the result of the use of material, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract; and
- c. Make good any work or material or the equipment and contents of structures or the site disturbed in fulfilling any such guarantee.

24.6 Warranty Extension: In any case, where in fulfilling the requirements of the Contract or any guarantee embraced in or required thereby, the Contractor disturbs, damages or repairs any work guaranteed under the Contract, Contractor shall restore such work to a condition satisfactory to the City Engineer and guarantee such restored work to the same extent and for a like additional period of time as it was originally guaranteed under this Contract.

24.7 Correction of Defects: If the Contractor, after notice, fails to proceed promptly, but in no event longer than 30 calendar days after such notice, unless otherwise agreed to by the City Engineer, to comply with the terms of the guarantee and/or correct the Work, the City may have the defects corrected by its own forces or another contractor and the

Contractor and its surety shall be liable to the City for all costs and expenses incurred in doing so.

- 24.8** Nothing contained in this section shall be construed to establish a period of limitation with respect to any other obligation which the Contractor might have under the Contract Documents or the law of Virginia, including liability for defective work.

SECTION 25. STOP WORK ORDER

In the event that conditions exist such that no work can or should continue, other than the routine closing of the site, the Contractor may submit to the City Engineer a request to stop work or the City Engineer on his/her own may issue a Stop Work Order. The City Engineer will, if he/she approves the request or issues the order himself/herself, deliver a written "Stop Work Order" to the Contractor stipulating the effective date and the Contract time remaining. The Work, other than the routine closing of the site, and Contract time shall not again be started until a written "Resume Work Order" is received by the Contractor from the City Engineer. When the Work is stopped at the request of the Contractor and through no fault of the Contractor, the Contractor may only recover from the City payment for the cost of the Work actually performed, together with reasonable overhead and profit thereon up to that time, but profit shall be recovered only to the extent that the Contractor can demonstrate that it would have had profit on the entire Contract if it had completed the Work. The Contractor may not receive profit or any other type of compensation for parts of the Work not performed, including, but not limited to, home office overhead or any other such costs. The Contractor may also recover the actual cost of physically closing down the jobsite, but no other costs of the Stop Work Order. The City may offset any claims it may have against the Contractor against the amounts due to the Contractor. In no event shall the Stop Work Order to the Contractor relieve in any way the obligations of the Contractor's surety on its payment and performance bonds. When work is stopped by the City Engineer due to any fault of the Contractor, the Contractor may not recover any of the above costs or items or any other costs, profits, expenses, or damages of any type.

SECTION 26. TERMINATION OF CONTRACT FOR CAUSE

- 26.1 Termination for Cause:** If the Contractor should file a petition for relief as a debtor under any applicable bankruptcy law or should be adjudged bankrupt, or if it should make a general assignment for the benefit of its creditors, or if a receiver should be appointed on account of its insolvency, the City may terminate the Contract. If the Contractor should refuse or should fail, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper material, or if it should fail to make prompt payment to subcontractors or suppliers of material or labor, or disregard laws, ordinances, or the written instructions of the City Engineer, or otherwise fails to comply with any of the terms or provisions of this Contract including, but not limited to, poor services, work or material, then the City may terminate this Contract. In no event shall termination for cause terminate the obligations of the Contractor's surety on its payment and performance bonds.
- 26.2 Possession of Work:** Upon termination of the Contract, the City may take possession of the premises and of all material, tools, and appliances thereon and finish the Work by whatever method the City may deem expedient. In such case the Contractor shall not be entitled to receive any further payment of any type. If the expense of finishing the Work, including compensation for additional managerial and administrative services, shall exceed the unpaid balance of the Contract price, the Contractor shall pay the difference to the City, together with any other cost or expenses of terminating the

Contract and having it completed by others, together with any and all other damages the City may be entitled to from the Contractor.

26.3 Alternative Termination: If it should be judicially determined that the City improperly terminated this Contract for cause, then the termination shall be deemed to be a termination for the convenience of the City.

26.4 Termination Rights: Termination of this Contract under Section 26 or Section 27 is without prejudice and in addition to any other rights or remedies of the City against the Contractor.

SECTION 27. TERMINATION FOR CONVENIENCE OF CITY

27.1 Termination for Convenience: The City, at its discretion, may terminate this Contract at any time without cause, in whole or in part, upon giving the Contractor written notice of such termination. Upon such termination, the Contractor shall immediately cease work and remove from the jobsite all of its labor forces, equipment, and material as the City elects not to purchase or to assume in the manner hereinafter provided. Upon such termination, the Contractor shall take such steps as City may require to assign to the City the Contractor's interest in all subcontracts and purchase orders designated by the City. After all such steps have been taken to the City's satisfaction, the Contractor shall receive as full compensation for termination and assignment only the following:

- a. All amounts then otherwise due under the terms of this Contract for actual work performed and approved by the City; and
- b. Reasonable compensation for the actual cost of demobilization incurred by the Contractor as a direct result of such termination. The Contractor shall not be entitled to any compensation for lost profits or for any other type of contractual compensation or damage, other than those provided by the preceding sentence, including any on site or home office overhead. Upon payment of the foregoing, the City shall have no further liabilities or obligations to Contractor of any nature.

27.2 Termination Effect on Surety: In no event shall termination for the convenience of the City terminate the obligation of the Contractor's surety on its payment and performance bonds.

SECTION 28. PRECONSTRUCTION CONFERENCE

The City Engineer shall notify the Contractor as to the location, date, and time of a preconstruction conference to confirm procedures for processing construction estimates for payment and related submissions and to discuss other matters pertaining to scheduling and execution of the Work.

SECTION 29. PROJECT SIGN(S)

The Contractor shall supply, erect, and maintain Project Sign(s) in accordance with the City of Roanoke Standard Detail. The sign(s) shall be located as directed by the City Engineer. The Contractor shall not display any other signs or advertisements.

SECTION 30. ASSIGNMENTS

Project: Public Works Service Center And Fire Station # 4 & 6 Fueling Improvements
ITB# SOL1254

General Conditions-Civil

The Contractor shall not assign or transfer this Contract in whole or in part except with the prior written consent of the City, which consent shall not be unreasonably withheld. If consent to assign is given, no such assignment shall in any way release or relieve the Contractor from any of the covenants or undertakings contained in this Contract and the Contractor shall remain liable for the Contract during the entire term thereof.

SECTION 31. CONTRACTUAL DISPUTES

Contractual claims, whether for money or for other relief, including any disputes as to change orders or extra work, shall be submitted, in writing, no later than 60 calendar days after final payment or payment designated by the City as a final payment; however, written notice of the Contractor's intention to file such claim must be given at the time of the occurrence or beginning of the work upon which the claim is based. Such notice is a condition precedent to the assertion of any such claim by the Contractor. A written decision upon any such claims will be made by the City Manager or his/her designee (hereafter City Manager) within 30 calendar days after submittal of the claim and any practically available additional supporting evidence required by the City Manager. The Contractor may not institute legal action prior to receipt of the City's decision on the claim unless the City Manager fails to render such decision within 120 calendar days from submittal of its claim. The decision of the City Manager shall be final and conclusive unless the Contractor within six months of the date of the final decision on a claim or from expiration of the 120 day time limit, whichever occurs first, initiates legal action as provided in Section 2.2 - 4364, of the Code of Virginia. Failure of the City to render a decision within said 120 calendar days shall not result in the Contractor being awarded the relief claimed nor shall it result in any other relief or penalty. The sole result of the City's failure to render a decision within said 120 calendar days shall be Contractor's right to immediately institute legal action. No administrative appeals procedure pursuant to Section 2.2 - 4365, of the Code of Virginia, has been established for contractual claims under this Contract.

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CITY OF ROANOKE, VIRGINIA

SUPPLEMENTAL GENERAL CONDITIONS

These Supplemental General Conditions modify, change, and/or add to the General Conditions as indicated below:

- A. Bidders are advised that this ITB and any information or documents provided pursuant to this ITB are subject to the Virginia Freedom of Information Act and the Federal Freedom of Information Act and the Bidder must comply with the provisions of those Acts to protect any documents the Bidder may want protected from disclosure pursuant to the provisions of those Acts.

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SECTION 011000
SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work performed by Owner.
5. Work under Owner's separate contracts.
6. Future work not part of this Project.
7. Owner's product purchase contracts.
8. Owner-furnished/Contractor-installed (OFICI) products.
9. Owner-furnished/Owner-installed (OFOI) products.
10. Contractor's use of site and premises.
11. Coordination with occupants.
12. Work restrictions.
13. Specification and Drawing conventions.
14. Construction Supervision Methods and Procedures.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 017300 "Execution" for coordination of Owner-installed products.

1.3 PROJECT INFORMATION

A. Project Identification: **Public Works Service Center and Fire Stations #4 & #6 Fueling Improvements.**

1. Project Location: Public Works Service Center
1802 Courtland Road, NE
Roanoke, Virginia, 24012
2. Project Location: Fire Station #4
3763 Peters Creek Road, SW
Roanoke, Virginia, 24018

3. Project Location: Fire Station #6
1833 Jamison Avenue, SE
Roanoke, Virginia, 24013
- B. Owner: City of Roanoke.
1. Owner's Representative:
James Nuckles, Project Manager
james.nuckles@roanokeva.gov
 2. Owner's Construction Representative
City of Roanoke, Engineering Division
215 Church Avenue Room 350
Roanoke, VA 24011
- C. Architect: Spectrum Design PC.
1. Architect's Representative:
Michael A. Rakes PE, Project Manager
Spectrum Design
10 Church Ave SE Plaza Suite 1
Roanoke, VA 24011
mrakes@spectrumpc.com
- D. Web-Based Project Software: Project software can be used for purposes of managing communication and documents during the construction stage at the Contractor's option.
1. See Section 013100 "Project Management and Coordination." for requirements for using web-based Project software.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:
1. The construction of fueling station with canopy at three locations, above ground fuel island, technology room, employee parking lot, fence upgrades, sidewalk, drainage improvements, stormwater BMP, utility work, parking lot improvements, tree removal, landscaping and milling & overlay. The project consists of three locations (Public Works Service Center – 1802 Courtland Road NE, Fire Station # 4 – 3763 Peters Creek Road SW and Fire Station # 6 – 1833 Jamison Avenue SE. The project limits along Courtland Road and Sycamore Avenue consists of existing variable right-of-way and other Work indicated in the Contract Documents.
 2. Project construction shall be phased as shown in the Contract Documents to allow for continuous operation of the service center and fire stations during construction.
- B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 PHASED CONSTRUCTION

- A. Construct the Work in stages, with each stage substantially complete as indicated **on Drawings**. See Civil drawings for details of work included in each phase.
- B. Before commencing Work of each phase, submit an updated copy of Contractor's construction schedule, showing the sequence, commencement and completion dates, and move-out and -in dates of Owner's personnel for all phases of the Work.

1.6 WORK PERFORMED BY OWNER

- A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
- B. Preceding Work: Owner will perform the following construction operations at Project site. Those operations may not be substantially complete before Work under this Contract begins and some concurrent work may overlap.
 1. Removal of existing Fuel Island and tanks: Owner will separately procure and manage the removal and backfill of the existing fuel island, tanks, and equipment located at the Public Works Center. This activity is adjacent to proposed Work.
- C. Concurrent Work: The Owner may at times be required to perform construction operations or other activity at Project sites. Those operations may be conducted simultaneously with Work under this Contract.
 1. Snow removal (seasonal).
 2. Emergency response operations (unpredictable).
 3. Facility repair on adjacent structures (various locations).
 4. Electric Vehicle Charging Station installation (planned adjacent to Public Works Facility but not yet scheduled).

1.7 WORK UNDER OWNER'S SEPARATE CONTRACTS

- A. Work with Separate Contractors (or Vendors): Cooperate fully with Owner's separate contractors, so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under Owner's separate contracts.
- B. Concurrent Work: Owner has awarded or will award separate contract(s) for the following construction operations at Project site(s). Those operations are dependent upon Work under this Contract being completed. Work may be partially conducted simultaneously with Work under this Contract.
 1. Kegley Electric: Will install camera equipment on light poles installed as Work under this Contract. All poles and conduit with pull string shall be provided as

- Work under this Contract and not by vendor. Vendor to provide cameras, wiring, and cabling and their connections.
2. Blossman Fuel: Will install propane tanks and equipment on pad prepared as Work under this Contract. Blossman Fuel will trench and install all underground propane piping and valves from tank to dispensers. All concrete flatwork, pavement, and underground communication and power conduits and cabling serving propane pump shall be provided as Work under this Contract and not by vendor.
 3. Fuel: Vender to be determined. Owner will furnish gasoline and diesel fuel for filling the new tanks.

1.8 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

- A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:
1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
 2. Provide for delivery of Owner-furnished products to Project site.
 3. Upon delivery, inspect, with Contractor present, delivered items.
 - a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
 4. Obtain manufacturer's inspections, service, and warranties.
 5. Inform Contractor of earliest available delivery date for Owner-furnished products.
- B. Contractor's Responsibilities: The Work includes the following, as applicable:
1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
 2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
 3. Receive, unload, handle, store, protect, and install Owner-furnished products.
 4. Make building services connections for Owner-furnished products.
 5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
 6. Repair or replace Owner-furnished products damaged following receipt.
- C. Owner-Furnished/Contractor-Installed (OFCI) Products:
1. Equipment as specified on Drawings A001-PW, A001-FS4, and A001-FS6: Some products will be furnished by Owner for Fuel Systems and Fuel Management for Contractor installation. Refer to Table on Drawings.
 2. Prefabricated Pedestrian Gate Frame: Location proposed at Public Works Facility adjacent to Sycamore Lane. Reference Detail 1/C502 on Drawing C502-PW and table on A001-PW.

1.9 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Restricted Use of Site: Each Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Limits on Use of Site: Limit use of Project site to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits on Use of Site: Confine construction operations to areas defined by Phasing Plans.
 - 2. Driveways, Walkways and Entrances: Keep entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
 - c. Continuous Site Access is required by the Owner for Public Works Operations and Fire Department response Operations. No construction activities shall impair Operations.
- C. Condition of Existing Building: Maintain portions of existing buildings affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations. These include but are not limited to the following Work:
 - 1. Public Works Center – Sprinkler System Improvements, Electrical and Communications installation.
 - 2. Fire Station #4 – Electrical and Communication installation.
 - 3. Fire Station #6 – Electrical and Communications installation.
- D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.10 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy Project site and existing and adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.

2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.
- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.11 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work to between 8 a.m. to 7 p.m., Monday through Friday.
1. Weekend Hours: With previous approval by City of Roanoke. Weekend hours will be limited to 8 a.m. to 7 p.m.
 2. Hours for Utility Shutdowns: Coordinate with Owner for Work involving water system or fire/sprinkler systems at the Public Works Facility. Notify Owner (15) days prior to the date service will be interrupted. Coordinate a work schedule, hours, and fire watch (as required).
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:
1. Notify Architect and Owner not less than 15 days in advance of proposed utility interruptions.
 2. Obtain Architect's or Owner's written permission before proceeding with utility interruptions.
- D. Smoking and Controlled Substance Restrictions:
1. Use of alcoholic beverages, and other controlled substances on Project site is not permitted.

2. Contractor shall identify a limited exterior "Smoking Area" within the construction fence. Area shall be kept clean and free of debris. No smoking is permitted in other areas of the site.

1.12 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.
 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.13 CONSTRUCTION SUPERVISION, METHODS & PROCEDURES

- A. Superintendence by Contractor
 1. The Contractor shall have a competent foreman or superintendent, satisfactory to the Architect/Engineer and the Owner, available at all times during the progress of the Work at any site. The superintendent shall be expected to cover all three sites and shall schedule to be present for significant portions of the Work at any

particular site. The superintendent or foreman shall be familiar with and be able to read and understand the plans and specifications, and be capable of communicating orally and in writing with the Owner's inspectors and the Contractor's workers. The Contractor shall be responsible for all construction means, methods, techniques, sequences and procedures, for coordinating all portions of the Work under the Contract except where otherwise specified in the Contract Documents, and for all safety and worker health programs and practices. The Contractor shall notify the Owner, in writing, of any proposed change in superintendent, including the reason therefor, prior to making such change.

2. The Contractor shall, at all times, enforce strict discipline and good order among the workers on the Project, and shall not employ on the Work, or contract with, any unfit person, anyone not skilled in the Work assigned to him, or anyone who will not work in harmony with those employed by the Contractor, the Subcontractors, the Owner or the Owner's separate contractors and their subcontractors.
 3. The Owner may, in writing, require the Contractor to remove from the Site any employee or Subcontractor's employee the Owner deems to be incompetent, careless, not working in harmony with others on the Site, or otherwise objectionable, but the Owner shall have no obligation to do so.
- B. The Contractor shall be solely responsible for supervising and directing the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract. The Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction and for coordinating all portions of the Work under the Contract, except where otherwise specified in the Contract Documents. However, the Contractor shall not be responsible for the negligence of others in the design or selection of a specific means, method, technique, sequence or procedure of construction which is indicated in and required by the Contract. The Contractor is solely responsible to the Owner that the finished Work complies with the Contract Documents.
- C. The Contractor shall be solely responsible for health and safety precautions and programs for workers and others in connection with the Work. No inspection by, knowledge on the part of, or acquiescence by the Architect or Engineer, the Project Inspector, the Owner, the Owner's employees and agents, or any other entity whatever shall relieve the Contractor from its sole responsibility for compliance with the requirements of the Contract or its sole responsibility for health and safety programs and precautions.
- D. If a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents, the Contractor may furnish or utilize a substitute means, method, sequence, technique or procedure of construction acceptable to Architect/Engineer, subject to the Owner's right to disapprove. The Contractor must submit its written request for the substitution to the Architect/Engineer with sufficient information to allow the Architect/Engineer to determine that the substitute proposed is equivalent to that indicated or required by the Contract.

- E. The divisions and sections of the Specifications and the identification of any drawings shall not control the Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012200
UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.3 DEFINITIONS

- A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.
- B. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Instructions to Bidders, Section 10, MATERIAL AND WORKMANSHIP.
 - 2. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
 - 1. Substitutions during Bidding: Refer to and comply with the Instructions to Bidders, Section 10 for dates, format for submission, and other requirements.
 - 2. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 3. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS (During Construction)

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form acceptable to Architect.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.

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- b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

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1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within [60] days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.

- d. Substitution request is fully documented and properly submitted.
- e. Requested substitution will not adversely affect Contractor's construction schedule.
- f. Requested substitution has received necessary approvals of authorities having jurisdiction.
- g. Requested substitution is compatible with other portions of the Work.
- h. Requested substitution has been coordinated with other portions of the Work.
- i. Requested substitution provides specified warranty.
- j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012900
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
 - 2. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 2. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:

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- a. Project name and location.
 - b. Owner's name.
 - c. Owner's Project number.
 - d. Name of Architect.
 - e. Architect's Project number.
 - f. Contractor's name and address.
 - g. Date of submittal.
2. Arrange schedule of values consistent with format of AIA Document G703 .
3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site.
6. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
7. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

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1. Other Application for Payment forms proposed by the Contractor may be acceptable to Architect and Owner. Submit forms for approval with initial submittal of schedule of values.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Submittal schedule (preliminary if not final).
 5. List of Contractor's staff assignments.
 6. Copies of building permits.
 7. Report of preconstruction conference.

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- H. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 - a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Certification of completion of final punch list items.
 3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 4. Updated final statement, accounting for final changes to the Contract Sum.
 5. AIA Document G706.
 6. AIA Document G706A.
 7. AIA Document G707.
 8. Evidence that claims have been settled.
 9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 10. Proof that taxes, fees, and similar obligations are paid.
 11. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013100
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. RFIs.
 - 4. Digital project management procedures.
 - 5. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

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1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
 2. Number and title of related Specification Section(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in Project meeting room, in temporary field office, in web-based Project software directory if being used, and in prominent location in each built facility. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.

1.6 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

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1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Owner name.
 3. Owner's Project number.
 4. Name of Architect.
 5. Architect's Project number.
 6. Date.
 7. Name of Contractor.
 8. RFI number, numbered sequentially.
 9. RFI subject.
 10. Specification Section number and title and related paragraphs, as appropriate.
 11. Drawing number and detail references, as appropriate.
 12. Field dimensions and conditions, as appropriate.
 13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 14. Contractor's signature.
 15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716 or Software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.

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3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log monthly . Include the following:
 1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number, including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three days if Contractor disagrees with response.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Architect's Data Files Not Available: Architect will not provide Architect's BIM model digital data files for Contractor's use during construction.
- B. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
 1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.

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2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Responsibilities and personnel assignments.
 - b. Tentative construction schedule.
 - c. Phasing.
 - d. Critical work sequencing and long lead items.
 - e. Designation of key personnel and their duties.
 - f. Lines of communications.
 - g. Use of web-based Project software.
 - h. Procedures for processing field decisions and Change Orders.
 - i. Procedures for RFIs.
 - j. Procedures for testing and inspecting.
 - k. Procedures for processing Applications for Payment.
 - l. Distribution of the Contract Documents.
 - m. Submittal procedures.
 - n. Preparation of Record Documents.
 - o. Use of the premises.
 - p. Work restrictions.
 - q. Working hours.
 - r. Owner's occupancy requirements.
 - s. Responsibility for temporary facilities and controls.
 - t. Procedures for moisture and mold control.
 - u. Procedures for disruptions and shutdowns.
 - v. Construction waste management and recycling.
 - w. Parking availability.
 - x. Office, work, and storage areas.
 - y. Equipment deliveries and priorities.
 - z. First aid.
 - aa. Security.
 - bb. Progress cleaning.
 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Sustainable design requirements.
 - i. Review of mockups.
 - j. Possible conflicts.
 - k. Compatibility requirements.
 - l. Time schedules.
 - m. Weather limitations.
 - n. Manufacturer's written instructions.
 - o. Warranty requirements.
 - p. Compatibility of materials.
 - q. Acceptability of substrates.
 - r. Temporary facilities and controls.
 - s. Space and access limitations.
 - t. Regulations of authorities having jurisdiction.
 - u. Testing and inspecting requirements.
 - v. Installation procedures.
 - w. Coordination with other work.
 - x. Required performance results.
 - y. Protection of adjacent work.
 - z. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at biweekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities

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- shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Status of sustainable design documentation.
 - 6) Deliveries.
 - 7) Off-site fabrication.
 - 8) Access.
 - 9) Site use.
 - 10) Temporary facilities and controls.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) Status of RFIs.
 - 16) Status of Proposal Requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) Documentation of information for payment requests.
 4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 013200
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's Construction Schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Unusual event reports.
- B. Related Requirements:
 - 1. Section 014000 "Quality Requirements" for schedule of tests and inspections.
 - 2. Section 012900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.

- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file.
 - 2. PDF file.
- B. Startup construction schedule.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- D. Unusual Event Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

- 1. Discuss constraints, including [phasing] [work stages] [area separations] [interim milestones] [and] [partial Owner occupancy].
- 2. Review delivery dates for Owner-furnished products.
- 3. Review schedule for work of Owner's separate contracts.
- 4. Review submittal requirements and procedures.

1.6 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
- B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Activities: Treat each separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Temporary Facilities: Indicate start and completion dates for the following as applicable:
 - a. Securing of approvals and permits required for performance of the Work.
 - b. Temporary facilities.
 - c. Construction of mock-ups, prototypes and samples.
 - d. Owner interfaces and furnishing of items.
 - e. Interfaces with Separate Contracts.
 - f. Regulatory agency approvals.
 - g. Punch list.
 - 3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 4. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
 - 5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 - 7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.

- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work under More Than One Contract: Include a separate activity for each contract.
 3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 4. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 5. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Uninterruptible services.
 - b. Partial occupancy before Substantial Completion.
 - c. Seasonal variations.
 - d. Environmental control.
 6. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion, and the following interim milestones:
1. Temporary enclosure and space conditioning.
 2. Completion of each Construction Phase as indicated on the Drawings.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and the Contract Time.
- G. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate Final Completion percentage for each activity.
- H. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
- I. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.8 STARTUP CONSTRUCTION SCHEDULE

- A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within seven days of date established for the Notice of Award.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

1.9 CPM SCHEDULE REQUIREMENTS

- A. Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for commencement of the Work. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's Construction Schedule using a time-scaled CPM network analysis diagram for the Work.
1. Develop network diagram in sufficient time to submit CPM schedule, so it can be accepted for use no later than 60 days after date established for commencement of the Work.

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- a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.
 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and inspection.
 - j. Commissioning.
 - k. Punch list and Final Completion.
 - l. Activities occurring following Final Completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

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1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

1.10 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.
- C. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
 - 1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

- B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
5. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
6. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
7. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
8. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying

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with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal Category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
1. Project name.
 2. Date.
 3. Name of Architect.
 4. Name of Contractor.
 5. Name of firm or entity that prepared submittal.
 6. Names of subcontractor, manufacturer, and supplier.
 7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
 8. Category and type of submittal.
 9. Submittal purpose and description.

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10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.
13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.
15. Remarks.
16. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

E. Submittals Utilizing Web-Based Project Software: At the Contractor's option, prepare submittals as PDF files or other format indicated by Project management software.

1.6 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit submittals via email or Web-Based Project Management Software at the Contractor's Option. Submission procedures shall be consistent through the project.
2. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
 - a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
3. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

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3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.7 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.

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- c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 - 5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
- 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
- 1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
 - 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 - 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
 - 4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
 - 5. Paper Transmittal: Include paper transmittal, including complete submittal information indicated.
 - 6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity.

Sample sets may be used to determine final acceptance of construction associated with each set.

- a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 7. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 8. Samples for Verification: When requested by the Architect, Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

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1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.

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- f. Test procedures and results.
- g. Limitations of use.

1.8 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

1.9 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp or indication in web-based Project management software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 - 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.
 - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.
 - 2. Submittals by Web-Based Project Management Software: Architect will indicate, on Project management software website, the appropriate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

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- E. Architect will return without review submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 014000
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

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- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."
- H. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- I. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.4 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the

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Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.6 ACTION SUBMITTALS

- A. Mockup Shop Drawings: For integrated exterior mockups.
 - 1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
 - 2. Indicate manufacturer and model number of individual components.
 - 3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.7 INFORMATIONAL SUBMITTALS

- A. Reports: Prepare and submit certified written reports and documents as specified.
- B. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, telephone number, and email address of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.

11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement of whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement of whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.

1.9 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
- F. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.10 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

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3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform duties of Contractor.
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 6. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in the Statement of Special Inspections attached to this Section, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
 6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.

Project: Public Works Service Center and Fire Stations #4 & #6 Fueling Improvements

ITB: SOL1254

Quality Requirements
014000 - 7

4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and authorities' having jurisdiction reference during normal working hours.
 1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.
 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION



Special Inspection and Testing Agreement

Permit # **CBLD25-0204**

Date **8/1/2025**

Tax Map # **3080433**

The current code in effect is the

2021 Virginia Uniform Statewide Building Code

Project Information:

Project Name **Refueling Centers Public Works Service Center**

Property Address **1802 Courtland Ave. Roanoke, VA 24012**

Before a Permit Can be Issued:

The Owner and the Registered Design Professional in Responsible Charge, acting as the Owner's Agent, shall complete this agreement and the City of Roanoke Statement of Special Inspections.

Approval of Special Inspection Agencies, Special Inspectors and/or Testing Labs:

Special Inspection Agencies, Special Inspectors and Testing Labs shall disclose any possible conflicts of interest. The Registered Design Professional in Responsible Charge shall pre-qualify the designated Special Inspection Agencies, Special Inspectors, Testing Labs and Fabricator Shops, and submit their qualifications as part of the Statement of Special Inspections. The City of Roanoke Building Safety Department shall approve the designated Special Inspection Agencies, Special Inspectors, Testing Labs and Fabricator Shops, Prior to any work being performed.

Special Inspections and Testing shall meet the minimum applicable requirements of Section 1703 through 1709 of the VUSBC-2021 and the following conditions:

A. Owner Responsibilities:

- 1. Agree and sign the Special Inspection and Testing Agreement.**
- 2. Employ and Fund the Special Inspections and Testing Services:**

The project Owner, the Engineer/Architect or record, an Agent of the Owner is responsible for employing and funding the special inspection and testing services. The Special Inspection Agencies and Special Inspectors shall not be in the employ of the Contractor, a subcontractor or material supplier. In the case of an Owner who is also acting as the Contractor, Special Inspection Agencies and the Special Inspectors shall be employed as specified by the Building Official.

B. Registered Design Professional in Responsible Charge Responsibilities:

- 1. Agree and sign the Special Inspection and Testing Agreement:**

The Engineer/Architect of record shall complete the Special Inspection and Testing Agreement and submit with the Building Permit Application.

- 2. Complete the City's Statement of Special Inspections:**

The Engineer/Architect of record shall complete the Statement of Special Inspections and submit it with the Building Permit Application. The Completion of the Statement of Special Inspections includes the following:

- Check the construction items on the Statement of Special Inspections that require Special Inspections. This shall include identification of materials, systems, components and work required to have Special Inspection and Testing.
- Identify the type and extent of each Special Inspection and the names of individuals and firms performing special inspections and/or testing.
- Identify the type and extent of each test.
- Coordinate with the project Owner on the selection of the Special Inspection Agencies, Special Inspectors, Testing Labs and Fabricator Shops.
- Pre-qualify Special Inspection Agencies, Special Inspectors, Testing Labs and Fabricator Shops for each applicable construction operation based on the City's "Qualification Standards for Special Inspections" that are listed in the City's Statement of Special Inspections.
- Provide (list on the City's Statement of Special Inspections) the name and contact information of each designated Special Inspection Agency, Special Inspector, Testing Lab and Fabricator Shop. This includes providing the Building Safety Department with all documents required by the City's Statement of Special Inspections for each party involved in the Special Inspection Program.

Planning Building & Development 215 Church Ave., SW, Room 170 Roanoke, VA 24011

Phone: (540) 853-1090 www.roanokeva.gov permitcenter@roanokeva.gov

- vii. Coordinate with Building Permit Applicant, to insure that the completed Special Inspection and Testing Agreement and the completed Statement of Special Inspections are submitted to the Building Safety Department for review and acceptance at the time of Building Permit Application.

3. Respond to field discrepancies:

The Engineer/Architect of Record shall respond to Special Inspector reports of uncorrected, nonconforming items and shall provide remedial measures.

4. Review shop drawings and submit design changes:

The Engineer/Architect of Record shall acknowledge and accept shop drawings that detail structural information. Written approval of any verbally approved deviations from the approved plans shall be submitted to the Building Safety Department and to the Special Inspector/Special Inspection Agency. Revised plans shall be submitted for Building Safety Department review and approval.

C. Contractor Responsibilities:

1. Agree and sign the Special Inspection and Testing Agreement.

2. Notify the Special Inspection Agency/Special Inspector/Testing Lab:

The Contractor or the holder of the Building Permit (Applicant or duly authorized agent) is responsible for notifying the Special Inspector or Special Inspection and Testing Agency regarding individual Special Inspections and Testing items listed on the City's Statement of Special Inspections.

3. Provide access to approved plans:

The contractor is responsible for providing the Special Inspector with access to the approved plans and approved shop drawings.

4. Retain Special Inspection records at the job site:

The Contractor is responsible for retaining, at the job site, copies of all special inspection records completed by Special Inspectors and making them available to the City's Building Inspector upon request.

5. Obtain Building Safety Department approval prior to concealment:

The Contractor shall request Building Safety Department inspections and obtain approval prior to concealing any work requiring special inspections.

D. Special Inspection Agency, Special Inspector and Testing Lab Duties and Responsibilities:

1. Agree and sign the Special Inspection and Testing Agreement.

2. General requirements:

Special Inspectors shall review approved plans, specifications, and the referenced standards and approved shop drawings for Special Inspection requirements. Special Inspectors shall comply with the Special Inspection requirements of the VUSBC-2015 and the Statement of Special Inspections regarding work and materials.

3. Signify presence at job site:

The Special Inspector shall notify Contractor's personnel of their presence and responsibilities at the job site. A Special Inspection Log (copy attached) of each Special Inspector's presence on the job site shall be provided near the building inspection reports. This record shall include the following:

- i. Inspection type
- ii. Name of special inspection
- iii. Certification number
- iv. Date
- v. Any pertinent notes
- vi. Time of arrival and departure

4. Observe assigned work and comply with Statement of Special Inspections:

- i. Inspect categories listed on the approved Statement of Special Inspections that they are responsible for. Inspections shall indicate conformance with approved plans, specifications, referenced standards and applicable workmanship provisions of the VUSBC-2021.
- ii. Use the Architect/Engineer reviewed and accepted structural shop drawings as an aid in conducting the related special inspections.
- iii. Be on site at all times to observe construction operations that require continuous Special Inspections and Testing. Be on site to observe construction operations that require periodic inspections as required per Sections 1703, 1704 and 1705 of VUSBC-2021.

5. Report nonconforming items:

The Special Inspectors shall bring all nonconforming items to the immediate attention of the Contractor and note all such items in the Special Inspector's daily report. If any item is not resolved in a timely manner or is about to be covered by construction, the Special Inspector shall immediately notify the Building Safety Department, the Engineer/Architect of record and post a discrepancy notice at the job site. The Special Inspector shall write a separate report to be posted at the job site regarding noted discrepancies. This report shall contain, as a minimum, the following about each nonconforming item:

- i. Description and exact location.
- ii. Reference to applicable details of approved plans/specifications.
- iii. Name and title of each individual notified and method of notification.
- iv. Corrective action taken to resolve noted discrepancy at the job site.

6. Provide Progress Reports:

The special Inspectors shall complete written inspection reports for each visit and leave a copy on site for the Contractor and the Building Inspector to review. The Special Inspector/Special Inspection Agency shall provide copies of these reports weekly, or at the completion of a Special Inspection if Special Inspections take place more than a week apart, to the Building Safety Department's Building Inspector, Engineer/Architect of record and any others designated. These reports shall include:

- i. Date
- ii. Time of arrival and departure
- iii. Building permit number
- iv. Project name and address
- v. Type of inspection
- vi. Inspection frequency required - Continuous or Periodic
- vii. Inspections made including locations
- viii. Tests performed
- ix. Any nonconformance items (discrepancies) and how they were resolved
- x. Listing of unresolved items, parties notified, time and method of notification
- xi. Itemization of changes authorized by the Engineer/Architect of record
- xii. Inspector's signature
- xiii. Full name of inspector printed clearly
- xiv. Certification number

7. Submit final report:

The Special Inspection Agency shall submit a final report that is sealed, signed and dated by its responsible Engineer/Architect, to the City of Roanoke Building Safety Department's Building Inspector, stating that all items requiring Special Inspections and Testing were fulfilled and reported. This report shall also state that all items required Special Inspections and tested items were inspected and found to be in conformance with the approved plans, shop drawings, specifications, referenced standards, Statement of Special Inspections and applicable provisions of the VUSBC: 2021. Items not in conformance, unresolved items, or any discrepancies in Special Inspection coverage (i.e., missed inspections, periodic inspections when continuous inspections were required, etc.) shall be specifically mentioned in this report.

E. Building Safety Department Responsibilities:

Specific duties and responsibilities of the Building Safety Department relating to Special Inspections include the following:

1. Review and approve of submittal documents for compliance with the Special Inspection Program Requirements:

The Building Safety Department is responsible for reviewing all submitted plans, specifications, forms related to the Special Inspection Program, and any other submitted documents for compliance with the Virginia Building Code. All items submitted must be reviewed and approved prior to issuance of the Building Permit. This includes the following:

- i. Check the qualification of each Special Inspector, Special Inspection Agency, Testing Lab and Fabricator Shop that is listed on the Statement of Special Inspections in accordance with the City's "Qualification Standards for Special Inspections".
- ii. Check that all parties involved in the Special Inspection Program have completed their portion of the Special Inspection and Testing Agreement.
- iii. Issue the Building Permit with the approved Statement of Special Inspections, Special Inspection and Testing Agreement and permit conditions attached to the approved plans that will be kept on the job site.
- iv. Determine if a pre-construction meeting is required to review the Special Inspection Program with all appropriate members of the construction team.

2. Monitor special inspections and testing activities:

The Building Inspectors will monitor work requiring Special Inspection and Testing activities at the job site to assure that the designated qualified Special Inspectors are performing their duties when work requiring Special Inspections is in progress.

3. Review special inspection reports:

The Building Inspector will check the special inspection reports left at the job site by the Special Inspector for any discrepancies or non-conforming items. Weekly special inspection reports received will be reviewed by the Building Inspector. The Building Inspector must review all special inspection reports and perform field inspections to verify conformance to the approved plans, shop drawings and specifications prior to concealing any work related to special inspections.


4. Perform final inspection:

The Building Safety Department will not perform a final inspection or approve the project until the final Special Inspection report has been received from a Special Inspection Agency and reviewed and approved by the Building Inspector.

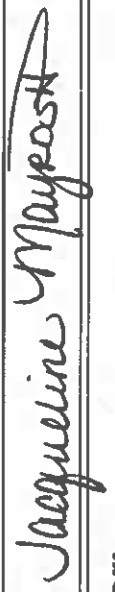
ACKNOWLEDGEMENTS

I have read and agree to comply with my responsibilities as they are outlined in the Special Inspection and Testing Agreement

Owner:

Print Name:	Luke Rich (CAR ENGINEER)	Date:	10/21/25
Signature:			

Registered Design Professional in Responsible Charge (Project Engineer/Architect of Record):

Print Name/Company:	Jacqueline Mayrosh	Date:	8/1/2025
Signature:			

Contractor:

Print Name/Company:		Date:	
Signature:			

Special Inspections and Testing Agencies and/or Testing Laboratories:

Print Name/Company:		Date:	
*Signature:			
Print Name/Company:		Date:	
*Signature:			

*This signature must be that of the responsible professional Engineer within the Special Inspection Agency.

Independent Special Inspectors:

Print Name:		Date:	
Signature:			
Print Name:		Date:	
Signature:			

**Accepted by the City of Roanoke's
Building Safety Department**

Print Name:		Date:	
Signature:			

Statement of Special Inspections

Work Location or Business Name: PWSC Roanoke
Property Address: 1802 Courtland Ave. Roanoke, VA 24012 Tax #: 3080433

Registered Design Professional (RDP) in Responsible Charge Information

Name: Jacqueline Mayrosh
Address: 10 Church Ave. SE
City: Roanoke State: VA Zip: 24011
Phone: (540) 342-6001 Email: jmayrosh@spectrumpc.com
*RDP DPOR License #: 43345

**If Property Owner is an LLC or Corporation, please provide a Member or Corporate Officer Name and Address*

Member/Officer Name: _____
Member/Officer Address: _____
City: _____ State: _____ Zip: _____
Phone: _____ Email: _____

Primary Contact (If different from RDP)

Name: _____
Phone: _____ Email: _____

This **Statement of Special Inspections** is submitted as a condition for permit issuance in accordance with the 2021 Edition of the Virginia Uniform Statewide Building Code (USBC), Section 111.2, and Chapter 17 of the 2021 Edition of the Virginia Construction Code (VCC). It includes the following:

1. **Complete** list of all materials and work requiring special inspections, and;
2. **Complete** list of all the inspections to be performed and whether they are required to be periodic or continuous inspections, and;
3. **Complete** list of the individuals, approved agencies or firms intended to be retained for conducting such inspections.

The RDP in Responsible Charge shall keep records of all inspections and shall furnish **Periodic Reports of Special Inspections** to the Building Official each month on the date shown below until the **Final Report of Special Inspections** is submitted. **Periodic Reports of Special Inspections** will include a summary of all activities requiring special inspections for the period along with a log of discrepancies noted. During the course of the project, discrepancies and deviations from the approved plans and specification and code violations observed during the conduct of special inspections services shall be brought to the immediate attention of the contractor for correction. **If such discrepancies are not corrected, the discrepancies shall be brought to the immediate attention of the Building Official.** The special inspection program does not relieve the Contractor of their responsibilities.

Special Inspections are in addition to the regular inspections by Building Inspections personnel specified in Section 113.3 of the Virginia Uniform Statewide Building Code.

Required building Inspections SHALL NOT be performed by individuals performing Special Inspection

A **Final Report of Special Inspections** documenting completion of all required special inspections and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Final Inspection and/or a Certificate of Occupancy.

Job site safety and means and methods of construction are solely the responsibility of the Contractor.

Instructions for Completing this Form:

1. The Registered Design Professional (Architect/Engineer) in responsible charge of the Project shall complete this form and submit it with the Building Permit Application for review and approval by the Building Department prior to the issuance of the Building Permit for the Project. This Statement of Special Inspections (SSI) form will be issued to the job site at the time of issuance of the Building Permit.
2. Information detailing the qualifications including copies of all current certifications and accreditations of each Special Inspector, Special Inspection Agency, and Fabricator Shop, to be used for the Project shall be submitted by the Registered Design Professional (Architect/ Engineer) in responsible charge with this completed form (Sections 1703 and 1704.2.1 of the 2021 VCC). Information shall also be provided outlining the qualifications of any Testing Labs (soils, concrete, masonry, steel, and others) being used for the project. This includes information about the Accreditation of the Testing Lab, names and qualifications of each.
3. Included in this document are the **"QUALIFICATION STANDARDS FOR SPECIAL INSPECTIONS"**. Each party involved with the Project shall meet these minimum qualifications standards. (Sections 1701, 1702, 1703, and 1704 of the 2021 VCC)
4. This form is intended for buildings of structures that are assigned to Seismic Design Category A or B. The Registered Design Professional shall provide a modified Statement of Special Inspection for buildings or structures assigned to Seismic Design Category higher than B.

Special Inspection Categories (1701.1, 1702, 1704 & 1705):

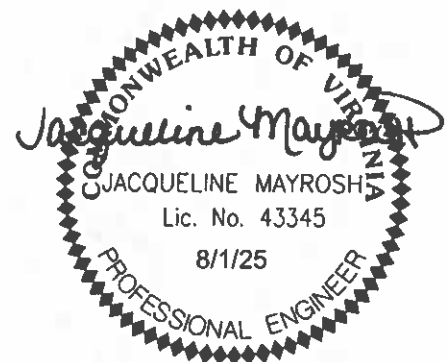
Special inspections are required for materials, installation, fabrication, erection or placement of components and connections requiring special expertise to insure compliance with approved construction documents and applicable reference standards. Section 1705 of the 2021 USBC lists a total of 15 different categories of special inspections and testing (Categories A through O) as listed below). Please check the appropriate boxes below that apply to your project and enter the name of each individual responsible for the Special Inspection you have checked in the space provided to the right of each category. Please provide the appropriate documents that verify the qualifications of each individual or firm listed.

Time of Month for Delivery of Periodic Report of Special Inspections: Last day

Periodic reports of special inspections must be submitted on the date listed above, if the reports are not submitted within 10 days of the date above, the permit maybe suspended until reports are submitted.

RDP in Responsible Charge:

Name: Jacqueline Mayrosh



Owner/Authorized Agent

Signature: [Signature]

(CITY ENGINEER)

Date: 10/21/2025

Building Official:

Signature: _____

Date: _____

A.	Inspection of Fabricators (1704.2.5): Where fabrication of structural load-bearing members and assemblies is being performed on the premises of a fabricator's shop, special inspection of the fabricated items shall be required by Section 1704.2.5 and as required elsewhere in the 2021 USBC. See Category A1 or A2 below for each Fabricator as appropriate:		
A. 1.	Fabrication & Implementation Procedures (1704.2.5) for Fabricators Not Registered & Not Approved:		
Check Box Below if Required	Indicate below all structural load-bearing members & assemblies that are being assembled on the premises of a fabricator's shop that is not registered and not approved (Section 1704.2.5)	Indicate below the name of the fabricator shop that is not registered and not approved (Section 1704.2.5)	Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	1. Structural Steel		
<input type="checkbox"/>	2. Steel Joists & Girders		
<input type="checkbox"/>	3. Pre-cast Concrete		
<input type="checkbox"/>	4. Prestressed Concrete		
<input type="checkbox"/>	5. Wood Construction (Section 1705.5) - Prefabricated Structural Elements Covering:		
<input type="checkbox"/>	5.1. Manufactured Wood Trusses		
<input type="checkbox"/>	5.2. Walls		
<input type="checkbox"/>	5.3. Floors		
<input type="checkbox"/>	5.4. Roof Assemblies		
<input type="checkbox"/>	6. Cold Formed Steel Trusses		

A. 2. Fabricator Approval (1704.2.5.1) for Fabricators Registered & Approved:			
Check Box Below if Required	Indicate below all structural load-bearing members & assemblies that are being assembled on the premises of a fabricator's shop that is not registered and not approved (Section 1704.2.5.1)	Indicate below the name of the fabricator shop that is not registered and not approved (Section 1704.2.5.1)	Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input checked="" type="checkbox"/>	1. Structural Steel		
<input type="checkbox"/>	2. Steel Joists & Girders		
<input type="checkbox"/>	3. Pre-cast Concrete		
<input type="checkbox"/>	4. Prestressed Concrete		
<input type="checkbox"/>	5. Wood Construction (Section 1705.5) - Prefabricated Structural Elements Covering:		
<input type="checkbox"/>	5.1. Manufactured Wood Trusses		
<input type="checkbox"/>	5.2. Walls		
<input type="checkbox"/>	5.3. Floors		
<input type="checkbox"/>	5.4. Roof Assemblies		
<input type="checkbox"/>	6. Cold Formed Steel Trusses		
Required tasks to complying with the requirements of Category A-2: 1. Prior to issuance of the Building Permit, provide the Building Department with a copy of the selected fabricator's current shop accreditation/certification. 2. At the completion of fabrication, the Special Inspector and/or Special Inspection Agency shall obtain from each registered and approved fabricator and submit to the Building Department a Certificate of Compliance stating that the work was performed in accordance with the approved construction documents.			

B. Steel Construction (1705.2 & Table 1705.2.3):				Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:	
	1. Material verification of high-strength bolts, nuts and washers:			
<input checked="" type="checkbox"/>	-	X	1.1. Identification markings to conform to ASTM standards specified in the approved construction documents. <u>Referenced Standard:</u> AISC 360 and applicable ASTM material standards	
<input checked="" type="checkbox"/>	-	X	1.2. Manufacturer's certificate of compliance required.	
	2. Inspection of high-strength bolting: <u>Referenced Standard:</u> AISC 360			
<input checked="" type="checkbox"/>	-	X	2.1. Snug-tight joints.	
<input checked="" type="checkbox"/>	-	X	2.2. Pretensioned and slip-critical joints using turn-of-nut with matchmarking, twist-off bolt or direct tension indicator methods of installation.	
<input checked="" type="checkbox"/>	X	-	2.3. Pretensioned and slip-critical joints using turn-of-nut without matchmaking or calibrated wrench methods of installation.	
	3. Material verification of structural steel and cold-formed steel deck:			
<input checked="" type="checkbox"/>	-	X	3.1. For structural steel, identification markings to conform to AISC 360. <u>Referenced Standards:</u> AISC 360.	
<input checked="" type="checkbox"/>	-	X	3.2. For other steel, identification markings to conform to ASTM standards specified in the approved construction documents. <u>Referenced Standards:</u> Applicable ASTM material standards	
<input checked="" type="checkbox"/>	-	X	3.3. Manufacturer's certified test reports.	
	4. Material verification of weld filler materials:			
<input checked="" type="checkbox"/>	-	X	4.1. Identification markings to conform to AWS specification in the approved construction documents. <u>Referenced Standard:</u> AISC 360 and applicable AWS documents	

B. Steel Construction (1705.2 & Table 1705.2.3):			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
<input checked="" type="checkbox"/>	-	X	4.2. Manufacturer's Certificate of Compliance required.
<input type="checkbox"/>			5. Inspection of welding:
			5.1. Structural Steel and cold-formed steel deck: <u>Referenced Standards:</u> AWS & the 2021 USBC: 1705.2.2
<input checked="" type="checkbox"/>	X	-	5.1.1. Complete and partial penetration groove welds.
<input checked="" type="checkbox"/>	X	-	5.1.2. Multipass fillet welds.
<input checked="" type="checkbox"/>	X	-	5.1.3. Single-pass fillet welds greater than 5/16".
<input checked="" type="checkbox"/>	X	-	5.1.4. Plug and slot welds.
<input checked="" type="checkbox"/>	-	X	5.1.5. Single-pass fillet welds less than or equal to 5/16".
<input type="checkbox"/>	-	X	5.1.6. Floor and roof deck welds. <u>Referenced Standards:</u> AWS
			5.2. Reinforcing steel: <u>Referenced Standards:</u> AWS & ACI 318
<input type="checkbox"/>	-	X	5.2.1. Verification of weldability of reinforcing steel other than ASTM A 706.
<input type="checkbox"/>	X	-	5.2.2. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special structural walls of concrete and shear reinforcement.
<input type="checkbox"/>	X	-	5.2.3. Shear reinforcement.

Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below

B. Steel Construction (1705.2 & Table 1705.2.3):			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
<input type="checkbox"/>	-	X	5.2.4. Other reinforcing steel.
			6. Inspection of steel frame joint details for compliance:
<input checked="" type="checkbox"/>	-	X	6.1. Details such as bracing and stiffening.
<input checked="" type="checkbox"/>	-	X	6.2. Member locations.
<input checked="" type="checkbox"/>	-	X	6.3. Applications of joint details at each connection.
<input type="checkbox"/>	-	X	7. Cold-formed steel trusses spanning 60 feet or greater (1705.2.4): Verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.
Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below			
C. Concrete Construction (1705.3 & Table 1705.3):			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
<input checked="" type="checkbox"/>	-	X	1. Inspection of reinforcing steel, including prestressing tendon, and placement. Referenced Standards: ACI 318 & the 2021 USBC: 1908.4
<input type="checkbox"/>			2. Inspection of reinforcing steel welding in accordance with 1705.3.1, or 1705.3.2. Referenced Standards: AWS D1.4 & ACI 318
<input checked="" type="checkbox"/>	X	-	3. Inspection of bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased or where strength design is used. Referenced Standards: ACI 318 & the 2021 USBC: 1901.3, 1905
Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below			

C. Concrete Construction (1705.3 & Table 1705.3):				Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:	
<input checked="" type="checkbox"/>	-	X	4. Inspection of anchors installed in hardened concrete. Referenced Standards: ACI 318 & the 2021 USBC: 1901.3, 1905	
<input checked="" type="checkbox"/>	-	X	5. Verifying use of required design mix. Referenced Standards: ACI 318 & the 2021 USBC: 1904, 1908.2, 1908.3	
<input checked="" type="checkbox"/>	X	-	6. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete. Referenced Standards: ASTM C 172, ASTM C 31 & ACI 318 & 2021 USBC: 1908.10	
<input checked="" type="checkbox"/>	X	-	7. Inspection of concrete and shotcrete placement for proper application techniques. Referenced Standards: ACI 318 & 2021 USBC: 1908.6, 1908.7, 1908.8	
<input checked="" type="checkbox"/>	-	X	8. Inspection for maintenance of specified curing temperature and techniques. Referenced Standards: ACI 318 & USBC-1018: 1908.9	
<input type="checkbox"/>			9. Inspection of prestressed concrete:	
<input type="checkbox"/>	X	-	9.1. Application of prestressing force. Referenced Standards: ACI 318	
<input type="checkbox"/>	X	-	9.2. Grouting of bonded prestressing tendons in the seismic-force-resisting system. Referenced Standard: ACI 318	
<input type="checkbox"/>	-	X	10. Erection of precast concrete members. Referenced Standards: ACI 318	
<input type="checkbox"/>	-	X	11. Verification of in-situ concrete strength, prior to stressing of tendons in posttensioned concrete and prior to the removal of shores and forms from beams and structural slabs. Referenced Standards: ACI 318	
<input checked="" type="checkbox"/>	-	X	12. Inspect formwork for shape, location and dimensions of the concrete members being formed. Referenced Standards: ACI 318	

D.	Masonry Construction (1705.4): Masonry construction shall be inspected and verified in accordance with the requirements of Sections 1705.4 through 1705.4.2, depending on the classification of the building or structure or nature of the occupancy. Please check the applicable categories of D.1 or Category D.2. Exception: Special Inspections are not required for masonry construction that meets one of the three exceptions listed in Section 1705.4.		
<input type="checkbox"/>	D.1.	Special Inspection (1705.4.1) for Empirical Designed Masonry, Glass Unit Masonry and Masonry Veneer in Occupancy Category IV (Essential Facilities): Special inspections and tests for empirically designed masonry, glass unit masonry or masonry veneer designed in accordance with Section 2109, 2110 or Chapter 14, respectively, where they are part of a structure classified as Risk Category IV shall be performed in accordance with TMS 602 Level 2.	
<input type="checkbox"/>	D.2.	Special Inspection (1705.4.1) for Empirical Masonry in Occupancy Category I, II, or III (Nonessential Facilities): The minimum Special Inspection Program for masonry designed per Section 2107 or 2108 or per Chapters of TMS 402 referenced in sections 2107 and 2108, in structures classified as Occupancy Category I, II, or III, in accordance with Section 1604.5.	
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections: Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	-	X	1. Compliance with required inspection provisions of the construction documents and the approved submittals shall be verified. <u>Reference for Criteria:</u> TMS 602
<input type="checkbox"/>	-	X	2. Verification of f_m^1 and f_{AAC}^1 prior to construction except where specifically exempted by code. <u>Reference for Criteria:</u> TMS 602
<input type="checkbox"/>	X	-	3. Verification of slump flow and VSI as delivered to the site for self-consolidating grout. <u>Reference for Criteria:</u> TMS 602
			4. As masonry construction begins, the following shall be verified to ensure compliance:
<input type="checkbox"/>	-	X	4.1. Proportions of site-prepared mortar. <u>Reference for Criteria:</u> TMS 602
<input type="checkbox"/>	-	X	4.2. Construction of mortar joints. <u>Reference for Criteria:</u> TMS 602
<input type="checkbox"/>	-	X	4.3. Location of reinforcement, connectors, prestressing tendons and anchorages. <u>Reference for Criteria:</u> TMS 602
<input type="checkbox"/>	-	X	4.4. Prestressing technique. <u>Reference for Criteria:</u> TMS 602
<input type="checkbox"/>	-	X	4.5. Grade and size of prestressing tendons and anchorages. <u>Reference for Criteria:</u> TMS 602

D.1. Level #1 Special Inspection (1705.4.1): (con't)		Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below	
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
5. During construction the inspection program shall verify:			
<input type="checkbox"/>	-	X	5.1. Size and location of structural elements. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	5.2. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction. Reference for Criteria: TMS 402
<input type="checkbox"/>	-	X	5.3. Specified size, grade and type of reinforcement, anchor bolts, prestressing tendons and anchorages. Reference for Criteria: TMS 402 & TMS 602
<input type="checkbox"/>	X	-	5.4. Welding of reinforcing bars. Reference for Criteria: TMS 402
<input type="checkbox"/>	-	X	5.5. Protection of masonry during cold weather (temperature below 40 °F) or hot weather (temperature above 90 °F). Reference for Criteria: TMS 602
<input type="checkbox"/>	X	-	5.6 Application and measurement of prestressing steel. Reference for Criteria: TMS 602
The following shall be verified to insure compliance:			
<input type="checkbox"/>	-	X	6.1. Grout space is clean. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	6.2. Placement of reinforcement, connectors and prestressing tendons and anchorages. Reference for Criteria: TMS 402 & TMS 602
<input type="checkbox"/>	-	X	6.3. Proportion of site-prepared grout and prestressing grout for bonded tendons. Reference for Criteria: TMS 602

D.1. Special Inspection (1705.4.1):			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
<input type="checkbox"/>	X	-	6.4. Verification of proportions of materials in premixed or preblended mortar and grout as delivered to the site. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	6.5. Construction of mortar joints. Reference for Criteria: TMS 602
<input type="checkbox"/>	X	-	7. Grout placement shall be verified to ensure compliance with code and construction document provisions. Reference for Criteria: TMS 602
<input type="checkbox"/>	X	-	7.1. Grout space prior to grouting. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	7.2. Placement of prestressing grout. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	7.3. Grouting of prestressing bonded tendons. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	8. Size and location of structural elements. Reference for Criteria: TMS 602
<input type="checkbox"/>	X	-	8.1. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction. Reference for Criteria: TMS 402
<input type="checkbox"/>	-	X	8.2. Specified size, grade and type of reinforcement, anchor bolts, prestressing tendons and anchorages. Reference for Criteria: TMS 402 & TMS 602
<input type="checkbox"/>	X	-	8.3. Welding of reinforcing bars. Reference for Criteria: TMS 402

Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below

	D.1. Special Inspection (1705.4.1):			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:	Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	X	-	8.4. Application and measurement of prestressing force. Reference for Criteria: TMS 602	
<input type="checkbox"/>	X	-	9. Preparation of any required grout specimens, mortar specimens and/or prisms shall be observed. Reference for Criteria: 2021 USBC: Sec. 2105.1 & TMS 602	
E.	Structural Wood Construction (1705.5):			
	1. Special Inspections of the fabrication process of prefabricated wood structural elements and assemblies (covering: walls, floors, or roof assemblies along with manufactured roof trusses) shall be in accordance with Section 1704.2.5 (see Category A above).			
	2. Special Inspections of site-built assemblies shall be in accordance with Section 1705.5 as indicated below.			
Check Box Below if Required			Required Verification and Inspections:	Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input checked="" type="checkbox"/>	1. Fabrication of high-load diaphragms designed in accordance with Section 2306.2 shall be installed with Special Inspections as indicated in Sections 1704.2:			
	1.1. Inspect the wood structural panel sheathing to ascertain that it is of the grade and thickness shown on the approved plans.			
	1.2. Verify the nominal size of the framing members at adjoining panel edges, the nail or staple diameter and length, the number of fastener lines and that the spacing between fasteners in each line and at edge margins agrees with the approved plans.			
<input type="checkbox"/>	2. Metal-plate-connected wood trusses spanning 60 feet or greater (1705.5.2): Verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.			
<input checked="" type="checkbox"/>	3. Prefabricated wood shear panels covering:			
	3.1. Holdown anchor size and placement, including embedment length, spacing and edge distance.			
	3.2. The connection of the structure to the shear panels.			

F. Soils (1705.6 & Table 1705.6): 1. Perform Special Inspections of existing site soil conditions, fill placement and load-bearing requirements as required by Section 1705.6 and Table 1705.6. 2. Determine compliance using the approved geotechnical report (Section 1803), and the construction documents prepared by the Registered Design Professional. 3. Determine that proper materials and procedures are used during fill placement and in accordance with the provisions of the approved geotechnical report. <u>Exception:</u> Where Section 1803 does not require reporting of materials and procedures for fill placement, the special inspector shall verify that the in-place dry density of the compacted fill is not less than 90% of the maximum dry density at optimum moisture content determined in accordance with ASTM D 1557.				Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:				
<input checked="" type="checkbox"/>	-	X	1. Verify materials below shallow footings are adequate to achieve the design bearing capacity.				
<input checked="" type="checkbox"/>	-	X	2. Verify excavations are extended to proper depth and have reached proper material.				
<input checked="" type="checkbox"/>	-	X	3. Perform classification and testing of compacted fill materials.				
<input checked="" type="checkbox"/>	X	-	4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill.				
<input checked="" type="checkbox"/>	-	X	5. Prior to placement of compacted fill, observe subgrade and verify that site has been prepared properly.				
G. Driven Deep Foundations (1705.7 & Table 1705.7): 1. Perform Special Inspections during installation and testing of driven deep foundation elements as required by Table 1705.7 2. Determine compliance using the approved geotechnical report (section 1803), and the construction documents prepared by the Registered Design Professional.				Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:				
<input type="checkbox"/>	X	-	1. Verify elements materials, size and lengths comply with the requirements.				
<input type="checkbox"/>	X	-	2. Determine capacities of test elements and conduct additional load tests, as required.				
<input type="checkbox"/>	X	-	3. Inspect driving operation and maintain complete accurate records for each element.				
<input type="checkbox"/>	X	-	4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element.				

G. Driven Deep Foundations (1705.7 & Table 1705.7:			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
<input type="checkbox"/>			5. For steel elements, perform additional inspections in accordance with 1705.2 (see Category B above).
<input type="checkbox"/>			6. For concrete elements and concrete-filled elements, perform additional inspections in accordance with Section 1705.3 & Table 1705.3 (see Category C above).
<input type="checkbox"/>			7. For specialty elements, perform additional inspections as determined by the Registered Design Professional in Responsible Charge.
Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below			
H. Cast-In-Place Deep Foundations (1705.8 & Table 1705.8):			
1. Perform Special Inspections during installation and testing of cast-in-place deep foundation elements as required by Table 1705.8. 2. Determine compliance using the approved geotechnical report (Section 1803), and the construction documents prepared by the Registered Design Professional.			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
<input type="checkbox"/>	X	-	1. Observe drilling operations and maintain complete and accurate records for each element.
<input type="checkbox"/>	X	-	2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes.
<input type="checkbox"/>			3. For concrete elements, perform additional inspections in accordance with Section 1705.3 & Table 1705.3 (see Category C above).
Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below			

I. Helical Pile Foundations (1705.9):			Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
Check Box Below if Required	Continual	Periodic	
	Required Verification and Inspections:		
<input type="checkbox"/>	X	-	1. Perform Special Inspections continuously during installation of helical pile foundations.
<input type="checkbox"/>	X	-	2. Record information for each helical pile that includes installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required by the Registered Design Professional in Responsible Charge.
<input type="checkbox"/>	X	-	3. Use the approved geotechnical report (Section 1803) and the approved construction documents prepared by the Registered Design Professional to determine compliance.
K. Spray-Applied Fire-Resistant Materials (SFRM) (1705.14):			Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
Check Box Below if Required	Required Verification and Inspections:		
<input type="checkbox"/>	Physical and Visual Tests (1705.14.1): Perform Special Inspections for SFRM to include the following test and observations to demonstrate compliance with listing and fire-resistance rating covering condition of substrate, thickness of application, density in pounds per cubic foot, bond strength adhesion/cohesion and condition of finished application (see below for requirements). Structural Member Surface Conditions (1705.14.2): 1. Prepared the surfaces in accordance with the approved fire-resistance design and the written instructions of approved manufacturers. 2. Inspect the prepared surface of structural members to be sprayed before the application of the SFRM. Application (1705.14.3): 1. Verify that the substrate has a minimum ambient temperature before and after application as specified in the written instructions of approved manufacturers. 2. Verify that the area for application is ventilated during and after application as required by the written instructions of approved manufacturers.		

<div>K. (con't)</div>	<div>Spray-Applied Fire-Resistant Materials (SFRM) (1705.14):</div>	
<div>Check Box Below if Required</div>	<div>Required Verification and Inspections:</div>	<div>Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below</div>
<div><input type="checkbox"/></div>	<div> <p>Thickness (1705.14.4): No more than 10% of the thickness measurements of the SFRM applied to floor, roof and wall assemblies and structural members shall be less than the thickness required by the approved fire-resistance design, but in no case less than the minimum allowable thickness required by Section 1705.14.4.1.</p> <ol style="list-style-type: none"> <u>1. Minimum allowable individual thickness (1705.14.4.1):</u> <ol style="list-style-type: none"> <u>1.1.</u> For design thicknesses 1 inch or greater. It shall be the design thickness minus 1/4 inch. <u>1.2.</u> For design thicknesses less than 1 inch, it shall be the design thickness minus 25%. <u>1.3.</u> Thickness shall be determined in accordance with ASTM E 605. <u>1.4.</u> Samples of the SFRM shall be selected in accordance with Section 1705.14.4.2 and 1705.14.4.3 (see below). <u>2. Floor, roof and wall assemblies (1705.14.4.2):</u> Determine the thickness of the applied SFRM in accordance with ASTM E 605, making not less than 4 measurements for each 1,000 square feet of the sprayed area in each story or portion thereof: <u>3. Cellular decks (1705.14.4.3):</u> Select the thickness measurements from a square area, 12" by 12" in size. Make a minimum of 4 measurements that are located symmetrically within the square area. <u>4. Fluted decks (1705.14.4.4):</u> Select the thickness measurements from a square area, 12" by 12" in size. Make a minimum of 4 measurements that are located symmetrically within the square area, including one each of the following: valley, crest and sides. Report the average of the measurements. <u>5. Structural members (1705.14.4.5):</u> Determine the thickness of the applied SFRM in accordance with ASTM E 605. Perform thickness testing on not less than 25% of the structural members on each floor: <u>6. Beams and girders (1705.14.4.6):</u> Make thickness measurements at 9 locations around the beams or girder at each end of a 12-inch length. <u>7. Joists and trusses (1705.14.4.7):</u> Make thickness measurements at 7 locations around the joist or truss at each end of a 12-inch length. <u>8. Wide-flanged columns (1705.14.4.8):</u> Make thickness measurements at 12 locations around the column at each end of a 12-inch length. <u>9. Hollow structural section and pipe (1705.14.4.9):</u> Make thickness measurements at 4 locations around the column at each end of a 12-inch length. </div>	

<div> <div>K.</div> <div>(con't)</div> </div> <div> <div>Spray-Applied Fire-Resistant Materials (SFRM) (1705.14):</div> </div>		<div> <div>Check Box Below if Required</div> </div>	<div> <div>Required Verification and Inspections:</div> </div>	<div> <div>Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below</div> </div>
<div> <div><input type="checkbox"/></div> </div>		<div> <div> Density (1705.14.5): The density of the SFRM shall not be less than the density specified in the approved fire-resistance design. Determine the density of the SFRM in accordance with ASTM E 605. Select the test samples to determine the density of the SFRM as follows: 1. From each floor, roof and wall assemblies at the rate of not less than 1 sample for every 2,500 square feet or portion thereof of the sprayed area in each story. 2. From beams, girders, trusses and columns at a rate of not less than 1 sample for each type of structural member for each 2,500 square feet of floor area or portion thereof in each story. </div> </div>		
<div> <div><input type="checkbox"/></div> </div>		<div> <div> Bond Strength (1705.14.6): Verify that the cohesive/adhesive bond strength of the cured SFRM applied to floor, roof and wall assemblies and structural members shall not be less than 150 pound per square foot. Determine the cohesive/adhesive bond strength in accordance with the field test specified in ASTM E 736 by testing in-place samples of SFRM selected in accordance with Sections 1704.12.6.1 through 1704.12.6.3 (see below): 1. <u>Floor, roof and wall assemblies (1705.14.6.1)</u>: Select the test samples for determining the cohesive/adhesive bond strength of the SFRM from floor, roof and wall assembly at a rate of not less than 1 sample for every 2,500 square feet of the sprayed area in each story or portion thereof. 2. <u>Structural members (1705.14.6.2)</u>: Select the test samples for determining the cohesive/adhesive bond strength of the SFRM from beams, girders, trusses, columns and other structural members at a rate of not less than 1 sample for every 2,500 square feet of floor area or portion thereof in each story. 3. <u>Primer, paint and encapsulated bond tests (1705.14.6.3)</u>: Conduct bond tests to qualify a primer, paint or encapsulate when the SFRM is applied to a primed, painted or encapsulated surface for which acceptable bond-strength performance between these coatings and fire-resistant material has not been determined. Verify that a bonding agent approved by the SFRM manufacturer is applied to a primed, painted or encapsulated surface where the bond strengths are found to be less than required values. </div> </div>		
<div> <div>L.</div> </div>		<div> <div>Mastic & Intumescent Fire-Resistant Coatings (1705.15):</div> </div>		
<div> <div>Check Box Below if Required</div> </div>		<div> <div>Required Verification and Inspections:</div> </div>		
<div> <div><input type="checkbox"/></div> </div>		<div> <div>Special Inspections for mastic and intumescent fire-resistant coatings applied to structural elements and decks shall be in accordance with AWCI 12-B and shall be based on the fire-resistance design as designated in the approved construction documents.</div> </div>		

M. Check Box Below if Required	Exterior Insulation and Finish Systems (EIFS) (1705.16):		Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	<p> Special Inspections are required for all EIFS applications unless one of the following exceptions applies. Exception #1: EIFS applications installed over a water-resistive barrier with a means of draining moisture to the exterior (unless the Special Inspection is required by the ICC Report of Approval for the selected EIFS). Exception #2: EIFS applications installed over masonry or concrete walls. Note: The Registered Design Professional shall indicate on the space to the right and on the plans the ICC Report of Approval number for the selected EIFS. </p>		
O. Check Box Below if Required	Special Inspections for Smoke Control (1705.18): Smoke control systems shall be tested by a Special Inspector.		Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	<p> Testing Scope (1705.18.1): The test scope shall be as follows: 1. During erection of ductwork and prior to concealment for the purpose of leakage testing and recording of device location. 2. Prior to occupancy and after sufficient completion for the purposes of pressure difference testing, flow measurements and detection and control verification. </p>		

Qualification Standards for Special Inspections

Special Inspectors, Laboratory Technicians, Special Inspection Agencies, Testing Labs and Fabricator Shops

General Notes:

Note #1: Basis for formulating City of Roanoke's Building Safety Department Special Inspection Program (SIP):

These requirements were based on the "Model Program for Special Inspection (Based on the 2021 IBC Chapter 17)" published by the International Code Council (ICC) and the International Accreditation Services (IAS) and reflect the following:

1. Applicable provisions of Chapter 17 of the 2021 USBC;
2. Applicable portions of the following IAS Accreditation Criteria:
 - 2.1. AC89 - Accreditation Criteria for Testing Laboratories;
 - 2.2. AC98 - Accreditation Criteria for Inspection Agencies;
 - 2.3. AC157 - Accreditation Criteria for Fabrication Inspection Programs for Reinforced Concrete;
 - 2.4. AC172 - Accreditation Criteria for Fabrication Inspection Programs for Structural Steel;
 - 2.5. AC196 - Accreditation Criteria for Fabrication Inspection Programs for Wood Wall Panels;
 - 2.6. AC204 - Accreditation Criteria for Calibration Laboratories;
 - 2.7. AC291 - Accreditation Criteria for Special Inspection Agencies;
 - 2.8. AC370 - Accreditation Criteria for Product Certification Agencies;
 - 2.9. AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems; and/or
3. Applicable portions of the following Standards by International Organization for Standardization/International Electrotechnical Commission (ISO/IEC):
 - 3.1. ISO/IEC 17011: 2004(E), Conformity Assessment - General Requirements for Accreditation Bodies Accrediting Conformity Assessment Bodies;
 - 3.2. ISO/IEC 17020: 1998(E), General Criteria for the Operation of Various Types of Bodies Performing Inspection;
 - 3.3. ISO/IEC 17024: 2003, Conformity Assessment - General Requirements for Bodies Performing Inspection;
 - 3.4. ISO/IEC 17025: 2005(E), General Requirements for the Competence of Testing and Calibration Laboratories;
 - 3.5. ISO/IEC 17025: 2005/Cor.1:2006(E), General Requirements for the Competence of Testing and Calibration Laboratories;
 - 3.6. ISO/IEC Guide 6.5: General Requirements for Bodies Operating Product Certification Systems.

Note #2: Guideline to Determine Compliance and Competence of Designated Special Inspector and Special Inspections Agency:

This information will be used as a guideline by the Building Safety Department to verify compliance with applicable provisions of Sections 1703 and 1704 of the 2021 USBC in determining the competence of each designated Special Inspector, Laboratory Technician, Special Inspection Agency, Testing Laboratories and/or Fabricator Shop listed in the Statement of Special Inspections.

Note #3: Minimum Qualifications for Special Inspectors:

The minimum qualifications for Special Inspectors listed below are from the International Accreditation Service's "Accreditation Criteria for the IBC Special Inspection Agencies" AC 291.

Note #4: Required Information/Documentation and How it Will be Used:

This information shall be used by the Registered Design Professional in Responsible Charge of the project and/or the Responsible Professional Engineer representing the Special Inspection Agency and/or Testing Laboratory to measure the qualifications of each designated Special Inspector, Laboratory Technician, Special Inspection Agency, Testing Laboratory and Fabricator Shop that are listed in the Statement of Special Inspections. The Building Safety Department will consider equivalent criteria for the qualifications of any designated party, if submitted by the Registered Design Professional and/or Responsible Professional Engineer. The Registered Design Professional and/or Responsible Professional Engineer shall provide the Building Safety Department with sufficient documentation to substantiate the equivalency request.

General Notes (Con't):

Note #5: Special Inspection Agency Qualification Standards:

Each designated Special Inspection Agency shall be:

1. An agency that maintains IAS current accreditation with the scope of accreditation covering the disciplines for which the agency is designated; OR
2. An agency that meets the requirements of Section 1700 of the 2021 USBC. The Registered Design Professional and/or Responsible Professional Engineer of the agency shall provide all documentation as necessary for the Building Safety Department to determine if the Agency meets the applicable code requirements; OR
3. An agency that has been accredited by an approved Inspection Agency in accordance with ISO/IEC 17020.

Note #6: Special Inspector Qualification Standards:

Each designated Special Inspector and Laboratory Technician shall meet the "Minimum Qualifications for Special Inspectors" and related criteria as listed below.

Note #7: Special Inspector in Training (SIIT):

1. The intent of this provision is to provide practical opportunities for a Special Inspector in Training (SIIT) to gain the needed experience to qualify as a Special Inspector.
2. An Inspector who does not meet the qualifications for a Special Inspector may be allowed to perform a "Special Inspection" at the discretion of the Special Inspection Agency's Registered Design Professional, provided one or more of the following conditions are met:
 - 2.1. The individual is working under the direct and continuous supervision of a Special Inspector fully qualified for the type of work involved.
 - 2.2. The individual is working under the indirect or periodic supervision of a Special Inspector, and the scope of work is minor and/or routine and within the capabilities of the individual.

Note #8: Testing Labs Qualification Standards:

Each designated Testing Lab shall be accredited by one the following major acceptable accreditation authorities:

1. IAS Accreditation with the scope of accreditation covering the discipline's for which the Testing Lab is designated.
2. AASHTO Accreditation Program per either AASHTO R18 or ISO/IES 17250.
3. American Association of Laboratory Accreditation.
4. National Voluntary Laboratory Accreditation Program.
5. Other Accreditation Authority Program. The Testing Lab shall be accredited by a third party and shall meet the requirements of Section 1703 of USBC-12.

Note #9: Laboratory Technician Qualification Standards:

Each Laboratory Technician shall have certification in the appropriate category and one year minimum experience.

Note #10: Experience:

1. For experience to count toward qualifications, it shall be based on verifiable work directly related to the category or type of inspection involved.
2. An engineering degree (BS) plus appropriate in-house training may be substituted for not more than one year of experience. An engineering technology degree plus appropriate in-house training may be substituted for not more than six months experience. (Degree experience may not be substituted for more than half of the experience requirements in any category.)
3. Five or more years experience as a qualified Special Inspector in one or more categories of work may fulfill up to half the experience requirements in any category, at the discretion of the Special Inspection Agency's designated Responsible Professional Engineer.

Note #11: Certification:

Certification, when specified, is intended to mean the successful completion of:

1. AN ICC examination appropriate to the category of work involved; and/or
2. Having other specific certification obtained from a Nationally recognized certifying organization that is appropriate to the category of work involved and is acceptable to the Building Department.

Note: The Building Safety Department will consider equivalent certifications from Nationally recognized organization obtained by written examination when sufficient documentation to substantiate the equivalency is provided by the Special Inspection Agency's designated Responsible Professional Engineer.

Minimum Qualifications for Special Inspectors

Based on IAS AC291 Accreditation Criteria for Special Inspection Agencies

A. - Inspections of Fabricators (1704.2.5):

A.1. - Fabrication and Implementation (1704.2.5) for Fabricators not Registered and not Approved:

1. The designated Special Inspector and/or Special Inspection Agency shall perform in-plant periodic visits and reviews of all listed fabricator shops that are not registered and not approved per Section 1704.2.5 (see Category A.2. below). The duties include:

1.1. Verify that the fabricator maintains detailed fabrication and quality control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards, and

1.2. Review the procedures for completeness and adequacy relative to the code requirements for the fabricator's scope of work.

2. The designated Special Inspector and/or Special Inspection Agency inspecting a fabricator shop for compliance with Section 1704.2.1 shall be pre-approved by the Building Department for the specified category of construction prior to Building Permit issuance. See the specific category below for minimum qualification criteria:

2.1. For Structural Steel Construction: See Category B below.

2.2. For Precast/Prestressed Concrete: See Category C below.

2.3. For Wood Construction: See Category E below.

A.2. - Fabricator Approval (1704.2.5.1) for Fabricators Registered and Approved:

1. Special Inspections required by Section 1704 are not required where the work is done on the premises of a Fabricator registered and approved to perform such work without Special Inspection. Approval shall be based upon review of the fabricator's written procedural and quality control manuals and periodic auditing of fabrication practices by an approved Special Inspection Agency (a third-party that is recognized by the Building Safety Department).

2. Special Inspections are not required for work done on the premises of a registered and approved Fabricator that has a current accreditation from the International Accreditation Service (IAS), a current certification from a Nationally recognized organization (see item #4 below), or an equivalent certification (see Note below).

3. An IAS-accredited fabricator that is listed on that AIAS web site (www.iasonline.org). The IAS Accreditation is based on the IAS Fabrication Accreditation Standards (IAS Fabricator Accreditation Program currently offers accreditation services for reinforced concrete, precast concrete, structural steel and wood panel assemblies)

4. A Nationally recognized organization/body that includes a third-party oversight of the fabricators facility (including processes and final products) as defined by the USBC. This option is subject to the review and acceptance by the Building Safety Department. The following National Fabricator Certifying Organizations are recognized and acceptable by City of Roanoke's Building Safety Department:

4.1. American Institute of Steel Construction (AISC) for Fabricators of Structural Steel.

4.2. American Steel Joist Institute (SJI) for Fabricators of Steel Joists.

4.3. Precast/Prestressed Concrete Institute for Fabricators of Precast and Prestressed Concrete.

4.4. Truss Plate Institute (TPI) for Fabricators of Wood Trusses.

Note: Equivalencies are subject to review and acceptance by the Building Department and shall be performed by an approved Special Inspection Agency in accordance with applicable provisions of Sections 1704.2.5 and 1703 of the 2021 USBC.

B. - Steel Construction:

B.1. - High Strength Bolting:

1. Current ICC certification as a Structural Steel and Bolting Special Inspector and a minimum one year of experience; OR
2. Virginia Professional Engineer and a minimum one year of direct experience in structural steel and bolting construction (Inspector shall be qualified under Item #1).
3. American Welding Society (AWS) Certified Welding Inspector (CWI) and has a minimum of one year of experience (Inspector shall be qualified under Item #B.1.1).

Note: ICC certifications for Structural Steel and Welding Special Inspectors are valid for the Bolting Special Inspector until the date of expiration.

B. - Steel Construction (con't):
B.2. - Welding:
1. American Welding Society (SAWS) Certified Welding Inspector (CWI); OR 2. Current ICC Certification as a Structural Steel and Welding Special Inspector and has a minimum one year of experience; OR 3. American Welding Society (AWS) Certified Associate Welding Inspector (CAWI) working under the direct on-site supervision of a Certified Welding Inspector (CWI) and a minimum one year of experience (Inspector shall be qualified under either Item #B.2.1 or Item #B.2.2).
B.3. - Nondestructive Testing (NDT):
1. Personnel qualified in accordance with nationally-recognized NDT personnel qualification practice or standard, such as ANSI/ANST-CP-189 or SNT-TC-1A; OR 2. American Society of Nondestructive Testing (ASNT) Level II and a minimum of 120 hours of direct testing experience or training as determined and approved by an ASNT Level III.
C. - Concrete Construction:
C.1. - Reinforced Concrete:
1. Current ICC Certification in Reinforced Concrete Special Inspection and one year of experience; OR 2. <i>Virginia</i> Professional Engineer and minimum one year of direct experience in reinforced concrete construction (Inspector shall be qualified under Item #C.1.1); OR 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience (Inspector shall be qualified under Item #C.1.1); OR 4. ACI Concrete Construction Special Inspector or ACI Concrete Field Testing Technician Grade 1 and a minimum one year of experience (Inspector shall be qualified under Item #C.1.1).
C.2. - Pre-stressed/Pre-cast/Cast-in-Place/Poured-in-Place Concrete:
1. Current ICC Certification in Prestressed Concrete Inspection and one year of experience; OR 2. Virginia Professional Engineer and minimum one year of direct experience in prestressed concrete construction (Inspector shall be qualified under Item #C.2.1 above); OR 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum one year of experience (Inspector shall be qualified under Item #C.2.1 above); OR 4. ACI Concrete Construction Special Inspector or ACI Concrete Field Testing Technician Grade 1 and a minimum two years of experience (Inspector shall be qualified under Item #C.2.1 above).
C.3. - Post-installed Structural Anchor in Concrete:
1. Current ICC Certification in Reinforced Concrete Special Inspection; OR 2. Current ICC Certification as a Residential or Commercial Building Inspector, as applicable, and a minimum two years of experience related to the activity being inspected; OR 3. Virginia Professional Engineer and minimum one year of experience related to the activity being inspected (Inspector shall be qualified under Item #C.3.1 above); OR 4. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience related to the activity being inspected (Inspector shall be qualified under Item #C.3.1 above).
D. - Masonry Construction:
1. Current ICC Certification in masonry and a minimum one year experience; OR 2. Virginia Professional Engineer and minimum one year of relevant experience (Inspector shall be qualified under Item #D.1 above); OR 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience (Inspector shall be qualified under Item #D.1 above).

E. - Masonry Construction:
<ol style="list-style-type: none"> 1. Virginia Professional Engineer and minimum one year of relevant experience related to the activity being inspected; OR 2. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience related to the activity being inspected; OR 3. Current ICC Certification as a Commercial or Residential Building Inspector, as applicable, AND <ol style="list-style-type: none"> 3.1. A minimum two years of related experience in engineered wood products.
F. - Soils:
<ol style="list-style-type: none"> 1. NICET Level II Geotechnical Engineering Technology Certification, or ICC Soils Special Inspector Certification, and a Minimum two years of experience; OR 2. Technician with a minimum three years of documented experience directly related to soils testing and inspection under a licensed Virginia Professional Engineer (Inspector shall be qualified under Item #F.1 above); OR 3. Bachelor's degree in Civil or Structural Engineering/Geotech/Geologist from an accredited institution and a minimum of one year of experience (Inspector shall be qualified under Item #F.1 above); OR 4. Virginia Professional Engineer and a minimum one year of experience (Inspector shall be qualified under Item #F.1 above); OR 5. Professional Engineer in Geotechnical Engineering.
G. - Driven Deep Foundations:
<ol style="list-style-type: none"> 1. Current ICC Certification in Concrete Special Inspection in addition to having one of the following (Virginia Professional Engineer, NICET III or IV, NICET CT Certified Engineering Technologist or Bachelors Degree in Civil or Structural Engineering); OR 2. Virginia Professional Engineer and minimum one year of relevant experience. In addition, Inspector shall obtain ICC Certification in Concrete Special Inspection; OR 3. NICET III or IV (geotechnical/construction or construction material testing/soils) and a minimum of five years experience. In addition, Inspector shall obtain ICC Certification in Concrete Special Inspection; OR 4. NICET CT Certified Engineering Technologist and a minimum of five years of experience. In addition, Inspector shall obtain ICC Certification in Concrete Special Inspection; OR 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum three years of experience. In addition, Inspector shall obtain ICC Certification in Concrete Special Inspection).
H. - Cast-in-Place Deep Foundations:
Same as Category G (see above).
I. - Helical Pile Foundations:
Same as Category G (see above).
J. - Vertical Masonry Foundation Elements:
Same as Category D (see above).
K. - Spray-Applied Fire-Resistant Materials (SFRM):
<ol style="list-style-type: none"> 1. Current ICC Certification as a Spray-applied Fireproofing Special Inspector and a minimum one year experience; OR 2. Virginia Professional Engineer and minimum one year of experience in fireproofing applications (Inspector shall be qualified under Item #K.1 above); OR 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience in fireproofing applications (Inspector shall be qualified under Item #K.1 above); OR 4. American Concrete Institute Concrete Field Testing Technician Grade 1 or American Welding Society Certified Welding Inspector and a minimum of one year experience in fireproofing applications (Inspector shall be qualified under Item #K.1 above).
L. - Mastic and Intumescent Fire-Resistant Coatings:
Same as Category K (see above).

M. - Exterior Insulation and Finish Systems (EIFS)::

1. Current ICC Certification as a Reinforced Concrete Special Inspector; OR
2. Current ICC Certification as a Commercial or Residential Building Inspector, and a minimum two years of experience related to the activity being inspected; OR
3. Virginia Professional Engineer and minimum one year of experience related to the activity being inspected (Inspector shall be qualified under Item #M.1 above); OR
4. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience related to the activity being inspected (Inspector shall be qualified under Item #M.1 above); OR
5. NICET CT Certified Engineering Technologist and a minimum five years of experience related to the activity being inspected (Inspector shall be qualified under Item #M.1 above); OR
6. Virginia Licensed Architect and a minimum one year of experience related to the activity being inspected (Inspector shall be qualified under Item #M.1 above).

N. - Special Cases As Determined by the Building Safety Department:

1. Current ICC Certification as a Special Inspector and a minimum two years of experience related to the activity being inspected; OR
2. Virginia Professional Engineer and minimum one year of experience related to the activity being inspected (Inspector shall be qualified under Item #N.1 above); OR
3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience related to the activity being inspected (Inspector shall be qualified under Item #N.1 above).

Exception: Individuals who have proven expertise in a field of specialty, either through education or field experiences of not less than five years, may be considered as meeting criteria to conduct one or more classes of Specialty Inspections.

O. - Special Inspections for Smoke Control:

1. Special Inspection Agencies for smoke control shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers (Documentation of qualifications shall be submitted to the Building Safety Department for review and approval); OR
2. Virginia Professional Engineer, Air Balancer Certification, and on year of relevant experience; OR
3. Bachelor's degree in Engineering, Air Balancer Certification and three years of relevant experience; OR
4. NEDD Certification, National Air Balancer Certification and three years of relevant experience, including installation and operation skills for smoke control systems.



Special Inspection and Testing Agreement

Permit # **CBLD25-0206**

Date **8/1/2025**

Tax Map # **5200112**

The current code in effect is the

2021 Virginia Uniform Statewide Building Code

Project Information:

Project Name **Refueling Centers Fire Station #4**

Property Address **3763 Peters Creek Rd. Roanoke, VA 24018**

Before a Permit Can be Issued:

The Owner and the Registered Design Professional in Responsible Charge, acting as the Owner's Agent, shall complete this agreement and the City of Roanoke Statement of Special Inspections.

Approval of Special Inspection Agencies, Special Inspectors and/or Testing Labs:

Special Inspection Agencies, Special Inspectors and Testing Labs shall disclose any possible conflicts of interest. The Registered Design Professional in Responsible Charge shall pre-qualify the designated Special Inspection Agencies, Special Inspectors, Testing Labs and Fabricator Shops, and submit their qualifications as part of the Statement of Special Inspections. The City of Roanoke Building Safety Department shall approve the designated Special Inspection Agencies, Special Inspectors, Testing Labs and Fabricator Shops, Prior to any work being performed.

Special Inspections and Testing shall meet the minimum applicable requirements of Section 1703 through 1709 of the VUSBC-2021 and the following conditions:

A. Owner Responsibilities:

- 1. Agree and sign the Special Inspection and Testing Agreement.**
- 2. Employ and Fund the Special Inspections and Testing Services:**

The project Owner, the Engineer/Architect or record, an Agent of the Owner is responsible for employing and funding the special inspection and testing services. The Special Inspection Agencies and Special Inspectors shall not be in the employ of the Contractor, a subcontractor or material supplier. In the case of an Owner who is also acting as the Contractor, Special Inspection Agencies and the Special Inspectors shall be employed as specified by the Building Official.

B. Registered Design Professional in Responsible Charge Responsibilities:

- 1. Agree and sign the Special Inspection and Testing Agreement:**

The Engineer/Architect of record shall complete the Special Inspection and Testing Agreement and submit with the Building Permit Application.

- 2. Complete the City's Statement of Special Inspections:**

The Engineer/Architect of record shall complete the Statement of Special Inspections and submit it with the Building Permit Application. The Completion of the Statement of Special Inspections includes the following:

- Check the construction items on the Statement of Special Inspections that require Special Inspections. This shall include identification of materials, systems, components and work required to have Special Inspection and Testing.
- Identify the type and extent of each Special Inspection and the names of individuals and firms performing special inspections and/or testing.
- Identify the type and extent of each test.
- Coordinate with the project Owner on the selection of the Special Inspection Agencies, Special Inspectors, Testing Labs and Fabricator Shops.
- Pre-qualify Special Inspection Agencies, Special Inspectors, Testing Labs and Fabricator Shops for each applicable construction operation based on the City's "Qualification Standards for Special Inspections" that are listed in the City's Statement of Special Inspections.
- Provide (list on the City's Statement of Special Inspections) the name and contact information of each designated Special Inspection Agency, Special Inspector, Testing Lab and Fabricator Shop. This includes providing the Building Safety Department with all documents required by the City's Statement of Special Inspections for each party involved in the Special Inspection Program.

Planning Building & Development 215 Church Ave., SW, Room 170 Roanoke, VA 24011

Phone: (540) 853-1090 www.roanokeva.gov permitcenter@roanokeva.gov

- vii. Coordinate with Building Permit Applicant, to insure that the completed Special Inspection and Testing Agreement and the completed Statement of Special Inspections are submitted to the Building Safety Department for review and acceptance at the time of Building Permit Application.

3. Respond to field discrepancies:

The Engineer/Architect of Record shall respond to Special Inspector reports of uncorrected, nonconforming items and shall provide remedial measures.

4. Review shop drawings and submit design changes:

The Engineer/Architect of Record shall acknowledge and accept shop drawings that detail structural information. Written approval of any verbally approved deviations from the approved plans shall be submitted to the Building Safety Department and to the Special Inspector/Special Inspection Agency. Revised plans shall be submitted for Building Safety Department review and approval.

C. Contractor Responsibilities:

1. Agree and sign the Special Inspection and Testing Agreement.

2. Notify the Special Inspection Agency/Special Inspector/Testing Lab:

The Contractor or the holder of the Building Permit (Applicant or duly authorized agent) is responsible for notifying the Special Inspector or Special Inspection and Testing Agency regarding individual Special Inspections and Testing items listed on the City's Statement of Special Inspections.

3. Provide access to approved plans:

The contractor is responsible for providing the Special Inspector with access to the approved plans and approved shop drawings.

4. Retain Special Inspection records at the job site:

The Contractor is responsible for retaining, at the job site, copies of all special inspection records completed by Special Inspectors and making them available to the City's Building Inspector upon request.

5. Obtain Building Safety Department approval prior to concealment:

The Contractor shall request Building Safety Department inspections and obtain approval prior to concealing any work requiring special inspections.

D. Special Inspection Agency, Special Inspector and Testing Lab Duties and Responsibilities:

1. Agree and sign the Special Inspection and Testing Agreement.

2. General requirements:

Special Inspectors shall review approved plans, specifications, and the referenced standards and approved shop drawings for Special Inspection requirements. Special Inspectors shall comply with the Special Inspection requirements of the VUSBC-2015 and the Statement of Special Inspections regarding work and materials.

3. Signify presence at job site:

The Special Inspector shall notify Contractor's personnel of their presence and responsibilities at the job site. A Special Inspection Log (copy attached) of each Special Inspector's presence on the job site shall be provided near the building inspection reports. This record shall include the following:

- i. Inspection type
- ii. Name of special inspection
- iii. Certification number
- iv. Date
- v. Any pertinent notes
- vi. Time of arrival and departure

4. Observe assigned work and comply with Statement of Special Inspections:

- i. Inspect categories listed on the approved Statement of Special Inspections that they are responsible for. Inspections shall indicate conformance with approved plans, specifications, referenced standards and applicable workmanship provisions of the VUSBC-2021.
- ii. Use the Architect/Engineer reviewed and accepted structural shop drawings as an aid in conducting the related special inspections.
- iii. Be on site at all times to observe construction operations that require continuous Special Inspections and Testing. Be on site to observe construction operations that require periodic inspections as required per Sections 1703, 1704 and 1705 of VUSBC-2021.

5. Report nonconforming items:

The Special Inspectors shall bring all nonconforming items to the immediate attention of the Contractor and note all such items in the Special Inspector's daily report. If any item is not resolved in a timely manner or is about to be covered by construction, the Special Inspector shall immediately notify the Building Safety Department, the Engineer/Architect of record and post a discrepancy notice at the job site. The Special Inspector shall write a separate report to be posted at the job site regarding noted discrepancies. This report shall contain, as a minimum, the following about each nonconforming item:

- i. Description and exact location.
- ii. Reference to applicable details of approved plans/specifications.
- iii. Name and title of each individual notified and method of notification.
- iv. Corrective action taken to resolve noted discrepancy at the job site.

6. Provide Progress Reports:

The special Inspectors shall complete written inspection reports for each visit and leave a copy on site for the Contractor and the Building Inspector to review. The Special Inspector/Special Inspection Agency shall provide copies of these reports weekly, or at the completion of a Special Inspection if Special Inspections take place more than a week apart, to the Building Safety Department's Building Inspector, Engineer/Architect of record and any others designated. These reports shall include:

- i. Date
- ii. Time of arrival and departure
- iii. Building permit number
- iv. Project name and address
- v. Type of inspection
- vi. Inspection frequency required - Continuous or Periodic
- vii. Inspections made including locations
- viii. Tests performed
- ix. Any nonconformance items (discrepancies) and how they were resolved
- x. Listing of unresolved items, parties notified, time and method of notification
- xi. Itemization of changes authorized by the Engineer/Architect of record
- xii. Inspector's signature
- xiii. Full name of inspector printed clearly
- xiv. Certification number

7. Submit final report:

The Special Inspection Agency shall submit a final report that is sealed, signed and dated by its responsible Engineer/Architect, to the City of Roanoke Building Safety Department's Building Inspector, stating that all items requiring Special Inspections and Testing were fulfilled and reported. This report shall also state that all items required Special Inspections and tested items were inspected and found to be in conformance with the approved plans, shop drawings, specifications, referenced standards, Statement of Special Inspections and applicable provisions of the VUSBC: 2021. Items not in conformance, unresolved items, or any discrepancies in Special Inspection coverage (i.e., missed inspections, periodic inspections when continuous inspections were required, etc.) shall be specifically mentioned in this report.

E. Building Safety Department Responsibilities:

Specific duties and responsibilities of the Building Safety Department relating to Special Inspections include the following:

1. Review and approve of submittal documents for compliance with the Special Inspection Program Requirements:

The Building Safety Department is responsible for reviewing all submitted plans, specifications, forms related to the Special Inspection Program, and any other submitted documents for compliance with the Virginia Building Code. All items submitted must be reviewed and approved prior to issuance of the Building Permit. This includes the following:

- i. Check the qualification of each Special Inspector, Special Inspection Agency, Testing Lab and Fabricator Shop that is listed on the Statement of Special Inspections in accordance with the City's "Qualification Standards for Special Inspections".
- ii. Check that all parties involved in the Special Inspection Program have completed their portion of the Special Inspection and Testing Agreement.
- iii. Issue the Building Permit with the approved Statement of Special Inspections, Special Inspection and Testing Agreement and permit conditions attached to the approved plans that will be kept on the job site.
- iv. Determine if a pre-construction meeting is required to review the Special Inspection Program with all appropriate members of the construction team.

2. Monitor special inspections and testing activities:

The Building Inspectors will monitor work requiring Special Inspection and Testing activities at the job site to assure that the designated qualified Special Inspectors are performing their duties when work requiring Special Inspections is in progress.

3. Review special inspection reports:

The Building Inspector will check the special inspection reports left at the job site by the Special Inspector for any discrepancies or non-conforming items. Weekly special inspection reports received will be reviewed by the Building Inspector. The Building Inspector must review all special inspection reports and perform field inspections to verify conformance to the approved plans, shop drawings and specifications prior to concealing any work related to special inspections.


4. Perform final inspection:

The Building Safety Department will not perform a final inspection or approve the project until the final Special Inspection report has been received from a Special Inspection Agency and reviewed and approved by the Building Inspector.

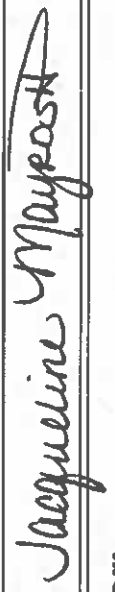
ACKNOWLEDGEMENTS

I have read and agree to comply with my responsibilities as they are outlined in the Special Inspection and Testing Agreement

Owner:

Print Name:	Luke Rich (CAR ENGINEER)	Date:	10/21/25
Signature:			

Registered Design Professional in Responsible Charge (Project Engineer/Architect of Record):

Print Name/Company:	Jacqueline Mayrosh	Date:	8/1/2025
Signature:			

Contractor:

Print Name/Company:		Date:	
Signature:			

Special Inspections and Testing Agencies and/or Testing Laboratories:

Print Name/Company:		Date:	
*Signature:			
Print Name/Company:		Date:	
*Signature:			

*This signature must be that of the responsible professional Engineer within the Special Inspection Agency.

Independent Special Inspectors:

Print Name:		Date:	
Signature:			
Print Name:		Date:	
Signature:			

**Accepted by the City of Roanoke's
Building Safety Department**

Print Name:		Date:	
Signature:			

Statement of Special Inspections

Work Location or Business Name: Roanoke Fire Station #4
Property Address: 3763 Peters Creek Rd. Roanoke, VA 24018 Tax #: 5200112

Registered Design Professional (RDP) in Responsible Charge Information

Name: Jacqueline Mayrosh
Address: 10 Church Ave. SE
City: Roanoke State: VA Zip: 24011
Phone: (540) 342-6001 Email: jmayrosh@spectrumpc.com
*RDP DPOR License #: 43345

**If Property Owner is an LLC or Corporation, please provide a Member or Corporate Officer Name and Address*

Member/Officer Name: _____
Member/Officer Address: _____
City: _____ State: _____ Zip: _____
Phone: _____ Email: _____

Primary Contact (If different from RDP)

Name: _____
Phone: _____ Email: _____

This **Statement of Special Inspections** is submitted as a condition for permit issuance in accordance with the 2021 Edition of the Virginia Uniform Statewide Building Code (USBC), Section 111.2, and Chapter 17 of the 2021 Edition of the Virginia Construction Code (VCC). It includes the following:

1. **Complete** list of all materials and work requiring special inspections, and;
2. **Complete** list of all the inspections to be performed and whether they are required to be periodic or continuous inspections, and;
3. **Complete** list of the individuals, approved agencies or firms intended to be retained for conducting such inspections.

The RDP in Responsible Charge shall keep records of all inspections and shall furnish **Periodic Reports of Special Inspections** to the Building Official each month on the date shown below until the **Final Report of Special Inspections** is submitted. **Periodic Reports of Special Inspections** will include a summary of all activities requiring special inspections for the period along with a log of discrepancies noted. During the course of the project, discrepancies and deviations from the approved plans and specification and code violations observed during the conduct of special inspections services shall be brought to the immediate attention of the contractor for correction. **If such discrepancies are not corrected, the discrepancies shall be brought to the immediate attention of the Building Official.** The special inspection program does not relieve the Contractor of their responsibilities.

Special Inspections are in addition to the regular inspections by Building Inspections personnel specified in Section 113.3 of the Virginia Uniform Statewide Building Code.

Required building Inspections SHALL NOT be performed by individuals performing Special Inspection

A **Final Report of Special Inspections** documenting completion of all required special inspections and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Final Inspection and/or a Certificate of Occupancy.

Job site safety and means and methods of construction are solely the responsibility of the Contractor.

Instructions for Completing this Form:

1. The Registered Design Professional (Architect/Engineer) in responsible charge of the Project shall complete this form and submit it with the Building Permit Application for review and approval by the Building Department prior to the issuance of the Building Permit for the Project. This Statement of Special Inspections (SSI) form will be issued to the job site at the time of issuance of the Building Permit.
2. Information detailing the qualifications including copies of all current certifications and accreditations of each Special Inspector, Special Inspection Agency, and Fabricator Shop, to be used for the Project shall be submitted by the Registered Design Professional (Architect/ Engineer) in responsible charge with this completed form (Sections 1703 and 1704.2.1 of the 2021 VCC). Information shall also be provided outlining the qualifications of any Testing Labs (soils, concrete, masonry, steel, and others) being used for the project. This includes information about the Accreditation of the Testing Lab, names and qualifications of each.
3. Included in this document are the **"QUALIFICATION STANDARDS FOR SPECIAL INSPECTIONS"**. Each party involved with the Project shall meet these minimum qualifications standards. (Sections 1701, 1702, 1703, and 1704 of the 2021 VCC)
4. This form is intended for buildings of structures that are assigned to Seismic Design Category A or B. The Registered Design Professional shall provide a modified Statement of Special Inspection for buildings or structures assigned to Seismic Design Category higher than B.

Special Inspection Categories (1701.1, 1702, 1704 & 1705):

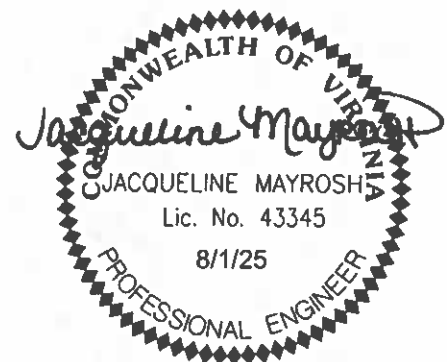
Special inspections are required for materials, installation, fabrication, erection or placement of components and connections requiring special expertise to insure compliance with approved construction documents and applicable reference standards. Section 1705 of the 2021 USBC lists a total of 15 different categories of special inspections and testing (Categories A through O) as listed below). Please check the appropriate boxes below that apply to your project and enter the name of each individual responsible for the Special Inspection you have checked in the space provided to the right of each category. Please provide the appropriate documents that verify the qualifications of each individual or firm listed.

Time of Month for Delivery of Periodic Report of Special Inspections: Last day

Periodic reports of special inspections must be submitted on the date listed above, if the reports are not submitted within 10 days of the date above, the permit maybe suspended until reports are submitted.

RDP in Responsible Charge:

Name: Jacqueline Mayrosh



Owner/Authorized Agent

Signature: [Signature] (CITY ENGINEER)

Date: 10/21/2025

Building Official:

Signature: _____

Date: _____

A.	Inspection of Fabricators (1704.2.5): Where fabrication of structural load-bearing members and assemblies is being performed on the premises of a fabricator's shop, special inspection of the fabricated items shall be required by Section 1704.2.5 and as required elsewhere in the 2021 USBC. See Category A1 or A2 below for each Fabricator as appropriate:		
A. 1.	Fabrication & Implementation Procedures (1704.2.5) for Fabricators Not Registered & Not Approved:		
Check Box Below if Required	Indicate below all structural load-bearing members & assemblies that are being assembled on the premises of a fabricator's shop that is not registered and not approved (Section 1704.2.5)	Indicate below the name of the fabricator shop that is not registered and not approved (Section 1704.2.5)	Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	1. Structural Steel		
<input type="checkbox"/>	2. Steel Joists & Girders		
<input type="checkbox"/>	3. Pre-cast Concrete		
<input type="checkbox"/>	4. Prestressed Concrete		
<input type="checkbox"/>	5. Wood Construction (Section 1705.5) - Prefabricated Structural Elements Covering:		
<input type="checkbox"/>	5.1. Manufactured Wood Trusses		
<input type="checkbox"/>	5.2. Walls		
<input type="checkbox"/>	5.3. Floors		
<input type="checkbox"/>	5.4. Roof Assemblies		
<input type="checkbox"/>	6. Cold Formed Steel Trusses		

A. 2. Fabricator Approval (1704.2.5.1) for Fabricators Registered & Approved:			
Check Box Below if Required	Indicate below all structural load-bearing members & assemblies that are being assembled on the premises of a fabricator's shop that is not registered and not approved (Section 1704.2.5.1)	Indicate below the name of the fabricator shop that is not registered and not approved (Section 1704.2.5.1)	Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input checked="" type="checkbox"/>	1. Structural Steel		
<input type="checkbox"/>	2. Steel Joists & Girders		
<input type="checkbox"/>	3. Pre-cast Concrete		
<input type="checkbox"/>	4. Prestressed Concrete		
<input type="checkbox"/>	5. Wood Construction (Section 1705.5) - Prefabricated Structural Elements Covering:		
<input type="checkbox"/>	5.1. Manufactured Wood Trusses		
<input type="checkbox"/>	5.2. Walls		
<input type="checkbox"/>	5.3. Floors		
<input type="checkbox"/>	5.4. Roof Assemblies		
<input type="checkbox"/>	6. Cold Formed Steel Trusses		
Required tasks to complying with the requirements of Category A-2: 1. Prior to issuance of the Building Permit, provide the Building Department with a copy of the selected fabricator's current shop accreditation/certification. 2. At the completion of fabrication, the Special Inspector and/or Special Inspection Agency shall obtain from each registered and approved fabricator and submit to the Building Department a Certificate of Compliance stating that the work was performed in accordance with the approved construction documents.			

B. Steel Construction (1705.2 & Table 1705.2.3):				Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:	
	1. Material verification of high-strength bolts, nuts and washers:			
<input checked="" type="checkbox"/>	-	X	1.1. Identification markings to conform to ASTM standards specified in the approved construction documents. <u>Referenced Standard:</u> AISC 360 and applicable ASTM material standards	
<input checked="" type="checkbox"/>	-	X	1.2. Manufacturer's certificate of compliance required.	
	2. Inspection of high-strength bolting: <u>Referenced Standard:</u> AISC 360			
<input checked="" type="checkbox"/>	-	X	2.1. Snug-tight joints.	
<input checked="" type="checkbox"/>	-	X	2.2. Pretensioned and slip-critical joints using turn-of-nut with matchmarking, twist-off bolt or direct tension indicator methods of installation.	
<input checked="" type="checkbox"/>	X	-	2.3. Pretensioned and slip-critical joints using turn-of-nut without matchmaking or calibrated wrench methods of installation.	
	3. Material verification of structural steel and cold-formed steel deck:			
<input checked="" type="checkbox"/>	-	X	3.1. For structural steel, identification markings to conform to AISC 360. <u>Referenced Standards:</u> AISC 360.	
<input checked="" type="checkbox"/>	-	X	3.2. For other steel, identification markings to conform to ASTM standards specified in the approved construction documents. <u>Referenced Standards:</u> Applicable ASTM material standards	
<input checked="" type="checkbox"/>	-	X	3.3. Manufacturer's certified test reports.	
	4. Material verification of weld filler materials:			
<input checked="" type="checkbox"/>	-	X	4.1. Identification markings to conform to AWS specification in the approved construction documents. <u>Referenced Standard:</u> AISC 360 and applicable AWS documents	

B. Steel Construction (1705.2 & Table 1705.2.3):				Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:	
<input checked="" type="checkbox"/>	-	X	4.2. Manufacturer's Certificate of Compliance required.	
<input type="checkbox"/>			5. Inspection of welding:	
			5.1. Structural Steel and cold-formed steel deck: <u>Referenced Standards:</u> AWS & the 2021 USBC: 1705.2.2	
<input checked="" type="checkbox"/>	X	-	5.1.1. Complete and partial penetration groove welds.	
<input checked="" type="checkbox"/>	X	-	5.1.2. Multipass fillet welds.	
<input checked="" type="checkbox"/>	X	-	5.1.3. Single-pass fillet welds greater than 5/16".	
<input checked="" type="checkbox"/>	X	-	5.1.4. Plug and slot welds.	
<input checked="" type="checkbox"/>	-	X	5.1.5. Single-pass fillet welds less than or equal to 5/16".	
<input type="checkbox"/>	-	X	5.1.6. Floor and roof deck welds. <u>Referenced Standards:</u> AWS	
			5.2. Reinforcing steel: <u>Referenced Standards:</u> AWS & ACI 318	
<input type="checkbox"/>	-	X	5.2.1. Verification of weldability of reinforcing steel other than ASTM A 706.	
<input type="checkbox"/>	X	-	5.2.2. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special structural walls of concrete and shear reinforcement.	
<input type="checkbox"/>	X	-	5.2.3. Shear reinforcement.	

B. Steel Construction (1705.2 & Table 1705.2.3):			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
<input type="checkbox"/>	-	X	5.2.4. Other reinforcing steel.
			6. Inspection of steel frame joint details for compliance:
<input checked="" type="checkbox"/>	-	X	6.1. Details such as bracing and stiffening.
<input checked="" type="checkbox"/>	-	X	6.2. Member locations.
<input checked="" type="checkbox"/>	-	X	6.3. Applications of joint details at each connection.
<input type="checkbox"/>	-	X	7. Cold-formed steel trusses spanning 60 feet or greater (1705.2.4): Verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.
Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below			
C. Concrete Construction (1705.3 & Table 1705.3):			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections: Reference Standard ACI 318 per any USBC 2021 section 1905 modification
<input checked="" type="checkbox"/>	-	X	1. Inspection of reinforcing steel, including prestressing tendon, and placement. <u>Referenced Standards:</u> ACI 318 & the 2021 USBC: 1908.4
<input type="checkbox"/>			2. Inspection of reinforcing steel welding in accordance with 1705.3.1, or 1705.3.2. <u>Referenced Standards:</u> AWS D1.4 & ACI 318
<input checked="" type="checkbox"/>	X	-	3. Inspection of bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased or where strength design is used. <u>Referenced Standards:</u> ACI 318 & the 2021 USBC: 1901.3, 1905
Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below			

C. (con't) Concrete Construction (1705.3 & Table 1705.3):				Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:	
<input checked="" type="checkbox"/>	-	X	4. Inspection of anchors installed in hardened concrete. Referenced Standards: ACI 318 & the 2021 USBC: 1901.3, 1905	
<input checked="" type="checkbox"/>	-	X	5. Verifying use of required design mix. Referenced Standards: ACI 318 & the 2021 USBC: 1904, 1908.2, 1908.3	
<input checked="" type="checkbox"/>	X	-	6. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete. Referenced Standards: ASTM C 172, ASTM C 31 & ACI 318 & 2021 USBC: 1908.10	
<input checked="" type="checkbox"/>	X	-	7. Inspection of concrete and shotcrete placement for proper application techniques. Referenced Standards: ACI 318 & 2021 USBC: 1908.6, 1908.7, 1908.8	
<input checked="" type="checkbox"/>	-	X	8. Inspection for maintenance of specified curing temperature and techniques. Referenced Standards: ACI 318 & USBC-1018: 1908.9	
<input type="checkbox"/>			9. Inspection of prestressed concrete:	
<input type="checkbox"/>	X	-	9.1. Application of prestressing force. Referenced Standards: ACI 318	
<input type="checkbox"/>	X	-	9.2. Grouting of bonded prestressing tendons in the seismic-force-resisting system. Referenced Standard: ACI 318	
<input type="checkbox"/>	-	X	10. Erection of precast concrete members. Referenced Standards: ACI 318	
<input type="checkbox"/>	-	X	11. Verification of in-situ concrete strength, prior to stressing of tendons in posttensioned concrete and prior to the removal of shores and forms from beams and structural slabs. Referenced Standards: ACI 318	
<input checked="" type="checkbox"/>	-	X	12. Inspect formwork for shape, location and dimensions of the concrete members being formed. Referenced Standards: ACI 318	

D.	Masonry Construction (1705.4): Masonry construction shall be inspected and verified in accordance with the requirements of Sections 1705.4 through 1705.4.2, depending on the classification of the building or structure or nature of the occupancy. Please check the applicable categories of D.1 or Category D.2. Exception: Special Inspections are not required for masonry construction that meets one of the three exceptions listed in Section 1705.4.		
<input type="checkbox"/>	D.1.	Special Inspection (1705.4.1) for Empirical Designed Masonry, Glass Unit Masonry and Masonry Veneer in Occupancy Category IV (Essential Facilities): Special inspections and tests for empirically designed masonry, glass unit masonry or masonry veneer designed in accordance with Section 2109, 2110 or Chapter 14, respectively, where they are part of a structure classified as Risk Category IV shall be performed in accordance with TMS 602 Level 2.	
<input type="checkbox"/>	D.2.	Special Inspection (1705.4.1) for Empirical Masonry in Occupancy Category I, II, or III (Nonessential Facilities): The minimum Special Inspection Program for masonry designed per Section 2107 or 2108 or per Chapters of TMS 402 referenced in sections 2107 and 2108, in structures classified as Occupancy Category I, II, or III, in accordance with Section 1604.5.	
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections: Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	-	X	1. Compliance with required inspection provisions of the construction documents and the approved submittals shall be verified. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	2. Verification of f_m^1 and f_{AAC}^1 prior to construction except where specifically exempted by code. Reference for Criteria: TMS 602
<input type="checkbox"/>	X	-	3. Verification of slump flow and VSI as delivered to the site for self-consolidating grout. Reference for Criteria: TMS 602
			4. As masonry construction begins, the following shall be verified to ensure compliance:
<input type="checkbox"/>	-	X	4.1. Proportions of site-prepared mortar. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	4.2. Construction of mortar joints. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	4.3. Location of reinforcement, connectors, prestressing tendons and anchorages. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	4.4. Prestressing technique. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	4.5. Grade and size of prestressing tendons and anchorages. Reference for Criteria: TMS 602

D.1. Level #1 Special Inspection (1705.4.1): (con't)		Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below	
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
5. During construction the inspection program shall verify:			
<input type="checkbox"/>	-	X	5.1. Size and location of structural elements. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	5.2. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction. Reference for Criteria: TMS 402
<input type="checkbox"/>	-	X	5.3. Specified size, grade and type of reinforcement, anchor bolts, prestressing tendons and anchorages. Reference for Criteria: TMS 402 & TMS 602
<input type="checkbox"/>	X	-	5.4. Welding of reinforcing bars. Reference for Criteria: TMS 402
<input type="checkbox"/>	-	X	5.5. Protection of masonry during cold weather (temperature below 40 °F) or hot weather (temperature above 90 °F). Reference for Criteria: TMS 602
<input type="checkbox"/>	X	-	5.6 Application and measurement of prestressing steel. Reference for Criteria: TMS 602
The following shall be verified to insure compliance:			
<input type="checkbox"/>	-	X	6.1. Grout space is clean. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	6.2. Placement of reinforcement, connectors and prestressing tendons and anchorages. Reference for Criteria: TMS 402 & TMS 602
<input type="checkbox"/>	-	X	6.3. Proportion of site-prepared grout and prestressing grout for bonded tendons. Reference for Criteria: TMS 602

D.1. Special Inspection (1705.4.1):			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
<input type="checkbox"/>	X	-	6.4. Verification of proportions of materials in premixed or preblended mortar and grout as delivered to the site. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	6.5. Construction of mortar joints. Reference for Criteria: TMS 602
<input type="checkbox"/>	X	-	7. Grout placement shall be verified to ensure compliance with code and construction document provisions. Reference for Criteria: TMS 602
<input type="checkbox"/>	X	-	7.1. Grout space prior to grouting. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	7.2. Placement of prestressing grout. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	7.3. Grouting of prestressing bonded tendons. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	8. Size and location of structural elements. Reference for Criteria: TMS 602
<input type="checkbox"/>	X	-	8.1. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction. Reference for Criteria: TMS 402
<input type="checkbox"/>	-	X	8.2. Specified size, grade and type of reinforcement, anchor bolts, prestressing tendons and anchorages. Reference for Criteria: TMS 402 & TMS 602
<input type="checkbox"/>	X	-	8.3. Welding of reinforcing bars. Reference for Criteria: TMS 402

Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below

	D.1. Special Inspection (1705.4.1):			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:	Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	X	-	8.4. Application and measurement of prestressing force. Reference for Criteria: TMS 602	
<input type="checkbox"/>	X	-	9. Preparation of any required grout specimens, mortar specimens and/or prisms shall be observed. Reference for Criteria: 2021 USBC: Sec. 2105.1 & TMS 602	
E.	Structural Wood Construction (1705.5):			
	1. Special Inspections of the fabrication process of prefabricated wood structural elements and assemblies (covering: walls, floors, or roof assemblies along with manufactured roof trusses) shall be in accordance with Section 1704.2.5 (see Category A above). 2. Special Inspections of site-built assemblies shall be in accordance with Section 1705.5 as indicated below.			
Check Box Below if Required			Required Verification and Inspections:	Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	1. Fabrication of high-load diaphragms designed in accordance with Section 2306.2 shall be installed with Special Inspections as indicated in Sections 1704.2:			
	1.1. Inspect the wood structural panel sheathing to ascertain that it is of the grade and thickness shown on the approved plans. 1.2. Verify the nominal size of the framing members at adjoining panel edges, the nail or staple diameter and length, the number of fastener lines and that the spacing between fasteners in each line and at edge margins agrees with the approved plans.			
<input type="checkbox"/>	2. Metal-plate-connected wood trusses spanning 60 feet or greater (1705.5.2): Verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.			
<input type="checkbox"/>	3. Prefabricated wood shear panels covering:			
	3.1. Holdown anchor size and placement, including embedment length, spacing and edge distance. 3.2. The connection of the structure to the shear panels.			

F.	Soils (1705.6 & Table 1705.6):			Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
	1. Perform Special Inspections of existing site soil conditions, fill placement and load-bearing requirements as required by Section 1705.6 and Table 1705.6. 2. Determine compliance using the approved geotechnical report (Section 1803), and the construction documents prepared by the Registered Design Professional. 3. Determine that proper materials and procedures are used during fill placement and in accordance with the provisions of the approved geotechnical report. <u>Exception:</u> Where Section 1803 does not require reporting of materials and procedures for fill placement, the special inspector shall verify that the in-place dry density of the compacted fill is not less than 90% of the maximum dry density at optimum moisture content determined in accordance with ASTM D 1557.			
	Check Box Below if Required	Continual	Periodic	
	<input checked="" type="checkbox"/>	-	X	
	<input checked="" type="checkbox"/>	-	X	
	<input checked="" type="checkbox"/>	-	X	
	<input checked="" type="checkbox"/>	X	-	
<input checked="" type="checkbox"/>	-	X		
G.	Driven Deep Foundations (1705.7 & Table 1705.7):			Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
	1. Perform Special Inspections during installation and testing of driven deep foundation elements as required by Table 1705.7 2. Determine compliance using the approved geotechnical report (section 1803), and the construction documents prepared by the Registered Design Professional.			
	Check Box Below if Required	Continual	Periodic	
	<input type="checkbox"/>	X	-	
	<input type="checkbox"/>	X	-	
<input type="checkbox"/>	X	-		
<input type="checkbox"/>	X	-		

G. Driven Deep Foundations (1705.7 & Table 1705.7:			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
<input type="checkbox"/>			5. For steel elements, perform additional inspections in accordance with 1705.2 (see Category B above).
<input type="checkbox"/>			6. For concrete elements and concrete-filled elements, perform additional inspections in accordance with Section 1705.3 & Table 1705.3 (see Category C above).
<input type="checkbox"/>			7. For specialty elements, perform additional inspections as determined by the Registered Design Professional in Responsible Charge.
Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below			
H. Cast-In-Place Deep Foundations (1705.8 & Table 1705.8):			
1. Perform Special Inspections during installation and testing of cast-in-place deep foundation elements as required by Table 1705.8. 2. Determine compliance using the approved geotechnical report (Section 1803), and the construction documents prepared by the Registered Design Professional.			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
<input type="checkbox"/>	X	-	1. Observe drilling operations and maintain complete and accurate records for each element.
<input type="checkbox"/>	X	-	2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes.
<input type="checkbox"/>			3. For concrete elements, perform additional inspections in accordance with Section 1705.3 & Table 1705.3 (see Category C above).
Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below			

I. Helical Pile Foundations (1705.9):				Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:	
<input type="checkbox"/>	X	-	1. Perform Special Inspections continuously during installation of helical pile foundations.	
<input type="checkbox"/>	X	-	2. Record information for each helical pile that includes installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required by the Registered Design Professional in Responsible Charge.	
<input type="checkbox"/>	X	-	3. Use the approved geotechnical report (Section 1803) and the approved construction documents prepared by the Registered Design Professional to determine compliance.	
K. Spray-Applied Fire-Resistant Materials (SFRM) (1705.14):				Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
Check Box Below if Required	Required Verification and Inspections:			
<input type="checkbox"/>	1. Special Inspections for sprayed fire-resistant materials (SFRM) applied to floor, roof and wall assemblies and structural members shall be in accordance with Sections 1705.14 through 1705.14.6.3 2. Special Inspections shall be based on the fire-resistance design as designated in the approved construction documents. 3. <i>The tests set forth in Section 1705.14.1 shall be based on samplings from specific floor, roof and wall assemblies and structural members.</i> 4. Special Inspections shall be performed after the rough installation of electrical, automatic sprinkler, mechanical and plumbing systems and suspension systems for ceilings, where applicable.			
<input type="checkbox"/>	Physical and Visual Tests (1705.14.1): Perform Special Inspections for SFRM to include the following test and observations to demonstrate compliance with listing and fire-resistance rating covering condition of substrate, thickness of application, density in pounds per cubic foot, bond strength adhesion/cohesion and condition of finished application (see below for requirements). Structural Member Surface Conditions (1705.14.2): 1. Prepared the surfaces in accordance with the approved fire-resistance design and the written instructions of approved manufacturers. 2. Inspect the prepared surface of structural members to be sprayed before the application of the SFRM. Application (1705.14.3): 1. Verify that the substrate has a minimum ambient temperature before and after application as specified in the written instructions of approved manufacturers. 2. Verify that the area for application is ventilated during and after application as required by the written instructions of approved manufacturers.			

<div>K. (con't)</div>	<div>Spray-Applied Fire-Resistant Materials (SFRM) (1705.14):</div>	
<div>Check Box Below if Required</div>	<div>Required Verification and Inspections:</div>	<div>Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below</div>
<div><input type="checkbox"/></div>	<div> <div> Thickness (1705.14.4): No more than 10% of the thickness measurements of the SFRM applied to floor, roof and wall assemblies and structural members shall be less than the thickness required by the approved fire-resistance design, but in no case less than the minimum allowable thickness required by Section 1705.14.4.1. <div> <div>1. <u>Minimum allowable individual thickness (1705.14.4.1):</u></div> <div> <div>1.1. For design thicknesses 1 inch or greater. It shall be the design thickness minus 1/4 inch.</div> <div>1.2. For design thicknesses less than 1 inch, it shall be the design thickness minus 25%.</div> <div>1.3. Thickness shall be determined in accordance with ASTM E 605.</div> <div>1.4. Samples of the SFRM shall be selected in accordance with Section 1705.14.4.2 and 1705.14.4.3 (see below).</div> </div> </div> <div> <div>2. <u>Floor, roof and wall assemblies (1705.14.4.2):</u></div> <div>Determine the thickness of the applied SFRM in accordance with ASTM E 605, making not less than 4 measurements for each 1,000 square feet of the sprayed area in each story or portion thereof:</div> </div> <div> <div>3. <u>Cellular decks (1705.14.4.3):</u> Select the thickness measurements from a square area, 12" by 12" in size. Make a minimum of 4 measurements that are located symmetrically within the square area.</div> <div>4. <u>Fluted decks (1705.14.4.4):</u> Select the thickness measurements from a square area, 12" by 12" in size. Make a minimum of 4 measurements that are located symmetrically within the square area, including one each of the following: valley, crest and sides. Report the average of the measurements.</div> </div> <div> <div>5. <u>Structural members (1705.14.4.5):</u> Determine the thickness of the applied SFRM in accordance with ASTM E 605. Perform thickness testing on not less than 25% of the structural members on each floor:</div> </div> <div> <div>6. <u>Beams and girders (1705.14.4.6):</u> Make thickness measurements at 9 locations around the beams or girder at each end of a 12-inch length.</div> <div>7. <u>Joists and trusses (1705.14.4.7):</u> Make thickness measurements at 7 locations around the joist or truss at each end of a 12-inch length.</div> </div> <div> <div>8. <u>Wide-flanged columns (1705.14.4.8):</u> Make thickness measurements at 12 locations around the column at each end of a 12-inch length.</div> <div>9. <u>Hollow structural section and pipe (1705.14.4.9):</u> Make thickness measurements at 4 locations around the column at each end of a 12-inch length.</div> </div> </div> </div>	

<div>K.</div> <div>Spray-Applied Fire-Resistant Materials (SFRM) (1705.14):</div>		<div>Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below</div>	
<div>Check Box Below if Required</div>	<div>Required Verification and Inspections:</div>	<div></div>	
<div><input type="checkbox"/></div>	<div> Density (1705.14.5): The density of the SFRM shall not be less than the density specified in the approved fire-resistance design. Determine the density of the SFRM in accordance with ASTM E 605. Select the test samples to determine the density of the SFRM as follows: 1. From each floor, roof and wall assemblies at the rate of not less than 1 sample for every 2,500 square feet or portion thereof of the sprayed area in each story. 2. From beams, girders, trusses and columns at a rate of not less than 1 sample for each type of structural member for each 2,500 square feet of floor area or portion thereof in each story. </div>	<div></div>	
<div><input type="checkbox"/></div>	<div> Bond Strength (1705.14.6): Verify that the cohesive/adhesive bond strength of the cured SFRM applied to floor, roof and wall assemblies and structural members shall not be less than 150 pound per square foot. Determine the cohesive/adhesive bond strength in accordance with the field test specified in ASTM E 736 by testing in-place samples of SFRM selected in accordance with Sections 1704.12.6.1 through 1704.12.6.3 (see below): 1. <u>Floor, roof and wall assemblies (1705.14.6.1)</u>: Select the test samples for determining the cohesive/adhesive bond strength of the SFRM from floor, roof and wall assembly at a rate of not less than 1 sample for every 2,500 square feet of the sprayed area in each story or portion thereof. 2. <u>Structural members (1705.14.6.2)</u>: Select the test samples for determining the cohesive/adhesive bond strength of the SFRM from beams, girders, trusses, columns and other structural members at a rate of not less than 1 sample for every 2,500 square feet of floor area or portion thereof in each story. 3. <u>Primer, paint and encapsulated bond tests (1705.14.6.3)</u>: Conduct bond tests to qualify a primer, paint or encapsulate when the SFRM is applied to a primed, painted or encapsulated surface for which acceptable bond-strength performance between these coatings and fire-resistant material has not been determined. Verify that a bonding agent approved by the SFRM manufacturer is applied to a primed, painted or encapsulated surface where the bond strengths are found to be less than required values. </div>	<div></div>	
<div>L.</div> <div>Mastic & Intumescent Fire-Resistant Coatings (1705.15):</div>		<div>Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below</div>	
<div>Check Box Below if Required</div>	<div>Required Verification and Inspections:</div>	<div></div>	
<div><input type="checkbox"/></div>	<div> Special Inspections for mastic and intumescent fire-resistant coatings applied to structural elements and decks shall be in accordance with AWC 12-B and shall be based on the fire-resistance design as designated in the approved construction documents. </div>	<div></div>	

M. Check Box Below if Required	Exterior Insulation and Finish Systems (EIFS) (1705.16):		Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	<p> Special Inspections are required for all EIFS applications unless one of the following exceptions applies. Exception #1: EIFS applications installed over a water-resistive barrier with a means of draining moisture to the exterior (unless the Special Inspection is required by the ICC Report of Approval for the selected EIFS). Exception #2: EIFS applications installed over masonry or concrete walls. Note: The Registered Design Professional shall indicate on the space to the right and on the plans the ICC Report of Approval number for the selected EIFS. </p>		
O. Check Box Below if Required	Special Inspections for Smoke Control (1705.18): Smoke control systems shall be tested by a Special Inspector.		Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	<p> Testing Scope (1705.18.1): The test scope shall be as follows: 1. During erection of ductwork and prior to concealment for the purpose of leakage testing and recording of device location. 2. Prior to occupancy and after sufficient completion for the purposes of pressure difference testing, flow measurements and detection and control verification. </p>		

Qualification Standards for Special Inspections

Special Inspectors, Laboratory Technicians, Special Inspection Agencies, Testing Labs and Fabricator Shops

General Notes:

Note #1: Basis for formulating City of Roanoke's Building Safety Department Special Inspection Program (SIP):

These requirements were based on the "*Model Program for Special Inspection (Based on the 2021 IBC Chapter 17)*" published by the International Code Council (ICC) and the International Accreditation Services (IAS) and reflect the following:

1. Applicable provisions of Chapter 17 of the 2021 USBC;
2. Applicable portions of the following IAS Accreditation Criteria:
 - 2.1. AC89 - Accreditation Criteria for Testing Laboratories;
 - 2.2. AC98 - Accreditation Criteria for Inspection Agencies;
 - 2.3. AC157 - Accreditation Criteria for Fabrication Inspection Programs for Reinforced Concrete;
 - 2.4. AC172 - Accreditation Criteria for Fabrication Inspection Programs for Structural Steel;
 - 2.5. AC196 - Accreditation Criteria for Fabrication Inspection Programs for Wood Wall Panels;
 - 2.6. AC204 - Accreditation Criteria for Calibration Laboratories;
 - 2.7. AC291 - Accreditation Criteria for Special Inspection Agencies;
 - 2.8. AC370 - Accreditation Criteria for Product Certification Agencies;
 - 2.9. AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems; and/or
3. Applicable portions of the following Standards by International Organization for Standardization/International Electrotechnical Commission (ISO/IEC):
 - 3.1. ISO/IEC 17011: 2004(E), Conformity Assessment - General Requirements for Accreditation Bodies Accrediting Conformity Assessment Bodies;
 - 3.2. ISO/IEC 17020: 1998(E), General Criteria for the Operation of Various Types of Bodies Performing Inspection;
 - 3.3. ISO/IEC 17024: 2003, Conformity Assessment - General Requirements for Bodies Performing Inspection;
 - 3.4. ISO/IEC 17025: 2005(E), General Requirements for the Competence of Testing and Calibration Laboratories;
 - 3.5. ISO/IEC 17025: 2005/Cor.1:2006(E), General Requirements for the Competence of Testing and Calibration Laboratories;
 - 3.6. ISO/IEC Guide 6.5: General Requirements for Bodies Operating Product Certification Systems.

Note #2: Guideline to Determine Compliance and Competence of Designated Special Inspector and Special Inspections Agency:

This information will be used as a guideline by the Building Safety Department to verify compliance with applicable provisions of Sections 1703 and 1704 of the 2021 USBC in determining the competence of each designated Special Inspector, Laboratory Technician, Special Inspection Agency, Testing Laboratories and/or Fabricator Shop listed in the Statement of Special Inspections.

Note #3: Minimum Qualifications for Special Inspectors:

The minimum qualifications for Special Inspectors listed below are from the International Accreditation Service's "Accreditation Criteria for the IBC Special Inspection Agencies" AC 291.

Note #4: Required Information/Documentation and How it Will be Used:

This information shall be used by the Registered Design Professional in Responsible Charge of the project and/or the Responsible Professional Engineer representing the Special Inspection Agency and/or Testing Laboratory to measure the qualifications of each designated Special Inspector, Laboratory Technician, Special Inspection Agency, Testing Laboratory and Fabricator Shop that are listed in the Statement of Special Inspections. The Building Safety Department will consider equivalent criteria for the qualifications of any designated party, if submitted by the Registered Design Professional and/or Responsible Professional Engineer. The Registered Design Professional and/or Responsible Professional Engineer shall provide the Building Safety Department with sufficient documentation to substantiate the equivalency request.

General Notes (Con't):

Note #5: Special Inspection Agency Qualification Standards:

Each designated Special Inspection Agency shall be:

1. An agency that maintains IAS current accreditation with the scope of accreditation covering the disciplines for which the agency is designated; OR
2. An agency that meets the requirements of Section 1700 of the 2021 USBC. The Registered Design Professional and/or Responsible Professional Engineer of the agency shall provide all documentation as necessary for the Building Safety Department to determine if the Agency meets the applicable code requirements; OR
3. An agency that has been accredited by an approved Inspection Agency in accordance with ISO/IEC 17020.

Note #6: Special Inspector Qualification Standards:

Each designated Special Inspector and Laboratory Technician shall meet the "Minimum Qualifications for Special Inspectors" and related criteria as listed below.

Note #7: Special Inspector in Training (SIIT):

1. The intent of this provision is to provide practical opportunities for a Special Inspector in Training (SIIT) to gain the needed experience to qualify as a Special Inspector.
2. An Inspector who does not meet the qualifications for a Special Inspector may be allowed to perform a "Special Inspection" at the discretion of the Special Inspection Agency's Registered Design Professional, provided one or more of the following conditions are met:
 - 2.1. The individual is working under the direct and continuous supervision of a Special Inspector fully qualified for the type of work involved.
 - 2.2. The individual is working under the indirect or periodic supervision of a Special Inspector, and the scope of work is minor and/or routine and within the capabilities of the individual.

Note #8: Testing Labs Qualification Standards:

Each designated Testing Lab shall be accredited by one the following major acceptable accreditation authorities:

1. IAS Accreditation with the scope of accreditation covering the discipline's for which the Testing Lab is designated.
2. AASHTO Accreditation Program per either AASHTO R18 or ISO/IES 17250.
3. American Association of Laboratory Accreditation.
4. National Voluntary Laboratory Accreditation Program.
5. Other Accreditation Authority Program. The Testing Lab shall be accredited by a third party and shall meet the requirements of Section 1703 of USBC-12.

Note #9: Laboratory Technician Qualification Standards:

Each Laboratory Technician shall have certification in the appropriate category and one year minimum experience.

Note #10: Experience:

1. For experience to count toward qualifications, it shall be based on verifiable work directly related to the category or type of inspection involved.
2. An engineering degree (BS) plus appropriate in-house training may be substituted for not more than one year of experience. An engineering technology degree plus appropriate in-house training may be substituted for not more than six months experience. (Degree experience may not be substituted for more than half of the experience requirements in any category.)
3. Five or more years experience as a qualified Special Inspector in one or more categories of work may fulfill up to half the experience requirements in any category, at the discretion of the Special Inspection Agency's designated Responsible Professional Engineer.

Note #11: Certification:

Certification, when specified, is intended to mean the successful completion of:

1. AN ICC examination appropriate to the category of work involved; and/or
2. Having other specific certification obtained from a Nationally recognized certifying organization that is appropriate to the category of work involved and is acceptable to the Building Department.

Note: The Building Safety Department will consider equivalent certifications from Nationally recognized organization obtained by written examination when sufficient documentation to substantiate the equivalency is provided by the Special Inspection Agency's designated Responsible Professional Engineer.

Minimum Qualifications for Special Inspectors

Based on IAS AC291 Accreditation Criteria for Special Inspection Agencies

A. - Inspections of Fabricators (1704.2.5):

A.1. - Fabrication and Implementation (1704.2.5) for Fabricators not Registered and not Approved:

1. The designated Special Inspector and/or Special Inspection Agency shall perform in-plant periodic visits and reviews of all listed fabricator shops that are not registered and not approved per Section 1704.2.5 (see Category A.2. below). The duties include:

1.1. Verify that the fabricator maintains detailed fabrication and quality control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards, and

1.2. Review the procedures for completeness and adequacy relative to the code requirements for the fabricator's scope of work.

2. The designated Special Inspector and/or Special Inspection Agency inspecting a fabricator shop for compliance with Section 1704.2.1 shall be pre-approved by the Building Department for the specified category of construction prior to Building Permit issuance. See the specific category below for minimum qualification criteria:

2.1. For Structural Steel Construction: See Category B below.

2.2. For Precast/Prestressed Concrete: See Category C below.

2.3. For Wood Construction: See Category E below.

A.2. - Fabricator Approval (1704.2.5.1) for Fabricators Registered and Approved:

1. Special Inspections required by Section 1704 are not required where the work is done on the premises of a Fabricator registered and approved to perform such work without Special Inspection. Approval shall be based upon review of the fabricator's written procedural and quality control manuals and periodic auditing of fabrication practices by an approved Special Inspection Agency (a third-party that is recognized by the Building Safety Department).

2. Special Inspections are not required for work done on the premises of a registered and approved Fabricator that has a current accreditation from the International Accreditation Service (IAS), a current certification from a Nationally recognized organization (see item #4 below), or an equivalent certification (see Note below).

3. An IAS-accredited fabricator that is listed on that AIAS web site (www.iasonline.org). The IAS Accreditation is based on the IAS Fabrication Accreditation Standards (IAS Fabricator Accreditation Program currently offers accreditation services for reinforced concrete, precast concrete, structural steel and wood panel assemblies)

4. A Nationally recognized organization/body that includes a third-party oversight of the fabricators facility (including processes and final products) as defined by the USBC. This option is subject to the review and acceptance by the Building Safety Department. The following National Fabricator Certifying Organizations are recognized and acceptable by City of Roanoke's Building Safety Department:

4.1. American Institute of Steel Construction (AISC) for Fabricators of Structural Steel.

4.2. American Steel Joist Institute (SJI) for Fabricators of Steel Joists.

4.3. Precast/Prestressed Concrete Institute for Fabricators of Precast and Prestressed Concrete.

4.4. Truss Plate Institute (TPI) for Fabricators of Wood Trusses.

Note: Equivalencies are subject to review and acceptance by the Building Department and shall be performed by an approved Special Inspection Agency in accordance with applicable provisions of Sections 1704.2.5 and 1703 of the 2021 USBC.

B. - Steel Construction:

B.1. - High Strength Bolting:

1. Current ICC certification as a Structural Steel and Bolting Special Inspector and a minimum one year of experience; OR
2. Virginia Professional Engineer and a minimum one year of direct experience in structural steel and bolting construction (Inspector shall be qualified under Item #1).
3. American Welding Society (AWS) Certified Welding Inspector (CWI) and has a minimum of one year of experience (Inspector shall be qualified under Item #B.1.1).

Note: ICC certifications for Structural Steel and Welding Special Inspectors are valid for the Bolting Special Inspector until the date of expiration.

B. - Steel Construction (con't):
B.2. - Welding:
1. American Welding Society (SAWS) Certified Welding Inspector (CWI); OR 2. Current ICC Certification as a Structural Steel and Welding Special Inspector and has a minimum one year of experience; OR 3. American Welding Society (AWS) Certified Associate Welding Inspector (CAWI) working under the direct on-site supervision of a Certified Welding Inspector (CWI) and a minimum one year of experience (Inspector shall be qualified under either Item #B.2.1 or Item #B.2.2).
B.3. - Nondestructive Testing (NDT):
1. Personnel qualified in accordance with nationally-recognized NDT personnel qualification practice or standard, such as ANSI/ANST-CP-189 or SNT-TC-1A; OR 2. American Society of Nondestructive Testing (ASNT) Level II and a minimum of 120 hours of direct testing experience or training as determined and approved by an ASNT Level III.
C. - Concrete Construction:
C.1. - Reinforced Concrete:
1. Current ICC Certification in Reinforced Concrete Special Inspection and one year of experience; OR 2. <i>Virginia</i> Professional Engineer and minimum one year of direct experience in reinforced concrete construction (Inspector shall be qualified under Item #C.1.1); OR 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience (Inspector shall be qualified under Item #C.1.1); OR 4. ACI Concrete Construction Special Inspector or ACI Concrete Field Testing Technician Grade 1 and a minimum one year of experience (Inspector shall be qualified under Item #C.1.1).
C.2. - Pre-stressed/Pre-cast/Cast-in-Place/Poured-in-Place Concrete:
1. Current ICC Certification in Prestressed Concrete Inspection and one year of experience; OR 2. Virginia Professional Engineer and minimum one year of direct experience in prestressed concrete construction (Inspector shall be qualified under Item #C.2.1 above); OR 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum one year of experience (Inspector shall be qualified under Item #C.2.1 above); OR 4. ACI Concrete Construction Special Inspector or ACI Concrete Field Testing Technician Grade 1 and a minimum two years of experience (Inspector shall be qualified under Item #C.2.1 above).
C.3. - Post-installed Structural Anchor in Concrete:
1. Current ICC Certification in Reinforced Concrete Special Inspection; OR 2. Current ICC Certification as a Residential or Commercial Building Inspector, as applicable, and a minimum two years of experience related to the activity being inspected; OR 3. Virginia Professional Engineer and minimum one year of experience related to the activity being inspected (Inspector shall be qualified under Item #C.3.1 above); OR 4. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience related to the activity being inspected (Inspector shall be qualified under Item #C.3.1 above).
D. - Masonry Construction:
1. Current ICC Certification in masonry and a minimum one year experience; OR 2. Virginia Professional Engineer and minimum one year of relevant experience (Inspector shall be qualified under Item #D.1 above); OR 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience (Inspector shall be qualified under Item #D.1 above).

E. - Masonry Construction:
<ol style="list-style-type: none"> 1. Virginia Professional Engineer and minimum one year of relevant experience related to the activity being inspected; OR 2. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience related to the activity being inspected; OR 3. Current ICC Certification as a Commercial or Residential Building Inspector, as applicable, AND <ol style="list-style-type: none"> 3.1. A minimum two years of related experience in engineered wood products.
F. - Soils:
<ol style="list-style-type: none"> 1. NICET Level II Geotechnical Engineering Technology Certification, or ICC Soils Special Inspector Certification, and a Minimum two years of experience; OR 2. Technician with a minimum three years of documented experience directly related to soils testing and inspection under a licensed Virginia Professional Engineer (Inspector shall be qualified under Item #F.1 above); OR 3. Bachelor's degree in Civil or Structural Engineering/Geotech/Geologist from an accredited institution and a minimum of one year of experience (Inspector shall be qualified under Item #F.1 above); OR 4. Virginia Professional Engineer and a minimum one year of experience (Inspector shall be qualified under Item #F.1 above); OR 5. Professional Engineer in Geotechnical Engineering.
G. - Driven Deep Foundations:
<ol style="list-style-type: none"> 1. Current ICC Certification in Concrete Special Inspection in addition to having one of the following (Virginia Professional Engineer, NICET III or IV, NICET CT Certified Engineering Technologist or Bachelors Degree in Civil or Structural Engineering); OR 2. Virginia Professional Engineer and minimum one year of relevant experience. In addition, Inspector shall obtain ICC Certification in Concrete Special Inspection; OR 3. NICET III or IV (geotechnical/construction or construction material testing/soils) and a minimum of five years experience. In addition, Inspector shall obtain ICC Certification in Concrete Special Inspection; OR 4. NICET CT Certified Engineering Technologist and a minimum of five years of experience. In addition, Inspector shall obtain ICC Certification in Concrete Special Inspection; OR 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum three years of experience. In addition, Inspector shall obtain ICC Certification in Concrete Special Inspection).
H. - Cast-in-Place Deep Foundations:
Same as Category G (see above).
I. - Helical Pile Foundations:
Same as Category G (see above).
J. - Vertical Masonry Foundation Elements:
Same as Category D (see above).
K. - Spray-Applied Fire-Resistant Materials (SFRM):
<ol style="list-style-type: none"> 1. Current ICC Certification as a Spray-applied Fireproofing Special Inspector and a minimum one year experience; OR 2. Virginia Professional Engineer and minimum one year of experience in fireproofing applications (Inspector shall be qualified under Item #K.1 above); OR 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience in fireproofing applications (Inspector shall be qualified under Item #K.1 above); OR 4. American Concrete Institute Concrete Field Testing Technician Grade 1 or American Welding Society Certified Welding Inspector and a minimum of one year experience in fireproofing applications (Inspector shall be qualified under Item #K.1 above).
L. - Mastic and Intumescent Fire-Resistant Coatings:
Same as Category K (see above).

M. - Exterior Insulation and Finish Systems (EIFS)::

1. Current ICC Certification as a Reinforced Concrete Special Inspector; OR
2. Current ICC Certification as a Commercial or Residential Building Inspector, and a minimum two years of experience related to the activity being inspected; OR
3. Virginia Professional Engineer and minimum one year of experience related to the activity being inspected (Inspector shall be qualified under Item #M.1 above); OR
4. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience related to the activity being inspected (Inspector shall be qualified under Item #M.1 above); OR
5. NICET CT Certified Engineering Technologist and a minimum five years of experience related to the activity being inspected (Inspector shall be qualified under Item #M.1 above); OR
6. Virginia Licensed Architect and a minimum one year of experience related to the activity being inspected (Inspector shall be qualified under Item #M.1 above).

N. - Special Cases As Determined by the Building Safety Department:

1. Current ICC Certification as a Special Inspector and a minimum two years of experience related to the activity being inspected; OR
 2. Virginia Professional Engineer and minimum one year of experience related to the activity being inspected (Inspector shall be qualified under Item #N.1 above); OR
 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience related to the activity being inspected (Inspector shall be qualified under Item #N.1 above).
- Exception:** Individuals who have proven expertise in a field of specialty, either through education or field experiences of not less than five years, may be considered as meeting criteria to conduct one or more classes of Specialty Inspections.

O. - Special Inspections for Smoke Control:

1. Special Inspection Agencies for smoke control shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers (Documentation of qualifications shall be submitted to the Building Safety Department for review and approval); OR
2. Virginia Professional Engineer, Air Balancer Certification, and on year of relevant experience; OR
3. Bachelor's degree in Engineering, Air Balancer Certification and three years of relevant experience; OR
4. NEDD Certification, National Air Balancer Certification and three years of relevant experience, including installation and operation skills for smoke control systems.



Special Inspection and Testing Agreement

Permit # **CBLD25-0205**

Date **8/1/2025**

Tax Map # **4220316**

The current code in effect is the

2021 Virginia Uniform Statewide Building Code

Project Information:

Project Name **Refueling Centers Fire Station #6**

Property Address **1333 Jamison Ave. SE Roanoke, VA 24013**

Before a Permit Can be Issued:

The Owner and the Registered Design Professional in Responsible Charge, acting as the Owner's Agent, shall complete this agreement and the City of Roanoke Statement of Special Inspections.

Approval of Special Inspection Agencies, Special Inspectors and/or Testing Labs:

Special Inspection Agencies, Special Inspectors and Testing Labs shall disclose any possible conflicts of interest. The Registered Design Professional in Responsible Charge shall pre-qualify the designated Special Inspection Agencies, Special Inspectors, Testing Labs and Fabricator Shops, and submit their qualifications as part of the Statement of Special Inspections. The City of Roanoke Building Safety Department shall approve the designated Special Inspection Agencies, Special Inspectors, Testing Labs and Fabricator Shops, Prior to any work being performed.

Special Inspections and Testing shall meet the minimum applicable requirements of Section 1703 through 1709 of the VUSBC-2021 and the following conditions:

A. Owner Responsibilities:

- 1. Agree and sign the Special Inspection and Testing Agreement.**
- 2. Employ and Fund the Special Inspections and Testing Services:**

The project Owner, the Engineer/Architect or record, an Agent of the Owner is responsible for employing and funding the special inspection and testing services. The Special Inspection Agencies and Special Inspectors shall not be in the employ of the Contractor, a subcontractor or material supplier. In the case of an Owner who is also acting as the Contractor, Special Inspection Agencies and the Special Inspectors shall be employed as specified by the Building Official.

B. Registered Design Professional in Responsible Charge Responsibilities:

- 1. Agree and sign the Special Inspection and Testing Agreement:**

The Engineer/Architect of record shall complete the Special Inspection and Testing Agreement and submit with the Building Permit Application.

- 2. Complete the City's Statement of Special Inspections:**

The Engineer/Architect of record shall complete the Statement of Special Inspections and submit it with the Building Permit Application. The Completion of the Statement of Special Inspections includes the following:

- Check the construction items on the Statement of Special Inspections that require Special Inspections. This shall include identification of materials, systems, components and work required to have Special Inspection and Testing.
- Identify the type and extent of each Special Inspection and the names of individuals and firms performing special inspections and/or testing.
- Identify the type and extent of each test.
- Coordinate with the project Owner on the selection of the Special Inspection Agencies, Special Inspectors, Testing Labs and Fabricator Shops.
- Pre-qualify Special Inspection Agencies, Special Inspectors, Testing Labs and Fabricator Shops for each applicable construction operation based on the City's "Qualification Standards for Special Inspections" that are listed in the City's Statement of Special Inspections.
- Provide (list on the City's Statement of Special Inspections) the name and contact information of each designated Special Inspection Agency, Special Inspector, Testing Lab and Fabricator Shop. This includes providing the Building Safety Department with all documents required by the City's Statement of Special Inspections for each party involved in the Special Inspection Program.

Planning Building & Development 215 Church Ave., SW, Room 170 Roanoke, VA 24011

Phone: (540) 853-1090 www.roanokeva.gov permitcenter@roanokeva.gov

- vii. Coordinate with Building Permit Applicant, to insure that the completed Special Inspection and Testing Agreement and the completed Statement of Special Inspections are submitted to the Building Safety Department for review and acceptance at the time of Building Permit Application.

3. Respond to field discrepancies:

The Engineer/Architect of Record shall respond to Special Inspector reports of uncorrected, nonconforming items and shall provide remedial measures.

4. Review shop drawings and submit design changes:

The Engineer/Architect of Record shall acknowledge and accept shop drawings that detail structural information. Written approval of any verbally approved deviations from the approved plans shall be submitted to the Building Safety Department and to the Special Inspector/Special Inspection Agency. Revised plans shall be submitted for Building Safety Department review and approval.

C. Contractor Responsibilities:

1. Agree and sign the Special Inspection and Testing Agreement.

2. Notify the Special Inspection Agency/Special Inspector/Testing Lab:

The Contractor or the holder of the Building Permit (Applicant or duly authorized agent) is responsible for notifying the Special Inspector or Special Inspection and Testing Agency regarding individual Special Inspections and Testing items listed on the City's Statement of Special Inspections.

3. Provide access to approved plans:

The contractor is responsible for providing the Special Inspector with access to the approved plans and approved shop drawings.

4. Retain Special Inspection records at the job site:

The Contractor is responsible for retaining, at the job site, copies of all special inspection records completed by Special Inspectors and making them available to the City's Building Inspector upon request.

5. Obtain Building Safety Department approval prior to concealment:

The Contractor shall request Building Safety Department inspections and obtain approval prior to concealing any work requiring special inspections.

D. Special Inspection Agency, Special Inspector and Testing Lab Duties and Responsibilities:

1. Agree and sign the Special Inspection and Testing Agreement.

2. General requirements:

Special Inspectors shall review approved plans, specifications, and the referenced standards and approved shop drawings for Special Inspection requirements. Special Inspectors shall comply with the Special Inspection requirements of the VUSBC-2015 and the Statement of Special Inspections regarding work and materials.

3. Signify presence at job site:

The Special Inspector shall notify Contractor's personnel of their presence and responsibilities at the job site. A Special Inspection Log (copy attached) of each Special Inspector's presence on the job site shall be provided near the building inspection reports. This record shall include the following:

- i. Inspection type
- ii. Name of special inspection
- iii. Certification number
- iv. Date
- v. Any pertinent notes
- vi. Time of arrival and departure

4. Observe assigned work and comply with Statement of Special Inspections:

- i. Inspect categories listed on the approved Statement of Special Inspections that they are responsible for. Inspections shall indicate conformance with approved plans, specifications, referenced standards and applicable workmanship provisions of the VUSBC-2021.
- ii. Use the Architect/Engineer reviewed and accepted structural shop drawings as an aid in conducting the related special inspections.
- iii. Be on site at all times to observe construction operations that require continuous Special Inspections and Testing. Be on site to observe construction operations that require periodic inspections as required per Sections 1703, 1704 and 1705 of VUSBC-2021.

5. Report nonconforming items:

The Special Inspectors shall bring all nonconforming items to the immediate attention of the Contractor and note all such items in the Special Inspector's daily report. If any item is not resolved in a timely manner or is about to be covered by construction, the Special Inspector shall immediately notify the Building Safety Department, the Engineer/Architect of record and post a discrepancy notice at the job site. The Special Inspector shall write a separate report to be posted at the job site regarding noted discrepancies. This report shall contain, as a minimum, the following about each nonconforming item:

- i. Description and exact location.
- ii. Reference to applicable details of approved plans/specifications.
- iii. Name and title of each individual notified and method of notification.
- iv. Corrective action taken to resolve noted discrepancy at the job site.

6. Provide Progress Reports:

The special Inspectors shall complete written inspection reports for each visit and leave a copy on site for the Contractor and the Building Inspector to review. The Special Inspector/Special Inspection Agency shall provide copies of these reports weekly, or at the completion of a Special Inspection if Special Inspections take place more than a week apart, to the Building Safety Department's Building Inspector, Engineer/Architect of record and any others designated. These reports shall include:

- i. Date
- ii. Time of arrival and departure
- iii. Building permit number
- iv. Project name and address
- v. Type of inspection
- vi. Inspection frequency required - Continuous or Periodic
- vii. Inspections made including locations
- viii. Tests performed
- ix. Any nonconformance items (discrepancies) and how they were resolved
- x. Listing of unresolved items, parties notified, time and method of notification
- xi. Itemization of changes authorized by the Engineer/Architect of record
- xii. Inspector's signature
- xiii. Full name of inspector printed clearly
- xiv. Certification number

7. Submit final report:

The Special Inspection Agency shall submit a final report that is sealed, signed and dated by its responsible Engineer/Architect, to the City of Roanoke Building Safety Department's Building Inspector, stating that all items requiring Special Inspections and Testing were fulfilled and reported. This report shall also state that all items required Special Inspections and tested items were inspected and found to be in conformance with the approved plans, shop drawings, specifications, referenced standards, Statement of Special Inspections and applicable provisions of the VUSBC: 2021. Items not in conformance, unresolved items, or any discrepancies in Special Inspection coverage (i.e., missed inspections, periodic inspections when continuous inspections were required, etc.) shall be specifically mentioned in this report.

E. Building Safety Department Responsibilities:

Specific duties and responsibilities of the Building Safety Department relating to Special Inspections include the following:

1. Review and approve of submittal documents for compliance with the Special Inspection Program Requirements:

The Building Safety Department is responsible for reviewing all submitted plans, specifications, forms related to the Special Inspection Program, and any other submitted documents for compliance with the Virginia Building Code. All items submitted must be reviewed and approved prior to issuance of the Building Permit. This includes the following:

- i. Check the qualification of each Special Inspector, Special Inspection Agency, Testing Lab and Fabricator Shop that is listed on the Statement of Special Inspections in accordance with the City's "Qualification Standards for Special Inspections".
- ii. Check that all parties involved in the Special Inspection Program have completed their portion of the Special Inspection and Testing Agreement.
- iii. Issue the Building Permit with the approved Statement of Special Inspections, Special Inspection and Testing Agreement and permit conditions attached to the approved plans that will be kept on the job site.
- iv. Determine if a pre-construction meeting is required to review the Special Inspection Program with all appropriate members of the construction team.

2. Monitor special inspections and testing activities:

The Building Inspectors will monitor work requiring Special Inspection and Testing activities at the job site to assure that the designated qualified Special Inspectors are performing their duties when work requiring Special Inspections is in progress.

3. Review special inspection reports:

The Building Inspector will check the special inspection reports left at the job site by the Special Inspector for any discrepancies or non-conforming items. Weekly special inspection reports received will be reviewed by the Building Inspector. The Building Inspector must review all special inspection reports and perform field inspections to verify conformance to the approved plans, shop drawings and specifications prior to concealing any work related to special inspections.


4. Perform final inspection:

The Building Safety Department will not perform a final inspection or approve the project until the final Special Inspection report has been received from a Special Inspection Agency and reviewed and approved by the Building Inspector.

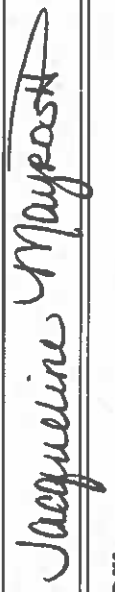
ACKNOWLEDGEMENTS

I have read and agree to comply with my responsibilities as they are outlined in the Special Inspection and Testing Agreement

Owner:

Print Name:	Luke Rich (CAR ENGINEER)	Date:	10/21/25
Signature:			

Registered Design Professional in Responsible Charge (Project Engineer/Architect of Record):

Print Name/Company:	Jacqueline Mayrosh	Date:	8/1/2025
Signature:			

Contractor:

Print Name/Company:		Date:	
Signature:			

Special Inspections and Testing Agencies and/or Testing Laboratories:

Print Name/Company:		Date:	
*Signature:			
Print Name/Company:		Date:	
*Signature:			

*This signature must be that of the responsible professional Engineer within the Special Inspection Agency.

Independent Special Inspectors:

Print Name:		Date:	
Signature:			
Print Name:		Date:	
Signature:			

**Accepted by the City of Roanoke's
Building Safety Department**

Print Name:		Date:	
Signature:			

Statement of Special Inspections

Work Location or Business Name: Roanoke Fire Station #6
Property Address: 1333 Jamison Ave. SE Roanoke, VA 24013 Tax #: 4220316

Registered Design Professional (RDP) in Responsible Charge Information

Name: Jacqueline Mayrosh
Address: 10 Church Ave. SE
City: Roanoke State: VA Zip: 24011
Phone: (540) 342-6001 Email: jmayrosh@spectrumpc.com
*RDP DPOR License #: 43345

**If Property Owner is an LLC or Corporation, please provide a Member or Corporate Officer Name and Address*

Member/Officer Name: _____
Member/Officer Address: _____
City: _____ State: _____ Zip: _____
Phone: _____ Email: _____

Primary Contact (If different from RDP)

Name: _____
Phone: _____ Email: _____

This **Statement of Special Inspections** is submitted as a condition for permit issuance in accordance with the 2021 Edition of the Virginia Uniform Statewide Building Code (USBC), Section 111.2, and Chapter 17 of the 2021 Edition of the Virginia Construction Code (VCC). It includes the following:

1. **Complete** list of all materials and work requiring special inspections, and;
2. **Complete** list of all the inspections to be performed and whether they are required to be periodic or continuous inspections, and;
3. **Complete** list of the individuals, approved agencies or firms intended to be retained for conducting such inspections.

The RDP in Responsible Charge shall keep records of all inspections and shall furnish **Periodic Reports of Special Inspections** to the Building Official each month on the date shown below until the **Final Report of Special Inspections** is submitted. **Periodic Reports of Special Inspections** will include a summary of all activities requiring special inspections for the period along with a log of discrepancies noted. During the course of the project, discrepancies and deviations from the approved plans and specification and code violations observed during the conduct of special inspections services shall be brought to the immediate attention of the contractor for correction. **If such discrepancies are not corrected, the discrepancies shall be brought to the immediate attention of the Building Official.** The special inspection program does not relieve the Contractor of their responsibilities.

Special Inspections are in addition to the regular inspections by Building Inspections personnel specified in Section 113.3 of the Virginia Uniform Statewide Building Code.

Required building Inspections SHALL NOT be performed by individuals performing Special Inspection

A **Final Report of Special Inspections** documenting completion of all required special inspections and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Final Inspection and/or a Certificate of Occupancy.

Job site safety and means and methods of construction are solely the responsibility of the Contractor.

Instructions for Completing this Form:

1. The Registered Design Professional (Architect/Engineer) in responsible charge of the Project shall complete this form and submit it with the Building Permit Application for review and approval by the Building Department prior to the issuance of the Building Permit for the Project. This Statement of Special Inspections (SSI) form will be issued to the job site at the time of issuance of the Building Permit.
2. Information detailing the qualifications including copies of all current certifications and accreditations of each Special Inspector, Special Inspection Agency, and Fabricator Shop, to be used for the Project shall be submitted by the Registered Design Professional (Architect/ Engineer) in responsible charge with this completed form (Sections 1703 and 1704.2.1 of the 2021 VCC). Information shall also be provided outlining the qualifications of any Testing Labs (soils, concrete, masonry, steel, and others) being used for the project. This includes information about the Accreditation of the Testing Lab, names and qualifications of each.
3. Included in this document are the "**QUALIFICATION STANDARDS FOR SPECIAL INSPECTIONS**". Each party involved with the Project shall meet these minimum qualifications standards. (Sections 1701, 1702, 1703, and 1704 of the 2021 VCC)
4. This form is intended for buildings of structures that are assigned to Seismic Design Category A or B. The Registered Design Professional shall provide a modified Statement of Special Inspection for buildings or structures assigned to Seismic Design Category higher than B.

Special Inspection Categories (1701.1, 1702, 1704 & 1705):

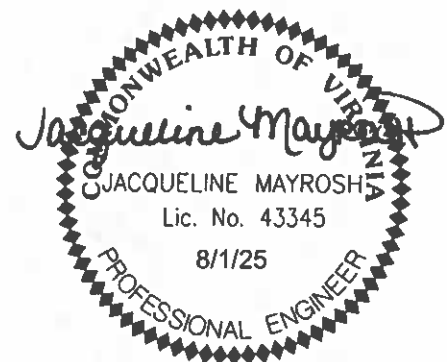
Special inspections are required for materials, installation, fabrication, erection or placement of components and connections requiring special expertise to insure compliance with approved construction documents and applicable reference standards. Section 1705 of the 2021 USBC lists a total of 15 different categories of special inspections and testing (Categories A through O) as listed below). Please check the appropriate boxes below that apply to your project and enter the name of each individual responsible for the Special Inspection you have checked in the space provided to the right of each category. Please provide the appropriate documents that verify the qualifications of each individual or firm listed.

Time of Month for Delivery of Periodic Report of Special Inspections: Last day

Periodic reports of special inspections must be submitted on the date listed above, if the reports are not submitted within 10 days of the date above, the permit maybe suspended until reports are submitted.

RDP in Responsible Charge:

Name: Jacqueline Mayrosh



Owner/Authorized Agent

Signature: [Signature] (CITY ENGINEER)

Date: 10/21/2025

Building Official:

Signature: _____

Date: _____

A.	Inspection of Fabricators (1704.2.5): Where fabrication of structural load-bearing members and assemblies is being performed on the premises of a fabricator's shop, special inspection of the fabricated items shall be required by Section 1704.2.5 and as required elsewhere in the 2021 USBC. See Category A1 or A2 below for each Fabricator as appropriate:		
A. 1.	Fabrication & Implementation Procedures (1704.2.5) for Fabricators Not Registered & Not Approved:		
Check Box Below if Required	Indicate below all structural load-bearing members & assemblies that are being assembled on the premises of a fabricator's shop that is not registered and not approved (Section 1704.2.5)	Indicate below the name of the fabricator shop that is not registered and not approved (Section 1704.2.5)	Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	1. Structural Steel		
<input type="checkbox"/>	2. Steel Joists & Girders		
<input type="checkbox"/>	3. Pre-cast Concrete		
<input type="checkbox"/>	4. Prestressed Concrete		
<input type="checkbox"/>	5. Wood Construction (Section 1705.5) - Prefabricated Structural Elements Covering:		
<input type="checkbox"/>	5.1. Manufactured Wood Trusses		
<input type="checkbox"/>	5.2. Walls		
<input type="checkbox"/>	5.3. Floors		
<input type="checkbox"/>	5.4. Roof Assemblies		
<input type="checkbox"/>	6. Cold Formed Steel Trusses		

A. 2. Fabricator Approval (1704.2.5.1) for Fabricators Registered & Approved:			
Check Box Below if Required	Indicate below all structural load-bearing members & assemblies that are being assembled on the premises of a fabricator's shop that is not registered and not approved (Section 1704.2.5.1)	Indicate below the name of the fabricator shop that is not registered and not approved (Section 1704.2.5.1)	Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input checked="" type="checkbox"/>	1. Structural Steel		
<input type="checkbox"/>	2. Steel Joists & Girders		
<input type="checkbox"/>	3. Pre-cast Concrete		
<input type="checkbox"/>	4. Prestressed Concrete		
<input type="checkbox"/>	5. Wood Construction (Section 1705.5) - Prefabricated Structural Elements Covering:		
<input type="checkbox"/>	5.1. Manufactured Wood Trusses		
<input type="checkbox"/>	5.2. Walls		
<input type="checkbox"/>	5.3. Floors		
<input type="checkbox"/>	5.4. Roof Assemblies		
<input type="checkbox"/>	6. Cold Formed Steel Trusses		
Required tasks to complying with the requirements of Category A-2: 1. Prior to issuance of the Building Permit, provide the Building Department with a copy of the selected fabricator's current shop accreditation/certification. 2. At the completion of fabrication, the Special Inspector and/or Special Inspection Agency shall obtain from each registered and approved fabricator and submit to the Building Department a Certificate of Compliance stating that the work was performed in accordance with the approved construction documents.			

B. Steel Construction (1705.2 & Table 1705.2.3):				Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:	
	1. Material verification of high-strength bolts, nuts and washers:			
<input checked="" type="checkbox"/>	-	X	1.1. Identification markings to conform to ASTM standards specified in the approved construction documents. <u>Referenced Standard:</u> AISC 360 and applicable ASTM material standards	
<input checked="" type="checkbox"/>	-	X	1.2. Manufacturer's certificate of compliance required.	
	2. Inspection of high-strength bolting: <u>Referenced Standard:</u> AISC 360			
<input checked="" type="checkbox"/>	-	X	2.1. Snug-tight joints.	
<input checked="" type="checkbox"/>	-	X	2.2. Pretensioned and slip-critical joints using turn-of-nut with matchmarking, twist-off bolt or direct tension indicator methods of installation.	
<input checked="" type="checkbox"/>	X	-	2.3. Pretensioned and slip-critical joints using turn-of-nut without matchmaking or calibrated wrench methods of installation.	
	3. Material verification of structural steel and cold-formed steel deck:			
<input checked="" type="checkbox"/>	-	X	3.1. For structural steel, identification markings to conform to AISC 360. <u>Referenced Standards:</u> AISC 360.	
<input checked="" type="checkbox"/>	-	X	3.2. For other steel, identification markings to conform to ASTM standards specified in the approved construction documents. <u>Referenced Standards:</u> Applicable ASTM material standards	
<input checked="" type="checkbox"/>	-	X	3.3. Manufacturer's certified test reports.	
	4. Material verification of weld filler materials:			
<input checked="" type="checkbox"/>	-	X	4.1. Identification markings to conform to AWS specification in the approved construction documents. <u>Referenced Standard:</u> AISC 360 and applicable AWS documents	

B. Steel Construction (1705.2 & Table 1705.2.3):			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
<input checked="" type="checkbox"/>	-	X	4.2. Manufacturer's Certificate of Compliance required.
<input type="checkbox"/>			5. Inspection of welding:
			5.1. Structural Steel and cold-formed steel deck: <u>Referenced Standards:</u> AWS & the 2021 USBC: 1705.2.2
<input checked="" type="checkbox"/>	X	-	5.1.1. Complete and partial penetration groove welds.
<input checked="" type="checkbox"/>	X	-	5.1.2. Multipass fillet welds.
<input checked="" type="checkbox"/>	X	-	5.1.3. Single-pass fillet welds greater than 5/16".
<input checked="" type="checkbox"/>	X	-	5.1.4. Plug and slot welds.
<input checked="" type="checkbox"/>	-	X	5.1.5. Single-pass fillet welds less than or equal to 5/16".
<input type="checkbox"/>	-	X	5.1.6. Floor and roof deck welds. <u>Referenced Standards:</u> AWS
			5.2. Reinforcing steel: <u>Referenced Standards:</u> AWS & ACI 318
<input type="checkbox"/>	-	X	5.2.1. Verification of weldability of reinforcing steel other than ASTM A 706.
<input type="checkbox"/>	X	-	5.2.2. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special structural walls of concrete and shear reinforcement.
<input type="checkbox"/>	X	-	5.2.3. Shear reinforcement.

Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below

B. Steel Construction (1705.2 & Table 1705.2.3):			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
<input type="checkbox"/>	-	X	5.2.4. Other reinforcing steel.
			6. Inspection of steel frame joint details for compliance:
<input checked="" type="checkbox"/>	-	X	6.1. Details such as bracing and stiffening.
<input checked="" type="checkbox"/>	-	X	6.2. Member locations.
<input checked="" type="checkbox"/>	-	X	6.3. Applications of joint details at each connection.
<input type="checkbox"/>	-	X	7. Cold-formed steel trusses spanning 60 feet or greater (1705.2.4): Verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.
C. Concrete Construction (1705.3 & Table 1705.3):			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections: Reference Standard ACI 318 per any USBC 2021 section 1905 modification
<input checked="" type="checkbox"/>	-	X	1. Inspection of reinforcing steel, including prestressing tendon, and placement. <u>Referenced Standards:</u> ACI 318 & the 2021 USBC: 1908.4
<input type="checkbox"/>			2. Inspection of reinforcing steel welding in accordance with 1705.3.1, or 1705.3.2. <u>Referenced Standards:</u> AWS D1.4 & ACI 318
<input checked="" type="checkbox"/>	X	-	3. Inspection of bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased or where strength design is used. <u>Referenced Standards:</u> ACI 318 & the 2021 USBC: 1901.3, 1905

Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below

Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below

C. (con't) Concrete Construction (1705.3 & Table 1705.3):				Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:	
<input checked="" type="checkbox"/>	-	X	4. Inspection of anchors installed in hardened concrete. Referenced Standards: ACI 318 & the 2021 USBC: 1901.3, 1905	
<input checked="" type="checkbox"/>	-	X	5. Verifying use of required design mix. Referenced Standards: ACI 318 & the 2021 USBC: 1904, 1908.2, 1908.3	
<input checked="" type="checkbox"/>	X	-	6. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete. Referenced Standards: ASTM C 172, ASTM C 31 & ACI 318 & 2021 USBC: 1908.10	
<input checked="" type="checkbox"/>	X	-	7. Inspection of concrete and shotcrete placement for proper application techniques. Referenced Standards: ACI 318 & 2021 USBC: 1908.6, 1908.7, 1908.8	
<input checked="" type="checkbox"/>	-	X	8. Inspection for maintenance of specified curing temperature and techniques. Referenced Standards: ACI 318 & USBC-1018: 1908.9	
<input type="checkbox"/>			9. Inspection of prestressed concrete:	
<input type="checkbox"/>	X	-	9.1. Application of prestressing force. Referenced Standards: ACI 318	
<input type="checkbox"/>	X	-	9.2. Grouting of bonded prestressing tendons in the seismic-force-resisting system. Referenced Standard: ACI 318	
<input type="checkbox"/>	-	X	10. Erection of precast concrete members. Referenced Standards: ACI 318	
<input type="checkbox"/>	-	X	11. Verification of in-situ concrete strength, prior to stressing of tendons in posttensioned concrete and prior to the removal of shores and forms from beams and structural slabs. Referenced Standards: ACI 318	
<input checked="" type="checkbox"/>	-	X	12. Inspect formwork for shape, location and dimensions of the concrete members being formed. Referenced Standards: ACI 318	

D.	Masonry Construction (1705.4): Masonry construction shall be inspected and verified in accordance with the requirements of Sections 1705.4 through 1705.4.2, depending on the classification of the building or structure or nature of the occupancy. Please check the applicable categories of D.1 or Category D.2. Exception: Special Inspections are not required for masonry construction that meets one of the three exceptions listed in Section 1705.4.		
<input type="checkbox"/>	D.1.	Special Inspection (1705.4.1) for Empirical Designed Masonry, Glass Unit Masonry and Masonry Veneer in Occupancy Category IV (Essential Facilities): Special inspections and tests for empirically designed masonry, glass unit masonry or masonry veneer designed in accordance with Section 2109, 2110 or Chapter 14, respectively, where they are part of a structure classified as Risk Category IV shall be performed in accordance with TMS 602 Level 2.	
<input type="checkbox"/>	D.2.	Special Inspection (1705.4.1) for Empirical Masonry in Occupancy Category I, II, or III (Nonessential Facilities): The minimum Special Inspection Program for masonry designed per Section 2107 or 2108 or per Chapters of TMS 402 referenced in sections 2107 and 2108, in structures classified as Occupancy Category I, II, or III, in accordance with Section 1604.5.	
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections: Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	-	X	1. Compliance with required inspection provisions of the construction documents and the approved submittals shall be verified. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	2. Verification of f_m^1 and f_{AAC}^1 prior to construction except where specifically exempted by code. Reference for Criteria: TMS 602
<input type="checkbox"/>	X	-	3. Verification of slump flow and VSI as delivered to the site for self-consolidating grout. Reference for Criteria: TMS 602
			4. As masonry construction begins, the following shall be verified to ensure compliance:
<input type="checkbox"/>	-	X	4.1. Proportions of site-prepared mortar. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	4.2. Construction of mortar joints. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	4.3. Location of reinforcement, connectors, prestressing tendons and anchorages. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	4.4. Prestressing technique. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	4.5. Grade and size of prestressing tendons and anchorages. Reference for Criteria: TMS 602

D.1. (con't)		Level #1 Special Inspection (1705.4.1):		Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:	
5. During construction the inspection program shall verify:				
<input type="checkbox"/>	-	X	5.1. Size and location of structural elements. Reference for Criteria: TMS 602	
<input type="checkbox"/>	-	X	5.2. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction. Reference for Criteria: TMS 402	
<input type="checkbox"/>	-	X	5.3. Specified size, grade and type of reinforcement, anchor bolts, prestressing tendons and anchorages. Reference for Criteria: TMS 402 & TMS 602	
<input type="checkbox"/>	X	-	5.4. Welding of reinforcing bars. Reference for Criteria: TMS 402	
<input type="checkbox"/>	-	X	5.5. Protection of masonry during cold weather (temperature below 40 °F) or hot weather (temperature above 90 °F). Reference for Criteria: TMS 602	
<input type="checkbox"/>	X	-	5.6 Application and measurement of prestressing steel. Reference for Criteria: TMS 602	
			The following shall be verified to insure compliance:	
<input type="checkbox"/>	-	X	6.1. Grout space is clean. Reference for Criteria: TMS 602	
<input type="checkbox"/>	-	X	6.2. Placement of reinforcement, connectors and prestressing tendons and anchorages. Reference for Criteria: TMS 402 & TMS 602	
<input type="checkbox"/>	-	X	6.3. Proportion of site-prepared grout and prestressing grout for bonded tendons. Reference for Criteria: TMS 602	

D.1. Special Inspection (1705.4.1):			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
<input type="checkbox"/>	X	-	6.4. Verification of proportions of materials in premixed or preblended mortar and grout as delivered to the site. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	6.5. Construction of mortar joints. Reference for Criteria: TMS 602
<input type="checkbox"/>	X	-	7. Grout placement shall be verified to ensure compliance with code and construction document provisions. Reference for Criteria: TMS 602
<input type="checkbox"/>	X	-	7.1. Grout space prior to grouting. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	7.2. Placement of prestressing grout. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	7.3. Grouting of prestressing bonded tendons. Reference for Criteria: TMS 602
<input type="checkbox"/>	-	X	8. Size and location of structural elements. Reference for Criteria: TMS 602
<input type="checkbox"/>	X	-	8.1. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction. Reference for Criteria: TMS 402
<input type="checkbox"/>	-	X	8.2. Specified size, grade and type of reinforcement, anchor bolts, prestressing tendons and anchorages. Reference for Criteria: TMS 402 & TMS 602
<input type="checkbox"/>	X	-	8.3. Welding of reinforcing bars. Reference for Criteria: TMS 402

Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below

	D.1. Special Inspection (1705.4.1):			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:	Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	X	-	8.4. Application and measurement of prestressing force. Reference for Criteria: TMS 602	
<input type="checkbox"/>	X	-	9. Preparation of any required grout specimens, mortar specimens and/or prisms shall be observed. Reference for Criteria: 2021 USBC: Sec. 2105.1 & TMS 602	
E.	Structural Wood Construction (1705.5):			
	1. Special Inspections of the fabrication process of prefabricated wood structural elements and assemblies (covering: walls, floors, or roof assemblies along with manufactured roof trusses) shall be in accordance with Section 1704.2.5 (see Category A above).			
	2. Special Inspections of site-built assemblies shall be in accordance with Section 1705.5 as indicated below.			
Check Box Below if Required			Required Verification and Inspections:	Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	1. Fabrication of high-load diaphragms designed in accordance with Section 2306.2 shall be installed with Special Inspections as indicated in Sections 1704.2:			
	1.1. Inspect the wood structural panel sheathing to ascertain that it is of the grade and thickness shown on the approved plans.			
<input type="checkbox"/>	1.2. Verify the nominal size of the framing members at adjoining panel edges, the nail or staple diameter and length, the number of fastener lines and that the spacing between fasteners in each line and at edge margins agrees with the approved plans.			
	2. Metal-plate-connected wood trusses spanning 60 feet or greater (1705.5.2): Verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.			
<input type="checkbox"/>	3. Prefabricated wood shear panels covering:			
	3.1. Holdown anchor size and placement, including embedment length, spacing and edge distance.			
	3.2. The connection of the structure to the shear panels.			

F. Soils (1705.6 & Table 1705.6): 1. Perform Special Inspections of existing site soil conditions, fill placement and load-bearing requirements as required by Section 1705.6 and Table 1705.6. 2. Determine compliance using the approved geotechnical report (Section 1803), and the construction documents prepared by the Registered Design Professional. 3. Determine that proper materials and procedures are used during fill placement and in accordance with the provisions of the approved geotechnical report. <u>Exception:</u> Where Section 1803 does not require reporting of materials and procedures for fill placement, the special inspector shall verify that the in-place dry density of the compacted fill is not less than 90% of the maximum dry density at optimum moisture content determined in accordance with ASTM D 1557.				Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:				
<input checked="" type="checkbox"/>	-	X	1. Verify materials below shallow footings are adequate to achieve the design bearing capacity.				
<input checked="" type="checkbox"/>	-	X	2. Verify excavations are extended to proper depth and have reached proper material.				
<input checked="" type="checkbox"/>	-	X	3. Perform classification and testing of compacted fill materials.				
<input checked="" type="checkbox"/>	X	-	4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill.				
<input checked="" type="checkbox"/>	-	X	5. Prior to placement of compacted fill, observe subgrade and verify that site has been prepared properly.				
G. Driven Deep Foundations (1705.7 & Table 1705.7): 1. Perform Special Inspections during installation and testing of driven deep foundation elements as required by Table 1705.7 2. Determine compliance using the approved geotechnical report (section 1803), and the construction documents prepared by the Registered Design Professional.				Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:				
<input type="checkbox"/>	X	-	1. Verify elements materials, size and lengths comply with the requirements.				
<input type="checkbox"/>	X	-	2. Determine capacities of test elements and conduct additional load tests, as required.				
<input type="checkbox"/>	X	-	3. Inspect driving operation and maintain complete accurate records for each element.				
<input type="checkbox"/>	X	-	4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element.				

G. Driven Deep Foundations (1705.7 & Table 1705.7:			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
<input type="checkbox"/>			5. For steel elements, perform additional inspections in accordance with 1705.2 (see Category B above).
<input type="checkbox"/>			6. For concrete elements and concrete-filled elements, perform additional inspections in accordance with Section 1705.3 & Table 1705.3 (see Category C above).
<input type="checkbox"/>			7. For specialty elements, perform additional inspections as determined by the Registered Design Professional in Responsible Charge.
Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below			
H. Cast-In-Place Deep Foundations (1705.8 & Table 1705.8):			
1. Perform Special Inspections during installation and testing of cast-in-place deep foundation elements as required by Table 1705.8. 2. Determine compliance using the approved geotechnical report (Section 1803), and the construction documents prepared by the Registered Design Professional.			
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:
<input type="checkbox"/>	X	-	1. Observe drilling operations and maintain complete and accurate records for each element.
<input type="checkbox"/>	X	-	2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes.
<input type="checkbox"/>			3. For concrete elements, perform additional inspections in accordance with Section 1705.3 & Table 1705.3 (see Category C above).
Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below			

I. Helical Pile Foundations (1705.9):				Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
Check Box Below if Required	Continual	Periodic	Required Verification and Inspections:	
<input type="checkbox"/>	X	-	1. Perform Special Inspections continuously during installation of helical pile foundations.	
<input type="checkbox"/>	X	-	2. Record information for each helical pile that includes installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required by the Registered Design Professional in Responsible Charge.	
<input type="checkbox"/>	X	-	3. Use the approved geotechnical report (Section 1803) and the approved construction documents prepared by the Registered Design Professional to determine compliance.	
K. Spray-Applied Fire-Resistant Materials (SFRM) (1705.14):				Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
Check Box Below if Required	Required Verification and Inspections:			
<input type="checkbox"/>	1. Special Inspections for sprayed fire-resistant materials (SFRM) applied to floor, roof and wall assemblies and structural members shall be in accordance with Sections 1705.14 through 1705.14.6.3 2. Special Inspections shall be based on the fire-resistance design as designated in the approved construction documents. 3. <i>The tests set forth in Section 1705.14.1 shall be based on samplings from specific floor, roof and wall assemblies and structural members.</i> 4. Special Inspections shall be performed after the rough installation of electrical, automatic sprinkler, mechanical and plumbing systems and suspension systems for ceilings, where applicable.			
<input type="checkbox"/>	Physical and Visual Tests (1705.14.1): Perform Special Inspections for SFRM to include the following test and observations to demonstrate compliance with listing and fire-resistance rating covering condition of substrate, thickness of application, density in pounds per cubic foot, bond strength adhesion/cohesion and condition of finished application (see below for requirements). Structural Member Surface Conditions (1705.14.2): 1. Prepared the surfaces in accordance with the approved fire-resistance design and the written instructions of approved manufacturers. 2. Inspect the prepared surface of structural members to be sprayed before the application of the SFRM. Application (1705.14.3): 1. Verify that the substrate has a minimum ambient temperature before and after application as specified in the written instructions of approved manufacturers. 2. Verify that the area for application is ventilated during and after application as required by the written instructions of approved manufacturers.			

<div>K. (con't)</div>	<div>Spray-Applied Fire-Resistant Materials (SFRM) (1705.14):</div>	
<div>Check Box Below if Required</div>	<div>Required Verification and Inspections:</div>	<div>Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below</div>
<div><input type="checkbox"/></div>	<div> <div> Thickness (1705.14.4): No more than 10% of the thickness measurements of the SFRM applied to floor, roof and wall assemblies and structural members shall be less than the thickness required by the approved fire-resistance design, but in no case less than the minimum allowable thickness required by Section 1705.14.4.1. <div> <div>1. <u>Minimum allowable individual thickness (1705.14.4.1):</u></div> <div> <div>1.1. For design thicknesses 1 inch or greater. It shall be the design thickness minus 1/4 inch.</div> <div>1.2. For design thicknesses less than 1 inch, it shall be the design thickness minus 25%.</div> <div>1.3. Thickness shall be determined in accordance with ASTM E 605.</div> <div>1.4. Samples of the SFRM shall be selected in accordance with Section 1705.14.4.2 and 1705.14.4.3 (see below).</div> </div> </div> <div> <div>2. <u>Floor, roof and wall assemblies (1705.14.4.2):</u></div> <div>Determine the thickness of the applied SFRM in accordance with ASTM E 605, making not less than 4 measurements for each 1,000 square feet of the sprayed area in each story or portion thereof:</div> </div> <div> <div>3. <u>Cellular decks (1705.14.4.3):</u> Select the thickness measurements from a square area, 12" by 12" in size. Make a minimum of 4 measurements that are located symmetrically within the square area.</div> <div>4. <u>Fluted decks (1705.14.4.4):</u> Select the thickness measurements from a square area, 12" by 12" in size. Make a minimum of 4 measurements that are located symmetrically within the square area, including one each of the following: valley, crest and sides. Report the average of the measurements.</div> </div> <div> <div>5. <u>Structural members (1705.14.4.5):</u> Determine the thickness of the applied SFRM in accordance with ASTM E 605. Perform thickness testing on not less than 25% of the structural members on each floor:</div> <div>6. <u>Beams and girders (1705.14.4.6):</u> Make thickness measurements at 9 locations around the beams or girder at each end of a 12-inch length.</div> <div>7. <u>Joists and trusses (1705.14.4.7):</u> Make thickness measurements at 7 locations around the joist or truss at each end of a 12-inch length.</div> </div> <div> <div>8. <u>Wide-flanged columns (1705.14.4.8):</u> Make thickness measurements at 12 locations around the column at each end of a 12-inch length.</div> <div>9. <u>Hollow structural section and pipe (1705.14.4.9):</u> Make thickness measurements at 4 locations around the column at each end of a 12-inch length.</div> </div> </div> </div>	

<div> <div>K.</div> <div>Spray-Applied Fire-Resistant Materials (SFRM) (1705.14):</div> </div>		<div> <div>Check Box Below if Required</div> <div>Required Verification and Inspections:</div> </div>		<div> <div>Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below</div> <div></div> </div>	
<input type="checkbox"/>	Density (1705.14.5): The density of the SFRM shall not be less than the density specified in the approved fire-resistance design. Determine the density of the SFRM in accordance with ASTM E 605. Select the test samples to determine the density of the SFRM as follows: 1. From each floor, roof and wall assemblies at the rate of not less than 1 sample for every 2,500 square feet or portion thereof of the sprayed area in each story. 2. From beams, girders, trusses and columns at a rate of not less than 1 sample for each type of structural member for each 2,500 square feet of floor area or portion thereof in each story.				
<input type="checkbox"/>	Bond Strength (1705.14.6): Verify that the cohesive/adhesive bond strength of the cured SFRM applied to floor, roof and wall assemblies and structural members shall not be less than 150 pound per square foot. Determine the cohesive/adhesive bond strength in accordance with the field test specified in ASTM E 736 by testing in-place samples of SFRM selected in accordance with Sections 1704.12.6.1 through 1704.12.6.3 (see below): 1. <u>Floor, roof and wall assemblies (1705.14.6.1)</u> : Select the test samples for determining the cohesive/adhesive bond strength of the SFRM from floor, roof and wall assembly at a rate of not less than 1 sample for every 2,500 square feet of the sprayed area in each story or portion thereof. 2. <u>Structural members (1705.14.6.2)</u> : Select the test samples for determining the cohesive/adhesive bond strength of the SFRM from beams, girders, trusses, columns and other structural members at a rate of not less than 1 sample for every 2,500 square feet of floor area or portion thereof in each story. 3. <u>Primer, paint and encapsulated bond tests (1705.14.6.3)</u> : Conduct bond tests to qualify a primer, paint or encapsulate when the SFRM is applied to a primed, painted or encapsulated surface for which acceptable bond-strength performance between these coatings and fire-resistant material has not been determined. Verify that a bonding agent approved by the SFRM manufacturer is applied to a primed, painted or encapsulated surface where the bond strengths are found to be less than required values.				
<div> <div>L.</div> <div>Mastic & Intumescent Fire-Resistant Coatings (1705.15):</div> </div>		<div> <div>Check Box Below if Required</div> <div>Required Verification and Inspections:</div> </div>		<div> <div>Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below</div> <div></div> </div>	
<input type="checkbox"/>	Special Inspections for mastic and intumescent fire-resistant coatings applied to structural elements and decks shall be in accordance with AWC 12-B and shall be based on the fire-resistance design as designated in the approved construction documents.				

M. Check Box Below if Required	Exterior Insulation and Finish Systems (EIFS) (1705.16):		Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	<p> Special Inspections are required for all EIFS applications unless one of the following exceptions applies. Exception #1: EIFS applications installed over a water-resistive barrier with a means of draining moisture to the exterior (unless the Special Inspection is required by the ICC Report of Approval for the selected EIFS). Exception #2: EIFS applications installed over masonry or concrete walls. Note: The Registered Design Professional shall indicate on the space to the right and on the plans the ICC Report of Approval number for the selected EIFS. </p>		
O. Check Box Below if Required	Special Inspections for Smoke Control (1705.18): Smoke control systems shall be tested by a Special Inspector.		Please provide the name and phone number of the special inspection agency and individual performing this special inspection service in the space below
<input type="checkbox"/>	<p> Testing Scope (1705.18.1): The test scope shall be as follows: 1. During erection of ductwork and prior to concealment for the purpose of leakage testing and recording of device location. 2. Prior to occupancy and after sufficient completion for the purposes of pressure difference testing, flow measurements and detection and control verification. </p>		

Qualification Standards for Special Inspections

Special Inspectors, Laboratory Technicians, Special Inspection Agencies, Testing Labs and Fabricator Shops

General Notes:

Note #1: Basis for formulating City of Roanoke's Building Safety Department Special Inspection Program (SIP):

These requirements were based on the "*Model Program for Special Inspection (Based on the 2021 IBC Chapter 17)*" published by the International Code Council (ICC) and the International Accreditation Services (IAS) and reflect the following:

1. Applicable provisions of Chapter 17 of the 2021 USBC;
2. Applicable portions of the following IAS Accreditation Criteria:
 - 2.1. AC89 - Accreditation Criteria for Testing Laboratories;
 - 2.2. AC98 - Accreditation Criteria for Inspection Agencies;
 - 2.3. AC157 - Accreditation Criteria for Fabrication Inspection Programs for Reinforced Concrete;
 - 2.4. AC172 - Accreditation Criteria for Fabrication Inspection Programs for Structural Steel;
 - 2.5. AC196 - Accreditation Criteria for Fabrication Inspection Programs for Wood Wall Panels;
 - 2.6. AC204 - Accreditation Criteria for Calibration Laboratories;
 - 2.7. AC291 - Accreditation Criteria for Special Inspection Agencies;
 - 2.8. AC370 - Accreditation Criteria for Product Certification Agencies;
 - 2.9. AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems; and/or
3. Applicable portions of the following Standards by International Organization for Standardization/International Electrotechnical Commission (ISO/IEC):
 - 3.1. ISO/IEC 17011: 2004(E), Conformity Assessment - General Requirements for Accreditation Bodies Accrediting Conformity Assessment Bodies;
 - 3.2. ISO/IEC 17020: 1998(E), General Criteria for the Operation of Various Types of Bodies Performing Inspection;
 - 3.3. ISO/IEC 17024: 2003, Conformity Assessment - General Requirements for Bodies Performing Inspection;
 - 3.4. ISO/IEC 17025: 2005(E), General Requirements for the Competence of Testing and Calibration Laboratories;
 - 3.5. ISO/IEC 17025: 2005/Cor.1:2006(E), General Requirements for the Competence of Testing and Calibration Laboratories;
 - 3.6. ISO/IEC Guide 6.5: General Requirements for Bodies Operating Product Certification Systems.

Note #2: Guideline to Determine Compliance and Competence of Designated Special Inspector and Special Inspections Agency:

This information will be used as a guideline by the Building Safety Department to verify compliance with applicable provisions of Sections 1703 and 1704 of the 2021 USBC in determining the competence of each designated Special Inspector, Laboratory Technician, Special Inspection Agency, Testing Laboratories and/or Fabricator Shop listed in the Statement of Special Inspections.

Note #3: Minimum Qualifications for Special Inspectors:

The minimum qualifications for Special Inspectors listed below are from the International Accreditation Service's "Accreditation Criteria for the IBC Special Inspection Agencies" AC 291.

Note #4: Required Information/Documentation and How it Will be Used:

This information shall be used by the Registered Design Professional in Responsible Charge of the project and/or the Responsible Professional Engineer representing the Special Inspection Agency and/or Testing Laboratory to measure the qualifications of each designated Special Inspector, Laboratory Technician, Special Inspection Agency, Testing Laboratory and Fabricator Shop that are listed in the Statement of Special Inspections. The Building Safety Department will consider equivalent criteria for the qualifications of any designated party, if submitted by the Registered Design Professional and/or Responsible Professional Engineer. The Registered Design Professional and/or Responsible Professional Engineer shall provide the Building Safety Department with sufficient documentation to substantiate the equivalency request.

General Notes (Con't):

Note #5: Special Inspection Agency Qualification Standards:

Each designated Special Inspection Agency shall be:

1. An agency that maintains IAS current accreditation with the scope of accreditation covering the disciplines for which the agency is designated; OR
2. An agency that meets the requirements of Section 1700 of the 2021 USBC. The Registered Design Professional and/or Responsible Professional Engineer of the agency shall provide all documentation as necessary for the Building Safety Department to determine if the Agency meets the applicable code requirements; OR
3. An agency that has been accredited by an approved Inspection Agency in accordance with ISO/IEC 17020.

Note #6: Special Inspector Qualification Standards:

Each designated Special Inspector and Laboratory Technician shall meet the "Minimum Qualifications for Special Inspectors" and related criteria as listed below.

Note #7: Special Inspector in Training (SIIT):

1. The intent of this provision is to provide practical opportunities for a Special Inspector in Training (SIIT) to gain the needed experience to qualify as a Special Inspector.
2. An Inspector who does not meet the qualifications for a Special Inspector may be allowed to perform a "Special Inspection" at the discretion of the Special Inspection Agency's Registered Design Professional, provided one or more of the following conditions are met:
 - 2.1. The individual is working under the direct and continuous supervision of a Special Inspector fully qualified for the type of work involved.
 - 2.2. The individual is working under the indirect or periodic supervision of a Special Inspector, and the scope of work is minor and/or routine and within the capabilities of the individual.

Note #8: Testing Labs Qualification Standards:

Each designated Testing Lab shall be accredited by one the following major acceptable accreditation authorities:

1. IAS Accreditation with the scope of accreditation covering the discipline's for which the Testing Lab is designated.
2. AASHTO Accreditation Program per either AASHTO R18 or ISO/IES 17250.
3. American Association of Laboratory Accreditation.
4. National Voluntary Laboratory Accreditation Program.
5. Other Accreditation Authority Program. The Testing Lab shall be accredited by a third party and shall meet the requirements of Section 1703 of USBC-12.

Note #9: Laboratory Technician Qualification Standards:

Each Laboratory Technician shall have certification in the appropriate category and one year minimum experience.

Note #10: Experience:

1. For experience to count toward qualifications, it shall be based on verifiable work directly related to the category or type of inspection involved.
2. An engineering degree (BS) plus appropriate in-house training may be substituted for not more than one year of experience. An engineering technology degree plus appropriate in-house training may be substituted for not more than six months experience. (Degree experience may not be substituted for more than half of the experience requirements in any category.)
3. Five or more years experience as a qualified Special Inspector in one or more categories of work may fulfill up to half the experience requirements in any category, at the discretion of the Special Inspection Agency's designated Responsible Professional Engineer.

Note #11: Certification:

Certification, when specified, is intended to mean the successful completion of:

1. AN ICC examination appropriate to the category of work involved; and/or
2. Having other specific certification obtained from a Nationally recognized certifying organization that is appropriate to the category of work involved and is acceptable to the Building Department.

Note: The Building Safety Department will consider equivalent certifications from Nationally recognized organization obtained by written examination when sufficient documentation to substantiate the equivalency is provided by the Special Inspection Agency's designated Responsible Professional Engineer.

Minimum Qualifications for Special Inspectors

Based on IAS AC291 Accreditation Criteria for Special Inspection Agencies

A. - Inspections of Fabricators (1704.2.5):

A.1. - Fabrication and Implementation (1704.2.5) for Fabricators not Registered and not Approved:

1. The designated Special Inspector and/or Special Inspection Agency shall perform in-plant periodic visits and reviews of all listed fabricator shops that are not registered and not approved per Section 1704.2.5 (see Category A.2. below). The duties include:

- 1.1. Verify that the fabricator maintains detailed fabrication and quality control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards, and
- 1.2. Review the procedures for completeness and adequacy relative to the code requirements for the fabricator's scope of work.
2. The designated Special Inspector and/or Special Inspection Agency inspecting a fabricator shop for compliance with Section 1704.2.1 shall be pre-approved by the Building Department for the specified category of construction prior to Building Permit issuance. See the specific category below for minimum qualification criteria:
 - 2.1. For Structural Steel Construction: See Category B below.
 - 2.2. For Precast/Prestressed Concrete: See Category C below.
 - 2.3. For Wood Construction: See Category E below.

A.2. - Fabricator Approval (1704.2.5.1) for Fabricators Registered and Approved:

1. Special Inspections required by Section 1704 are not required where the work is done on the premises of a Fabricator registered and approved to perform such work without Special Inspection. Approval shall be based upon review of the fabricator's written procedural and quality control manuals and periodic auditing of fabrication practices by an approved Special Inspection Agency (a third-party that is recognized by the Building Safety Department).
 2. Special Inspections are not required for work done on the premises of a registered and approved Fabricator that has a current accreditation from the International Accreditation Service (IAS), a current certification from a Nationally recognized organization (see item #4 below), or an equivalent certification (see Note below).
 3. An IAS-accredited fabricator that is listed on that AIAS web site (www.iasonline.org). The IAS Accreditation is based on the IAS Fabrication Accreditation Standards (IAS Fabricator Accreditation Program currently offers accreditation services for reinforced concrete, precast concrete, structural steel and wood panel assemblies)
 4. A Nationally recognized organization/body that includes a third-party oversight of the fabricators facility (including processes and final products) as defined by the USBC. This option is subject to the review and acceptance by the Building Safety Department. The following National Fabricator Certifying Organizations are recognized and acceptable by City of Roanoke's Building Safety Department:
 - 4.1. American Institute of Steel Construction (AISC) for Fabricators of Structural Steel.
 - 4.2. American Steel Joist Institute (SJI) for Fabricators of Steel Joists.
 - 4.3. Precast/Prestressed Concrete Institute for Fabricators of Precast and Prestressed Concrete.
 - 4.4. Truss Plate Institute (TPI) for Fabricators of Wood Trusses.
- Note:** Equivalencies are subject to review and acceptance by the Building Department and shall be performed by an approved Special Inspection Agency in accordance with applicable provisions of Sections 1704.2.5 and 1703 of the 2021 USBC.

B. - Steel Construction:

B.1. - High Strength Bolting:

1. Current ICC certification as a Structural Steel and Bolting Special Inspector and a minimum one year of experience; OR
2. Virginia Professional Engineer and a minimum one year of direct experience in structural steel and bolting construction (Inspector shall be qualified under Item #1).
3. American Welding Society (AWS) Certified Welding Inspector (CWI) and has a minimum of one year of experience (Inspector shall be qualified under Item #B.1.1).

Note: ICC certifications for Structural Steel and Welding Special Inspectors are valid for the Bolting Special Inspector until the date of expiration.

B. - Steel Construction (con't):
B.2. - Welding:
1. American Welding Society (SAWS) Certified Welding Inspector (CWI); OR 2. Current ICC Certification as a Structural Steel and Welding Special Inspector and has a minimum one year of experience; OR 3. American Welding Society (AWS) Certified Associate Welding Inspector (CAWI) working under the direct on-site supervision of a Certified Welding Inspector (CWI) and a minimum one year of experience (Inspector shall be qualified under either Item #B.2.1 or Item #B.2.2).
B.3. - Nondestructive Testing (NDT):
1. Personnel qualified in accordance with nationally-recognized NDT personnel qualification practice or standard, such as ANSI/ANST-CP-189 or SNT-TC-1A; OR 2. American Society of Nondestructive Testing (ASNT) Level II and a minimum of 120 hours of direct testing experience or training as determined and approved by an ASNT Level III.
C. - Concrete Construction:
C.1. - Reinforced Concrete:
1. Current ICC Certification in Reinforced Concrete Special Inspection and one year of experience; OR 2. <i>Virginia</i> Professional Engineer and minimum one year of direct experience in reinforced concrete construction (Inspector shall be qualified under Item #C.1.1); OR 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience (Inspector shall be qualified under Item #C.1.1); OR 4. ACI Concrete Construction Special Inspector or ACI Concrete Field Testing Technician Grade 1 and a minimum one year of experience (Inspector shall be qualified under Item #C.1.1).
C.2. - Pre-stressed/Pre-cast/Cast-in-Place/Poured-in-Place Concrete:
1. Current ICC Certification in Prestressed Concrete Inspection and one year of experience; OR 2. Virginia Professional Engineer and minimum one year of direct experience in prestressed concrete construction (Inspector shall be qualified under Item #C.2.1 above); OR 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum one year of experience (Inspector shall be qualified under Item #C.2.1 above); OR 4. ACI Concrete Construction Special Inspector or ACI Concrete Field Testing Technician Grade 1 and a minimum two years of experience (Inspector shall be qualified under Item #C.2.1 above).
C.3. - Post-installed Structural Anchor in Concrete:
1. Current ICC Certification in Reinforced Concrete Special Inspection; OR 2. Current ICC Certification as a Residential or Commercial Building Inspector, as applicable, and a minimum two years of experience related to the activity being inspected; OR 3. Virginia Professional Engineer and minimum one year of experience related to the activity being inspected (Inspector shall be qualified under Item #C.3.1 above); OR 4. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience related to the activity being inspected (Inspector shall be qualified under Item #C.3.1 above).
D. - Masonry Construction:
1. Current ICC Certification in masonry and a minimum one year experience; OR 2. Virginia Professional Engineer and minimum one year of relevant experience (Inspector shall be qualified under Item #D.1 above); OR 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience (Inspector shall be qualified under Item #D.1 above).

E. - Masonry Construction:
1. Virginia Professional Engineer and minimum one year of relevant experience related to the activity being inspected; OR 2. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience related to the activity being inspected; OR 3. Current ICC Certification as a Commercial or Residential Building Inspector, as applicable, AND 3.1. A minimum two years of related experience in engineered wood products.
F. - Soils:
1. NICET Level II Geotechnical Engineering Technology Certification, or ICC Soils Special Inspector Certification, and a Minimum two years of experience; OR 2. Technician with a minimum three years of documented experience directly related to soils testing and inspection under a licensed Virginia Professional Engineer (Inspector shall be qualified under Item #F.1 above); OR 3. Bachelor's degree in Civil or Structural Engineering/Geotech/Geologist from an accredited institution and a minimum of one year of experience (Inspector shall be qualified under Item #F.1 above); OR 4. Virginia Professional Engineer and a minimum one year of experience (Inspector shall be qualified under Item #F.1 above); OR 5. Professional Engineer in Geotechnical Engineering.
G. - Driven Deep Foundations:
1. Current ICC Certification in Concrete Special Inspection in addition to having one of the following (Virginia Professional Engineer, NICET III or IV, NICET CT Certified Engineering Technologist or Bachelors Degree in Civil or Structural Engineering); OR 2. Virginia Professional Engineer and minimum one year of relevant experience. In addition, Inspector shall obtain ICC Certification in Concrete Special Inspection; OR 3. NICET III or IV (geotechnical/construction or construction material testing/soils) and a minimum of five years experience. In addition, Inspector shall obtain ICC Certification in Concrete Special Inspection; OR 4. NICET CT Certified Engineering Technologist and a minimum of five years of experience. In addition, Inspector shall obtain ICC Certification in Concrete Special Inspection; OR 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum three years of experience. In addition, Inspector shall obtain ICC Certification in Concrete Special Inspection).
H. - Cast-in-Place Deep Foundations:
Same as Category G (see above).
I. - Helical Pile Foundations:
Same as Category G (see above).
J. - Vertical Masonry Foundation Elements:
Same as Category D (see above).
K. - Spray-Applied Fire-Resistant Materials (SFRM):
1. Current ICC Certification as a Spray-applied Fireproofing Special Inspector and a minimum one year experience; OR 2. Virginia Professional Engineer and minimum one year of experience in fireproofing applications (Inspector shall be qualified under Item #K.1 above); OR 3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience in fireproofing applications (Inspector shall be qualified under Item #K.1 above); OR 4. American Concrete Institute Concrete Field Testing Technician Grade 1 or American Welding Society Certified Welding Inspector and a minimum of one year experience in fireproofing applications (Inspector shall be qualified under Item #K.1 above).
L. - Mastic and Intumescent Fire-Resistant Coatings:
Same as Category K (see above).

M. - Exterior Insulation and Finish Systems (EIFS)::

1. Current ICC Certification as a Reinforced Concrete Special Inspector; OR
2. Current ICC Certification as a Commercial or Residential Building Inspector, and a minimum two years of experience related to the activity being inspected; OR
3. Virginia Professional Engineer and minimum one year of experience related to the activity being inspected (Inspector shall be qualified under Item #M.1 above); OR
4. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience related to the activity being inspected (Inspector shall be qualified under Item #M.1 above); OR
5. NICET CT Certified Engineering Technologist and a minimum five years of experience related to the activity being inspected (Inspector shall be qualified under Item #M.1 above); OR
6. Virginia Licensed Architect and a minimum one year of experience related to the activity being inspected (Inspector shall be qualified under Item #M.1 above).

N. - Special Cases As Determined by the Building Safety Department:

1. Current ICC Certification as a Special Inspector and a minimum two years of experience related to the activity being inspected; OR
2. Virginia Professional Engineer and minimum one year of experience related to the activity being inspected (Inspector shall be qualified under Item #N.1 above); OR
3. Bachelor's degree in Civil or Structural Engineering from an accredited institution and a minimum two years of experience related to the activity being inspected (Inspector shall be qualified under Item #N.1 above).

Exception: Individuals who have proven expertise in a field of specialty, either through education or field experiences of not less than five years, may be considered as meeting criteria to conduct one or more classes of Specialty Inspections.

O. - Special Inspections for Smoke Control:

1. Special Inspection Agencies for smoke control shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers (Documentation of qualifications shall be submitted to the Building Safety Department for review and approval); OR
2. Virginia Professional Engineer, Air Balancer Certification, and on year of relevant experience; OR
3. Bachelor's degree in Engineering, Air Balancer Certification and three years of relevant experience; OR
4. NEDD Certification, National Air Balancer Certification and three years of relevant experience, including installation and operation skills for smoke control systems.

SECTION 014200
REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and

effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
 - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
 - 1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
 - 2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 - 3. ICC - International Code Council; www.iccsafe.org.
 - 4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

- A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, occupants of Project, occupants of Temporary Facility, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

Project: Public Works Service Center and Fire Stations #4 & #6 Fueling Improvements

Temporary Facilities and Controls

ITB: SOL1254

015000 - 1

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.

2.2 TEMPORARY FACILITIES

- A. Field Offices (Public Works): Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Field Offices (Fire Station #4 & #6): Not required.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements

Project: Public Works Service Center and Fire Stations #4 & #6 Fueling Improvements

Temporary Facilities and Controls

of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Use of Permanent Toilets: Use of Owner's existing toilet facilities is not permitted.
- E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Install electric power service underground unless otherwise indicated.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel.
1. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Contractor's home office.
 - c. Contractor's emergency after-hours telephone number.
 - d. Architect's office.
 - e. Owner's office.
 - f. Principal subcontractors' field and home offices.
- I. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.
- J. Project Computer: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:
1. Display: 24-inch LCD monitor with 256-Mb dedicated video RAM.
 2. Full-size keyboard and mouse.
 3. Operating System: Microsoft Windows 10 Professional.
 4. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.

5. Internet Service: Broadband modem, router, and ISP, equipped with hardware firewall, providing minimum 10.0 -Mbps upload and 15 -Mbps download speeds at each computer.
6. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
7. Backup: External hard drive, minimum 2 terrabytes, with automated backup software providing daily backups.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
- 2.
3. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations . Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Drawings and Specifications.
3. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course in accordance with Section 321216 "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

- E. Parking: Provide temporary offsite parking areas for construction personnel if on-site space is not adequate.
 - 1. Comply with all City of Roanoke Parking regulations.
 - 2. Fire Station Parking: Four (4) spaces will be reserved for Contractor use for the duration of the project. All other parking needs shall be arranged by the contractor.
- F. Storage and Staging: Provide temporary offsite area for storage and staging needs if on-site space is not adequate.
- G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
- H. - Project Signs: Project signs are not allowed. Unauthorized signs are not permitted.
 - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 - 2. Graphic Screens: Provide graphic screening on fences as indicated on Drawings.
 - 3. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - 4. Maintain and touch up signs, so they are legible at all times.
- I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
 - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Section 011000 "Summary."

- C. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Section 311000 "Site Clearing."
 - 1. Erosion and Sediment Control Measures are indicated for each Phase of the Construction Project.
 - 2. Comply with Drawings and Division 31 Specifications.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to delineate Project Phasing.
- G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- H. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
 - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Periodically collect and remove waste containing cellulose or other organic matter.
 - 4. Discard or replace water-damaged material.
 - 5. Do not install material that is wet.
 - 6. Discard and replace stored or installed material that begins to grow mold.
 - 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 - 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor.
 - 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION

SECTION 016000
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for Contractor requirements related to Owner-furnished products.
 - 2. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 3. Section 014200 "References" for applicable industry standards for products specified.
 - 4. Section 01770 "Closeout Procedures" for submitting warranties.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
 - 1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 - 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."
- F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
 - 1. Resolution of Compatibility Disputes between Multiple Contractors:
 - a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.

- b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
 - 3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.5 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.
- C. Storage:

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1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.
- B. Product Selection Procedures:
1. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
 - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
 2. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
 3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the

product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

- a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

- C. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:
 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."
 1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

- D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017300 EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner's portion of the Work.
 - 6. Coordination of Owner-installed products.
 - 7. Progress cleaning.
 - 8. Starting and adjusting.
 - 9. Protection of installed construction.
 - 10. Correction of the Work.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for coordination of, and limits on use of Project site.
 - 2. Section 013300 "Submittal Procedures" for submitting surveys.
 - 3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
 - 4. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 PREINSTALLATION MEETINGS

- A. Layout Conference: Conduct conference at Project site.
 - 1. Prior to establishing layout of new perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:

- a. Contractor's superintendent.
 - b. Professional surveyor responsible for performing site survey serving as basis for Project design.
- 2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
- 3. Review requirements for including layouts on Shop Drawings and other submittals.
- 4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- 5. Review phasing plan.

1.4 INFORMATIONAL SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor , certifying that location and elevation of improvements comply with requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Final Property Survey (each site): Submit electronic version showing the Work performed and record survey data covering each project limits of Work.

1.6 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Plumbing piping systems.
 - f. Mechanical systems piping and ducts.
 - g. Control systems.
 - h. Communication systems.

- i. Fire-detection and -alarm systems.
 - j. Conveying systems.
 - k. Electrical wiring systems.
 - l. Operating systems of special construction.
 - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Sprayed fire-resistive material.
 - e. Equipment supports.
 - f. Piping, ductwork, vessels, and equipment.
 - g. Noise- and vibration-control elements and systems.
 - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
 - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.
- C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.
- B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- D. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb, and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

- C. Temporary Support: Provide temporary support of Work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

- A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with the Owner.
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Restore permanent facilities used during construction to their specified condition.
- D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 017700
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
 - 2. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 3. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 4. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.3 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

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1.5 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest-control inspection.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.7 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
 - 5. Submit testing, adjusting, and balancing records.
 - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.

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4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 6. Advise Owner of changeover in utility services.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, construction tools, and similar elements.
 9. Complete final cleaning requirements.
 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for Final Completion.

1.8 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
 5. Submit Final Completion photographic documentation.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.9 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 1. Organize list of spaces in sequential order, starting with exterior areas first, listed by feature or space.
 2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:
 - a. MS Excel Electronic File: Architect will return annotated file.

1.10 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 1. Submit on digital media acceptable to Architect.
- E. Warranties in Paper Form:
 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- F. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.

- f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
 - i. Vacuum and mop concrete.
 - j. Remove labels that are not permanent.
 - k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - o. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - p. Clean strainers.
 - q. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION

SECTION 017823
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

- B. Format: Submit operation and maintenance manuals in the following format:

Project: Public Works Service Center and Fire Stations #4 & #6 Fueling Improvements

Operation and Maintenance Data

1. Submit on digital media acceptable to Architect by uploading to web-based project software site or by email to Architect. Enable reviewer comments on draft submittals.
 2. Submit three paper copies. Architect will deliver two copies to the Owner.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.
- E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter

of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Architect.
 8. Name and contact information for Commissioning Authority.
 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
 1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 1. Fire.
 2. Gas leak.
 3. Water leak.

4. Power failure.
 5. Water outage.
 6. System, subsystem, or equipment failure.
 7. Chemical or fuel release or spill.
- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.

2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and

maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

- D. **Manufacturers' Maintenance Documentation:** Include the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- E. **Maintenance Procedures:** Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- F. **Maintenance and Service Schedules:** Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. **Spare Parts List and Source Information:** Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. **Warranties and Bonds:** Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.
- I. **Drawings:** Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control

sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

1.11 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
 1. Product name and model number.
 2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 1. Inspection procedures.
 2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.
 4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017839
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for final property survey.
 - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set(s) of marked-up record prints.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. As-Built Survey: Produce a complete topographic, improvement, and utility survey of as-built conditions including work performed for this project outside of the property boundaries. Survey shall document all easements (proposed or recorded) and fulfill all WVWA and City of Roanoke requirements. Provide all as-built survey data for City Stormwater Management requirements involving BMP's installed on the project.

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Project Record Documents

1.4 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.

3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

1.5 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 5. Note related Change Orders and Record Drawings where applicable.
- B. Format: Submit record specifications as annotated PDF electronic file.

1.6 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

1.7 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours. Provide daily input as changes or discovery occur.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017900
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. For Owner provided equipment, vendors, or installations the Contractor shall provide coordination for instruction in operation and maintenance.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

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- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:

- a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Architect, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

Technical Specifications

SECTION 031000
CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Form-facing materials.
 2. Form liners.
 3. Insulating concrete forms.
 4. Waterstops.

1.2 DEFINITIONS

- A. Form-Facing Material: The temporary form materials that come in direct contact with the concrete as part of the formwork components in supporting the concrete while the concrete is setting and gaining sufficient strength to be self-supporting. The most common materials are steel, aluminum, and wood.
- B. Form Lining: Materials used to line the concreting face of formwork to impart a smooth or patterned finish to the concrete surface, to absorb moisture from the concrete, or to apply a set-retarding chemical to the formed surface of the concrete.
- C. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.
1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
 2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.
 - a. Location of construction joints is subject to approval of Architect.
 3. Indicate location of waterstops.
- C. Samples:
1. For waterstops.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 - 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 - 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.
 - a. For architectural concrete specified in Section 033300 "Architectural Concrete," limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).
- B. Design, engineer, erect, shore, brace, and maintain insulating concrete forms in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 - 1. Design cross ties to transfer the effects of the following loads to the cast-in-place concrete core:
 - a. Wind Loads: As indicated on Drawings.
 - 1) Horizontal Deflection Limit: Not more than 1/360 of the wall height.

2.2 FORM-FACING MATERIALS

- A. As-Cast Surface Form-Facing Material:
 - 1. Provide continuous, true, and smooth concrete surfaces.
 - 2. Furnish in largest practicable sizes to minimize number of joints.
 - 3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-in-Place Concrete, and as follows:
 - a. Plywood, metal, or other approved panel materials.
 - b. Exterior-grade plywood panels, suitable for concrete forms, complying with

DOC PS 1, and as follows:

- 1) APA HDO (high-density overlay).
 - 2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
 - 3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
 - 4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.
- B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
1. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces without spiral or vertical seams not exceeding specified formwork surface class.
1. Provide forms with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation, with end forms.

2.3 WATERSTOPS

- A. Flexible Rubber Waterstops: U.S. Army Corps of Engineers' CE CRD-C 513, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints, with factory-fabricated corners, intersections, and directional changes.
1. Profile: Flat dumbbell with center bulb.
 2. Dimensions: 4 by 3/16 inch thick nontapered.
- B. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstop with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals, with factory-fabricated corners, intersections, and directional changes.
1. Profile: Flat dumbbell with center bulb.
 2. Dimensions: 4 by 3/16 inch thick nontapered.
- C. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
- D. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.

2.4 RELATED MATERIALS

- A. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

- B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 - 2. Form release agent for form liners to be acceptable to form liner manufacturer.
- F. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
- G. Sealant: One-part moisture cure silicone sealant used with form liners.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with ACI 301.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 033000 "Cast-in-Place Concrete" for as-cast finishes[.]
- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-1.0: ACI 117 Class D, 1 inch.
 - 2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
 - 3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.

- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips
 - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- L. Form Liners: Install per manufacturer's written installation instructions and recommended tolerances.
- M. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 3. Place joints perpendicular to main reinforcement.
 - 4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
 - a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

6. Space vertical joints in walls as indicated on Drawings.
 - a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- N. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- O. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- P. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- Q. Coat contact surfaces of forms with form-release agent, in accordance with manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
 5. Clean embedded items immediately prior to concrete placement.

3.3 INSTALLATION OF WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm.
 1. Install in longest lengths practicable.
 2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
 3. Allow clearance between waterstop and reinforcing steel of not less than 2 times the largest concrete aggregate size specified in Section 033000 "Cast-in-Place Concrete."
 4. Secure waterstops in correct position at 12 inches o.c.

5. Field fabricate joints in accordance with manufacturer's written instructions using heat welding.
 - a. Miter corners, intersections, and directional changes in waterstops.
 - b. Align center bulbs.
 6. Clean waterstops immediately prior to placement of concrete.
 7. Support and protect exposed waterstops during progress of the Work.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, in accordance with manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.
1. Install in longest lengths practicable.
 2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
 3. Protect exposed waterstops during progress of the Work.

3.4 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work.
1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
1. Align and secure joints to avoid offsets.
 2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.5 INSTALLATION OF SHORING AND RESHORING

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.6 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Owner will engage Engage a qualified testing agency to perform tests and inspections.
- C. Inspections:
 - 1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
 - 2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 032000
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel reinforcement bars.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: Comply with ACI SP-066:
 - 1. Include placing drawings that detail fabrication, bending, and placement.
 - 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
- B. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Steel Reinforcement:
 - 2. Mechanical splice couplers.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. and to avoid damaging coatings on steel reinforcement.
 - 1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed.

2.2 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.
- C. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.
 - 1. Finish: Plain.

2.3 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
1. Bars indicated to be continuous be lapped as indicated on Drawings.
 2. Stagger splices in accordance with ACI 318.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel-reinforcement placement.

END OF SECTION

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - e. Special concrete finish Subcontractor.
 - 2. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction joints, control joints, isolation joints, and joint-filler strips.
 - c. Semirigid joint fillers.
 - d. Vapor-retarder installation.
 - e. Anchor rod and anchorage device installation tolerances.
 - f. Cold and hot weather concreting procedures.
 - g. Concrete finishes and finishing.
 - h. Curing procedures.

- i. Forms and form-removal limitations.
- j. Methods for achieving specified floor and slab flatness and levelness.
- k. Floor and slab flatness and levelness measurements.
- l. Concrete repair procedures.
- m. Concrete protection.
- n. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
- o. Protection of field cured field test cylinders.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following.

- 1. Portland cement.
- 2. Fly ash.
- 3. Aggregates.
- 4. Admixtures:
 - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
- 5. Vapor retarders.
- 6. Curing and sealing compounds
- 7. Sealer.
- 8. Joint fillers.
- 9. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

- 1. Mixture identification.
- 2. Minimum 28-day compressive strength.
- 3. Durability exposure class.
- 4. Maximum w/cm.
- 5. Slump limit.
- 6. Air content.
- 7. Nominal maximum aggregate size.
- 8. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

- 1. Installer: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

- 1. Cementitious materials.
- 2. Admixtures.
- 3. Curing compounds.

4. Floor and slab treatments.
5. Bonding agents.
6. Adhesives.
7. Vapor retarders.
8. Semirigid joint filler.
9. Joint-filler strips.
10. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Aggregates.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

E. Field quality-control reports.

F. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

- A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

- B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I Type II Type I/II , gray.
2. Fly Ash: ASTM C618, Class C or F.

- C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

- D. Air-Entraining Admixture: ASTM C260/C260M.

- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.

- F. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A, except with maximum water-vapor permeance of 0.01 perms; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.4 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete to temporarily reduce moisture loss from concrete surfaces in hot, dry and windy conditions. A curing or curing and sealing compound are still required.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
 - 1. Color:
 - a. Ambient Temperature Below 50 deg F: Black.
 - b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
 - c. Ambient Temperature Above 85 deg F: White.
- D. Curing Paper: Eight-feet- wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.
- E. Water: Potable or complying with ASTM C1602/C1602M.
- F. Curing and Sealing Compounds: ASTM C309, Type 1, Class A or B.
 - 1. Dayton Superior Cure & Seal 1315 J22WB.
 - 2. Euclid Chemical Diamond Clear VOX.
 - 3. W.R. Meadows Vocomp-20.

2.5 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.
- C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene
- D. Fuel (Petroleum) Contact Conditions: Where susceptible to petroleum sources, joint sealants shall be resistant to weather, resistant to corrosion, and specifically

manufactured to be resistant to petroleum and fuel products. Where detailed adjacent to fuel islands, bentonite shall be incorporated beneath sealants as detailed and shall have a hydraulic conductivity of 1×10^{-9} per ASTM D5887.

- E. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

- 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

- F. Concrete Sealers

- 1. Dayton Superior Ultra Seal EF.
 - 2. Euclid Chemical Euco Diamond Hard.
 - 3. W.R. Meadows Liqui-Hard.

2.6 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

- 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

- 1. Fly Ash or Other Pozzolans: 25 percent by mass.

- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

- 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, and concrete with a w/cm below 0.50.

2.7 CONCRETE MIXTURES

- A. Normal-weight concrete used for footings, piers, tension ties, and slabs-on-grade with broom finish.

- 1. Exposure Class: ACI 318 F2.
 - 2. Minimum Compressive Strength: 4500 psi at 28 days.
 - 3. Maximum w/cm: 0.45.
 - 4. Slump Limit: 5 inches , plus or minus 1 inch or 8 inches , plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.

5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size.
- B. Normal-weight concrete used for interior slabs-on-grade with trowel finish.
1. Exposure Class: ACI 318 F0.
 2. Minimum Compressive Strength: 4000 psi at 28 days.
 3. Maximum w/cm: 0.50.
 4. Minimum Cementitious Materials Content: 470 lb/cu. yd.
 5. Slump Limit: 5 inches , plus or minus 1 inch.
 6. Slump Flow Limit: 22 inches, plus or minus 1.5 inches.
 7. Air Content: Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
 2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
1. Daily access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
 4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303 and the metal building manufacturer.

3.4 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.5 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
 3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
1. Install dowel bars and support assemblies at joints where indicated on Drawings.
 2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
 - 1. If a section cannot be placed continuously, provide construction joints as indicated.
 - 2. Deposit concrete to avoid segregation.
 - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Do not place concrete floors and slabs in a checkerboard sequence.
 - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 3. Maintain reinforcement in position on chairs during concrete placement.
 - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 5. Level concrete, cut high areas, and fill low areas.
 - 6. Slope surfaces uniformly to drains where required.
 - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 - 8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

- A. Rubbed Finish: Apply to the portions of the piers exposed in the finished condition.
- B. Related Unformed Surfaces:
 - 1. At tops of piers, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.

2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish:
 1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
 2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
 3. Apply float finish to surfaces to receive trowel finish.
- C. Trowel Finish:
 1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
 2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
 3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 4. Do not add water to concrete surface.
 5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
 6. Apply a trowel finish to slab-on-grade surfaces indicated on Drawings.
 7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
 - a. Slabs on Ground:
 - 1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.
- D. Broom Finish: Apply a broom finish to all exterior slabs-on-grade, interior slabs-on-grade not indicated to receive a trowel finish, top surfaces of perimeter edge slabs.
 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
 2. Coordinate required final finish with Architect before application.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

- A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 6 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - b. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.

- c. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
 - 1. Begin curing immediately after finishing concrete.
 - 2. Interior and Exterior Concrete Slabs-on-Grade Receiving Broom Finish:
 - a. Curing and Sealing Compound
 - 1)
 - 3. Interior Slabs-on-Grade Receiving Trowel Finish and Sealer:
 - a. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
 - 1) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - 2) Cure for not less than seven days.
 - b. Dissipating Curing Compound:
 - 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Maintain continuity of coating, and repair damage during curing period.
 - 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of sealer used on Project.
 - c. Floors to Receive Curing and Sealing Compound:
 - 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Repeat process 24 hours later or as specified by the manufacturer, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.11 TOLERANCES

- A. Conform to ACI 117.
- B. Top of pier elevations shall be within 1/4 inch plus or minus vertically from the datum elevation for all piers or tolerances specified by the metal building manufacturer, whichever have the lowest variance.

- C. Anchor rods shall be placed using templates provided by the metal building manufacturer. Comply with tolerances in Section 7.5 of ANSI/AISC 303 or the metal building manufacturer, whichever have the lowest variance.

3.12 JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month.
 - 2. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
 - 1. Repair and patch defective areas when approved by Architect.
 - 2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.
 - a. Limit cut depth to 3/4 inch.
 - b. Make edges of cuts perpendicular to concrete surface.
 - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
 - d. Fill and compact with patching mortar before bonding agent has dried.
 - e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

- a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
 - b. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
 - a. Correct low and high areas.
 - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.
5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
 - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - b. Feather edges to match adjacent floor elevations.
6. Correct other low areas scheduled to remain exposed with repair topping.
 - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
 - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
 - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
 - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
 - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
 - d. Place, compact, and finish to blend with adjacent finished concrete.
 - e. Cure in same manner as adjacent concrete.
8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
 - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
 - b. Dampen cleaned concrete surfaces and apply bonding agent.
 - c. Place patching mortar before bonding agent has dried.
 - d. Compact patching mortar and finish to match adjacent concrete.

- e. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
 - 1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
 - 2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 - 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
 - a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
3. Slump Flow: ASTM C1611/C1611M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure two sets of three 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests:
 - a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 72 hours of completion of floor finishing and promptly report test results to Architect.

3.15 PROTECTION

- A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION

SECTION 061000
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood products.
2. Wood-preservative-treated lumber.
3. Dimension lumber framing.
4. Miscellaneous lumber.
5. Plywood backing panels.

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. Lumber grading agencies, and abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NLGA: National Lumber Grades Authority.
 3. SPIB: The Southern Pine Inspection Bureau.
 4. WCLIB: West Coast Lumber Inspection Bureau.
 5. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.

4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

1.5 DELIVERY, STORAGE, AND HANDLING

- ##### A.
- Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

- ##### A.
- Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Boards: 15 percent.
2. Dimension Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- ##### A.
- Preservative Treatment by Pressure Process: AWP A U1, Use categories as follows:

1. UC1: Interior construction not in contact with ground or subject to moisture. Include all rough carpentry.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
3. After treatment, redry dimension lumber to 19 percent maximum moisture

content.

- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 MISCELLANEOUS LUMBER

- A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.
 - 6. Grounds.
 - 7. Utility shelving.
- B. Dimension Lumber Items: No. 2 grade lumber of the following species:
 - 1. Mixed southern pine or southern pine; SPIB.
- C. Concealed Boards: 15 percent maximum moisture content and the following species and grades:
 - 1. Mixed southern pine or southern pine; No. 3 grade; SPIB.
- D. Roofing Nailers: Structural- or No. 2-grade lumber or better; kiln-dried Douglas fir, southern pine, or wood having similar decay-resistant properties.
- E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 FASTENERS

- A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.

2.5 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets:
 - 1. Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
 - 2. Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
 - 3. Self-adhering sheet consisting of 64 mils of rubberized asphalt laminated on one side to a 4-mil-thick, polyethylene-film reinforcement, and with release liner on adhesive side.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
- D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted.

Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- F. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.
- G. Do not splice structural members between supports unless otherwise indicated.
- H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- I. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
- J. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- K. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.

- L. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- M. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. ICC-ES evaluation report for fastener.
- N. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.
- O. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.
- D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 INSTALLATION OF WOOD FURRING

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally and vertically at 24 inches o.c.

3.4 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered

label.

END OF SECTION

SECTION 061050
MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Framing with dimension lumber.
 - 2. Wood blocking and nailers.
 - 3. Plywood backing panels.
 - 4. Fiber cement siding and soffit panels.
- B. Related Sections include the following:
 - 1. Division 2 Section "Termite Control" for site application of borate treatment to wood framing.
 - 2. Division 6 Section "Finish Carpentry" for nonstructural carpentry items exposed to view and not specified in another Section.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. SPIB: The Southern Pine Inspection Bureau.
 - 3. WCLIB: West Coast Lumber Inspection Bureau.
 - 4. WWPA: Western Wood Products Association.
 - 5. NLGA: National Lumber Grades Authority.
 - 6. RIS: Redwood Inspection Service.
 - 7. WCLIB: West Coast Lumber Inspection Bureau.
 - 8. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with

- requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
1. Preservative-treated wood.
 2. Fire-retardant-treated wood.
 3. Power-driven fasteners.
 4. Powder-actuated fasteners.
 5. Expansion anchors.
 6. Metal framing anchors.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
- B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece .
 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 4. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP C2.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece .
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood equipment support bases.
 - 2. Wood blocking at coping.

2.3 Preservative Treatment by Pressure Process:

- 1. Lumber: AWP C2 except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWP C31 with inorganic boron (SBX). Kiln dry after treatment to a maximum moisture content of 19 percent.
- 2. Plywood: AWP C9. Kiln dry after treatment to a maximum moisture content of 18 percent.
- 3. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- 4. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
- 5. Do not use material that is warped or does not comply with requirements for untreated material.
- 6. Mark lumber with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
 - a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- 7. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
 - a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.

2.4 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPAC20 (lumber) and AWPAC27 (plywood).
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Use Exterior type for exterior locations and where indicated.
 - 3. Use Interior Type A, unless otherwise indicated.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece .
- C. Application: Treat all miscellaneous carpentry, including the following, unless otherwise indicated:
 - 1. Concealed blocking.
 - 2. Roof construction.
 - 3. Plywood backing panels.

2.5 DIMENSION LUMBER FRAMING

- A. Maximum Moisture Content: 19 percent .
- B. Other Framing: No. 2 grade and any of the following species:
 - 1. Southern pine; SPIB.

2.6 FIBER CEMENT PANEL SIDING

- A. Cementitious express/reveal jointed panel with accessories.
 - 1. Pattern (Basis of Design): James Hardie Primed HZ10 Straight Fiber Cement Sierra 8 Panel siding Primed 48.0-in x 96.0-in.
- B. Cementitious soffit panel.
 - 1. Pattern (Basis of Design): James Hardie Primed HZ10 Primed Smooth Fiber Cement Solid Soffit with perforated venting.

2.7 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
- B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content and any of the following species:
 - 1. Mixed southern pine; SPIB.
 - 2. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

- C. For blocking not used for attachment of other construction Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.8 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.9 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M .
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A ; with ASTM A 563 hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.10 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cleveland Steel Specialty Co.

2. Harlen Metal Products, Inc.
 3. KC Metals Products, Inc.
 4. Simpson Strong-Tie Co., Inc.
 5. Southeastern Metals Manufacturing Co., Inc.
 6. USP Structural Connectors.
- B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
1. Use for interior locations where stainless steel is not indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- D. Do not splice structural members between supports, unless otherwise indicated.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- thickness.
 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- G. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that

interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

- H. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- I. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- J. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.4 PROTECTION

- A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 061600
SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section includes: Wall sheathing.
- B. Related Requirements:
 - 1. Section 07 25 00 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 2. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WALL SHEATHING

- A. Glass-mat gypsum wall sheathing.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

2.3 MANUFACTURERS

- A. Provide products by one of the following manufacturers:
 - 1. Certain Teed Corporation; GlasRoc
 - 2. G-P Gypsum Corporation; Dens-Glas Gold
 - 3. United States Gypsum Company; Securock
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
- D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
 - E. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

END OF SECTION

SECTION 061753
SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood products.
 - 2. Preservative-treated lumber.
 - 3. Fire-retardant-treated lumber.

1.2 DEFINITIONS

- A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.
 - 1. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.
- B. Shop Drawings: Show fabrication and installation details for trusses.
 - 1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
 - 2. Indicate sizes, stress grades, and species of lumber.
 - 3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
 - 4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
 - 5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
 - 6. Show splice details and bearing details.
- C. Delegated Design Submittals: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For metal connector-plate manufacturer.

- B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.
- C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.
- D. Evaluation Reports: For the following, from ICC-ES:
 - 1. Metal-plate connectors.
 - 2. Metal truss accessories.

1.5 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
 - 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
 - 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
 - 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 - 3. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.
- B. Structural Performance: Metal-plate-connected wood trusses are to be capable of

withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.

1. Design Loads: As indicated.
2. Maximum Deflection under Design Loads:
 - a. Roof Trusses: Vertical deflection of 1/240 of span.

- C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 WOOD PRODUCTS

- A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. Provide dressed lumber, S4S.
 3. Provide dry lumber with 15 percent maximum moisture content at time of dressing.
- B. Minimum Specific Gravity for Top Chords: 0.50.
- C. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061000 "Rough Carpentry."

2.3 FASTENERS

- A. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
 2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.

2.4 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 92 percent zinc dust by weight.

2.5 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.6 SOURCE QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.
 - 1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.
 - 2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.
- B. Correct deficiencies in Work that special inspections indicate do not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.

- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- H. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with Section 061000 "Rough Carpentry."
- I. Install wood trusses within installation tolerances in TPI 1.
- J. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- K. Replace wood trusses that are damaged or do not comply with requirements.
 - 1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIRS AND PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- C. Repair damaged galvanized coatings on exposed surfaces in accordance with ASTM A780/A780M and manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections to verify that temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

END OF SECTION

SECTION 072100
THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Concealed building insulation.

1.3 DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 PERFORMANCE REQUIREMENTS

- A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
 - 1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm air velocity.
 - 2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.
- D. Research/Evaluation Reports: For foam-plastic insulation.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers:
 - 1. CertainTeed Corporation.
 - 2. Guardian Fiberglass, Inc.
 - 3. Johns Manville.
 - 4. Knauf Fiber Glass.

5. Owens Corning.

- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- C. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on 1 face.
- D. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
 - 1. 3-5/8 inches thick with a thermal resistance of 11 deg F x h x sq. ft./Btu at 75 deg F .
 - 2. 5-1/2 inches thick with a thermal resistance of 21 deg F x h x sq. ft./Btu at 75 deg F .

2.3 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
 - 1. Products:
 - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
 - b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
 - c. Gemco; Spindle Type.
 - 2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
 - 1. Products:
 - a. Gemco; 90-Degree Insulation Hangers.
 - 2. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
 - 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.

- 1. Products:

- a. AGM Industries, Inc.; RC150.
 - b. AGM Industries, Inc.; SC150.
 - c. Gemco; Dome-Cap.
 - d. Gemco; R-150.
 - e. Gemco; S-150.
- 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Ceiling plenums.
 - b. Attic spaces.
 - c. Where indicated.
- D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 1 inch between face of insulation and substrate to which anchor is attached.
 - 1. Products:
 - a. Gemco; Clutch Clip.
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
 - 1. Products:
 - a. AGM Industries, Inc.; TACTOO Adhesive.
 - b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
 - c. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated.
 - 1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- D. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures.
 - 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.
 - 6. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320 and as follows:

- a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
- b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

3.5 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.6 PROTECTION

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 073110
ASPHALT SHINGLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Asphalt shingles.
 - 2. Underlayment.
 - 3. Sheet metal

1.3 DEFINITION

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for asphalt shingles.
- C. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain ridge and hip cap shingles ridge vents felt underlayment and self-adhering sheet underlayment from single source from single manufacturer.
- C. Fire-Resistance Characteristics: Where indicated, provide asphalt shingles and related roofing materials identical to those of assemblies tested for fire resistance per test method below by UL or another testing and inspecting agency acceptable to authorities

having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.
 1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
- B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install asphalt shingles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.8 WARRANTY

- A. Special Warranty: Standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Manufacturing defects.
 - b. Structural failures including failure of asphalt shingles to self-seal after a reasonable time.
 2. Material Warranty Period: 25 years from date of Substantial Completion, prorated, with first three years nonprorated.
 3. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds up to 100 mph for 10 years from date of Substantial Completion.
 4. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor five years from date of Substantial Completion.
 5. Workmanship Warranty Period: 10 years from date of Substantial Completion.

- B. Special Project Warranty: Roofing Installer's Warranty, or warranty form at end of this Section, signed by roofing Installer, covering the Work of this Section, in which roofing Installer agrees to repair or replace components of asphalt shingle roofing that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Asphalt Shingles: 100 sq. ft of each type, in unbroken bundles.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Laminated-Strip Asphalt Shingles: ASTM D 3462, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.

1. Product: Subject to compliance with requirements, provide product by one of the following:

- a. GAF Timberline ArmorShield II (Basis of Design).
- b. Certainteed.
- c. Owens Corning.

2. Butt Edge: Notched cut.

3. Strip Size: Manufacturer's standard.

4. Algae Resistance: Granules treated to resist algae discoloration.

5. Color and Blends: As selected by Architect from manufacturer's full range.

- B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

2.2 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226, Type II, asphalt-saturated organic felts, nonperforated.

- B. Self-Adhering Sheet Underlayment, Grace Ultra, Polyethylene Faced: ASTM D 1970, minimum of 30-mil- thick, slip-resisting, polyethylene-film-reinforced top surface laminated to butyl rubber, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

- a. Carlisle Coatings & Waterproofing, Inc.

- b. Grace, W. R. & Co. - Conn.
- c. Henry Company.
- d. Johns Manville.
- e. Owens Corning.
- f. Polyguard Products, Inc.
- g. Protecto Wrap Company.
- h. Elk Corporation.

2.3 RIDGE VENTS

- A. Flexible Ridge Vent: Manufacturer's standard, compression-resisting, three-dimensional, open-nylon or polyester-mat filter bonded to a nonwoven, nonwicking, geotextile fabric cover.

2.4 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch- diameter, barbed shank, sharp-pointed, with a minimum 3/8-inch- diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through OSB or plywood sheathing.
 - 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- C. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch minimum diameter.

2.5 METAL FLASHING AND TRIM

- A. General: Comply with requirements in SMACNA's "Architectural Sheet Metal Manual."
 - 1. Sheet Metal: Zinc-tin alloy-coated steel, 22 gage, at crickets, drips and valleys.
 - 2. Kynar-finish 24 gage steel at step flashings.
 - 3. Ledge flashings: 24 gage stainless steel.
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item.
 - 1. Apron Flashings: Fabricate with lower flange a minimum of 4 inches over and 4 inches beyond each side of downslope asphalt shingles and 6 inches up the vertical surface.
 - 2. Step Flashings: Fabricate with a headlap of 2 inches and a minimum extension of 4 inches over the underlying asphalt shingle and up the vertical surface.

3. Cricket Flashings: Fabricate with concealed flange extending a minimum of 18 inches beneath upslope asphalt shingles and 6 inches beyond each side of chimney and 6 inches above the roof plane.
 4. Open-Valley Flashings: Fabricate in lengths not exceeding 10 feet with 1-inch-high, inverted-V profile at center of valley and equal flange widths of 10 inches.
 5. Drip Edges: Fabricate in lengths not exceeding 10 feet with 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.
- C. Vent Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches from pipe onto roof.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
- B. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with felt underlayment nails.
1. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches in direction to shed water. Lap ends of felt not less than 6 inches over self-adhering sheet underlayment.
 2. Install fasteners at no more than 36 inch o.c.

- C. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated on Drawings, lapped in direction to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.
1. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
 2. Eaves: Extend from edges of eaves 24 inches beyond interior face of exterior wall.
 3. Rakes: Extend from edges of rake 24 inches beyond interior face of exterior wall.
 4. Valleys: Extend from lowest to highest point 18 inches on each side.
 5. Hips: Extend 18 inches on each side.
 6. Ridges: Extend 36 inches on each side without obstructing continuous ridge vent slot.
 7. Sidewalls: Extend beyond sidewall 18 inches, and return vertically against sidewall not less than 4 inches.
 8. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend beyond penetrating element 18 inches, and return vertically against penetrating element not less than 4 inches.
 9. Roof Slope Transitions: Extend 18 inches on each roof slope.
- D. Metal-Flashed, Open-Valley Underlayment: Install two layers of 36-inch- wide felt underlayment centered in valley. Stagger end laps between layers at least 72 inches. Lap ends of each layer at least 12 inches in direction to shed water, and seal with asphalt roofing cement. Fasten each layer to roof deck with felt underlayment nails.
1. Lap roof-deck felt underlayment over first layer of valley felt underlayment at least 6 inches.

3.3 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim."
1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.
- C. Step Flashings: Install with a headlap of 2 inches and extend over the underlying asphalt shingle and up the vertical surface. Fasten to roof deck only.
- D. Cricket Flashings: Install against the roof-penetrating element extending concealed flange beneath upslope asphalt shingles and beyond each side.

- E. Open-Valley Flashings: Install centered in valleys, lapping ends at least 8 inches in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.
 - 1. Secure hemmed flange edges into metal cleats spaced 12 inches apart and fastened to roof deck.
 - 2. Adhere 9-inch- wide strip of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.
- F. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.
- G. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.
- H. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 ASPHALT SHINGLE INSTALLATION

- A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip with tabs removed at least 7 inches wide with self-sealing strip face up at roof edge.
 - 1. Extend asphalt shingles 3/4 inch over fasciae at eaves and rakes.
 - 2. Install starter strip along rake edge.
- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Install asphalt shingles by single-strip column or racking method, maintaining uniform exposure. Install full-length first course followed by cut second course, repeating alternating pattern in succeeding courses.
- E. Fasten asphalt shingle strips with a minimum of four roofing nails located according to manufacturer's written instructions.
 - 1. Where roof slope exceeds 20:12, seal asphalt shingles with asphalt roofing cement spots after fastening with additional roofing nails.
 - 2. Where roof slope is less than 4:12, seal asphalt shingles with asphalt roofing cement spots.
 - 3. When ambient temperature during installation is below 50 deg F, seal asphalt shingles with asphalt roofing cement spots.
- F. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.

- G. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.

1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

3.5 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS <<**Company Name**>>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: _____.
2. Building Name: _____.
3. Acceptance Date: Substantial Completion.
4. Warranty Period: 25 years.

- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

- D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. Lightning;
 - b. Peak gust wind speed exceeding 100 mph;
 - c. Fire;
 - d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. Vapor condensation on bottom of roofing; and
 - g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this **<Insert day>** day of **<Insert month>**, **<Insert year>**.

1. Authorized Signature: **<Insert signature>**.
2. Name: **<Insert name>**.
3. Title: **<Insert title>**.

END OF SECTION

SECTION 077140
GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes pre-finished aluminum gutters and downspouts.

1.2 REFERENCES

- A. AAMA 603.8 (American Architectural Manufacturers Association) - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
- B. AAMA 605.2 (American Architectural Manufacturers Association) - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
- C. ASTM B32 - Specification for Solder Metal.
- D. ASTM B209/B209M - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- E. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.
- F. SMACNA (Sheet Metal and Air Conditioning Contractors National Association) - Architectural Sheet Metal Manual.

1.3 DESIGN REQUIREMENTS

- A. When size is not indicated, conform to SMACNA Manual for sizing components for rainfall intensity determined by a storm occurrence of 1 in 10 years.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.
- B. Product Data: Submit data on manufactured components, materials, and finishes.
- C. Samples: Submit two samples, 4 inch x 4 inch, for each type of metal illustrating finish, color, and configuration.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA Manual.
- B. Maintain one copy of each document on site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Products and Substitutions: Product storage and handling requirements.
- B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope to drain.
- C. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.7 COORDINATION

- A. Coordinate Work with installation of metal flashings and roofing shingles.

1.8 WARRANTY

- A. Special Warranty on Metal Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal gutters and downspouts roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 GUTTERS AND DOWNSPOUTS

- A. Product Description:
 - 1. Gutter: SMACNA "A" Profile, .032" prefinished aluminum, maximum lengths.
 - 2. Downspouts: 4" x 4", .032" prefinished aluminum, maximum lengths.

2.2 COMPONENTS

- A. Pre-Finished Aluminum Sheet: ASTM B209/B209M, manufacturer's standard alloy and temper for specified finish; minimum 0.040 inch thick; mill finish shop Fluoropolymer coating; color as selected by Architect from full range of standard colors.

2.3 ACCESSORIES

- A. Anchors and Supports: Profiled to suit gutters and downspouts.
 - 1. Anchoring Devices: Where not indicated provide in accordance with SMACNA requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Brackets.
- B. Fasteners: Same material and finish as gutters and downspouts.
- C. Protective Backing Paint: FS TT-C-494, bituminous.

2.4 FABRICATION

- A. Form gutters and downspouts of profiles and sizes indicated.
- B. Fabricate with required connection pieces.
- C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- D. Hem exposed edges of metal.
- E. Fabricate gutter and downspout accessories; seal watertight.

2.5 FACTORY FINISHING

- A. PVDF (polyvinylidene fluoride) coating: Multiple coat, thermally cured, fluoropolymer system conforming to AAMA 605.2.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify surfaces are ready to receive gutters and downspouts.

3.2 PREPARATION

- A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil.

3.3 INSTALLATION

- A. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.
- B. Slope gutters 1/8 inch per foot minimum.

- C. Anchor downspouts to walls per SMACNA requirements.
- D. Terminate downspouts in cast iron boots.

END OF SECTION

SECTION 079200
JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes joint sealants for the following applications:
 - 1. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Control and expansion joints on exposed surfaces.
 - b. Perimeter joints of openings where indicated.
 - c. Other joints as indicated.
 - 2. Interior joints in the following horizontal traffic surfaces:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Other joints as indicated.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- D. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.
- E. Qualification Data: For Installer.

- F. Field Test Report Log: For each elastomeric sealant application.
- G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 5 years from date of Substantial Completion.
- C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
 - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- D. Single-Component Neutral- and Basic-Curing Silicone Sealant:
 - 1. Available Products:
 - a. Tremco; Spectrem 1 (Basic).
 - 2. Type and Grade: S (single component) and NS (nonsag).
 - 3. Class: 100/50.
 - 4. Use Related to Exposure: NT (nontraffic).
 - 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
 - 6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.
- E. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:
 - 1. Available Products:
 - a. Pecora Corporation; 898.
 - b. Tremco; Tremsil 600 White.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: ceramic tile.

F. Multicomponent Nonsag Urethane Sealant:

1. Available Products:
 - a. Pecora Corporation; Dynatrol II.
 - b. Tremco; Dymeric 511.
 - c. Tremco; Vulkem 922.
2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

G. Multicomponent Nonsag Urethane Sealant:

1. Available Products:
 - a. Schnee-Morehead, Inc.; Permathane SM 7200.
 - b. Sika Corporation, Inc.; Sikaflex - 2c NS TG.
 - c. Sonneborn, Division of ChemRex Inc.; NP 2.
 - d. Tremco; Vulkem 227.
 - e. Tremco; Vulkem 322 DS.
2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: aluminum coated with a high-performance coating brick.

H. Single-Component Nonsag Urethane Sealant:

1. Available Products:
 - a. Sika Corporation, Inc.; Sikaflex - 1a.
 - b. Sonneborn, Division of ChemRex Inc.; Ultra.
 - c. Sonneborn, Division of ChemRex Inc.; NP 1.
 - d. Tremco; Vulkem 116.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).

5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

2.4 LATEX JOINT SEALANTS

- A. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.
- B. Available Products:
 1. Bostik Findley; Chem-Calk 600.
 2. Pecora Corporation; AC-20+.
 3. Schnee-Morehead, Inc.; SM 8200.
 4. Sonneborn, Division of ChemRex Inc.; Sonolac.
 5. Tremco; Tremflex 834.

2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) , and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F . Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such

contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed elastomeric sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.
 - b. Perform 1 test for each of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab in Appendix X1 in ASTM C 1193.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
 4. Inspect tested joints and report on the following:
 - a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - b. Whether sealants filled joint cavities and are free of voids.
 - c. Whether sealant dimensions and configurations comply with specified requirements.
 5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.
- 3.5 CLEANING
- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.
- 3.6 PROTECTION
- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 081113
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Standard hollow metal doors and frames.
- B. Related Sections:
 - 1. Division 4 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
 - 2. Division 8 Section "Door Hardware" for door hardware for hollow metal doors.
 - 3. Division 9 Sections "Painting" for field painting hollow metal doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door design.
 - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.

C. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 257 or UL 10C.
- C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 1. Provide additional protection to prevent damage to finish of factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
 - 1. Amweld Building Products, LLC.
 - 2. Benchmark; a division of Therma-Tru Corporation.
 - 3. Ceco Door Products; an Assa Abloy Group company.
 - 4. Curries Company; an Assa Abloy Group company.
 - 5. Deansteel Manufacturing Company, Inc.
 - 6. Firedoor Corporation.
 - 7. Fleming Door Products Ltd.; an Assa Abloy Group company.
 - 8. Habersham Metal Products Company.
 - 9. Karpen Steel Custom Doors & Frames.
 - 10. Kewanee Corporation (The).
 - 11. Mesker Door Inc.
 - 12. Pioneer Industries, Inc.
 - 13. Security Metal Products Corp.
 - 14. Steelcraft; an Ingersoll-Rand company.
 - 15. Windsor Republic Doors.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
 - a. Fire Door Core: As required to provide fire-protection ratings indicated.
 - b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - 1) Locations: Exterior doors.
 - 3. Vertical Edges for Single-Acting Doors: Beveled edge.
 - a. Beveled Edge: 1/8 inch in 2 inches.
 - 4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.
 - 5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
 - 6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).

- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as knocked down or face welded unless otherwise indicated.
 - 3. Frames for Level 3 Steel Doors: 0.053-inch- thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as knocked down or face welded unless otherwise indicated.
 - 3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
 - 4. Frames for Level 3 Steel Doors: 0.053-inch- thick steel sheet.
 - 5. Frames for Wood Doors: 0.053-inch- thick steel sheet.
 - 6. Frames for Borrowed Lights: 0.053-inch- thick steel sheet, same as adjacent door frame.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.8 LOUVERS

- A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.

2.9 ACCESSORIES

- A. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch-wide steel.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:
1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 2. Glazed Lites: Factory cut openings in doors.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. Sidelight Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 6. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
 - c. Compression Type: Not less than two anchors in each jamb.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8 .
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.
- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of hollow metal work.
 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.11 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

- a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that are filled with grout or mortar.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
 9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection and prior to 1 year warranty date after substantial completion. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 087100
DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Mechanical door hardware for swinging doors.

B. Products furnished but not installed, under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain requirements of this Section.

1. Permanent cores and keys.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.

b. Content: Include the following information:

- 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
- 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
- 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.

2. Keying Schedule: Prepared by or under the supervision of hardware consultant, detailing Owner's final keying instructions for locks.

1.3 QUALITY ASSURANCE

A. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:

1. For door hardware, an Architectural Hardware Consultant (AHC).
 - B. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.
 - C. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.
 - D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
 - E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines ICC/ANSI A117.1.
 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
 - F. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."
- 1.4 DELIVERY, STORAGE, AND HANDLING
- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
 - B. Tag each item with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
 - C. Deliver keys to Owner by registered mail or overnight package service.

1.5 COORDINATION

- A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion, unless otherwise indicated.
 - a. Locksets: Five years from date of substantial Completion.
 - b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" to comply with requirements in this Section.
 - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products. Products complying with BHMA designations referenced.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames. Provide 5 knuckle ball bearing design. Provide with additional features as scheduled.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by following:
 - a. Bommer Industries (BB)

- b. Hager Hinge Co.; (BB)
- c. IVES Hardware; an Allegion Company. (5BB)
- d. McKinney Products Company; an ASSA ABLOY Group company (TB)
- e. Stanley Commercial Hardware. (FBB)

2.3 LOCKS AND LATCHES, GENERAL

- A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with ANSI A117.1. FED-STD-795, "Uniform Federal Accessibility Standards."
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- C. Lock Trim:
 - 1. Levers: Cast, plated to finish specified.
 - 2. Escutcheons: Wrought
 - 3. Lockset Designs: Provide design indicated.
- D. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
 - 2. Deadbolts: Minimum 1-inch (25-mm) bolt throw.
- E. Backset: 2-3/4 inches, unless otherwise indicated.
- F. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
 - 1. Strikes for Locks and Latches: BHMA A156.2.
- G. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
 - 1. Bored Locks: BHMA A156.2.
- H. Bored Locks: BHMA A156.2, Grade 1; Series 4000
 - 1. Required Manufacturer:
 - a. Best Access Systems. (9K Series)

2.4 LOCK CYLINDERS

- A. Cylinders: BHMA A156.5, Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
 - 1. Number of Pins: Seven.
 - 2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
 - 3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
- B. Required Manufacturer:
 - 1. Best Access Systems.

2.5 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. For bid purposes provide all cylinders and keys with patented protection feature to prevent unauthorized key duplication. Incorporate decisions made in keying conference, and as follows:
 - 1. Match Owners Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
- B. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
 - 1. Removable Cores: Core insert, removable by use of a special key; for use only with core manufacturer's cylinder and door hardware.
 - 2. Provide all cores with patent-protected feature to prevent unauthorized duplication.
- C. Keys: Nickel silver.
 - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: "DO NOT DUPLICATE."
 - 2. Quantity: Provide the following:
 - a. Cylinder Change Keys: Three.
 - b. Master Keys: Five.
 - c. Control Keys: Two
- D. Manufacturer:
 - 1. Best Access Systems. (Cormax Series)

2.6 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; Cast Iron, rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide non-sized closers, adjustable to meet field conditions and requirements for opening force.
 - 1. Acceptable Manufacturers:
 - a. LCN Closers; an Allegion Group Company; (4040XP Series)
 - b. Sargent Manufacturing; an Assa Abloy Group Company. (281 Series)
 - c. Stanley Commercial Hardware. (QDC100 Series)

2.7 PROTECTIVE TRIM UNITS

- A. Size: 2 inches (51 mm) less than door width on push side and 1 inch (25 mm) less than door width on pull side, by height specified in door hardware sets.
- B. Fasteners: Manufacturer's standard self-tapping countersunk screws.
- C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:
 - 1. Material: 0.050-inch- (1.3-mm-) thick stainless steel.
 - 2. Available Manufacturers:
 - a. Burns Manufacturing Incorporated.
 - b. Don-Jo Manufacturing
 - c. Hiawatha, Inc.
 - d. IVES Hardware; an Allegion Company.
 - e. Rockwood Manufacturing Company.
 - f. Trimco.

2.8 STOPS AND HOLDERS

- A. Stops and Bumpers: BHMA A156.16 Grade 1 unless Grade 2 is indicated.
 - 1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
- B. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.
 - 1. Available Manufacturers:
 - a. ABH Manufacturing.
 - b. Burns Manufacturing Incorporated.

- c. Don-Jo Manufacturing
- d. Hiawatha, Inc.
- e. IVES Hardware; an Allegion Company.
- f. Rockwood Manufacturing Company.
- g. Trimco.

2.9 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

1. Available Manufacturers:

- a. ABH Manufacturing.
- b. Glynn Johnson.
- c. Rixson.
- d. Rockwood.

2.10 FLUSH BOLTS

A. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1 designed for mortising into door edge. Provide type required by UL listing.

B. Manual-Extension Flush Bolts: BHMA A156.16, Grade 1, fabricated from extruded brass or bronze, unless otherwise indicated, with 12-inch rod actuated by flat lever; listed and labeled for fire-rated doors. Provide with matching dustproof strike unless threshold is installed.

C. Available Manufacturers:

- 1. Burns Manufacturing Incorporated.
- 2. Door Controls International, Inc.
- 3. Don-Jo Manufacturing.
- 4. Hager Companies.
- 5. Ives Company
- 6. Trimco.

2.11 DOOR GASKETING

A. Standard: BHMA A156.22.

B. General: Provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners as indicated.

- 1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- 2. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

- D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.
 - 2. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Gasketing Materials: ASTM D 2000 and AAMA 701/702.
- G. Available Manufacturers:
 - 1. National Guard Products.
 - 2. Pemko Manufacturing
 - 3. Reese Enterprises.

2.12 THRESHOLDS

- A. Standard: BHMA A156.21
- B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with ANSI A117.1.
 - 1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.
- D. Provide Slip resistant type as listed.
- E. Provide stainless steel fasteners and lead shields for all thresholds.
- F. Available Manufacturers:
 - 1. National Guard Products.
 - 2. Pemko Manufacturing
 - 3. Reese Enterprises.

2.13 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:
 - a. Wood or Machine Screws: For the following:
 - 1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.
 - b. Steel Through Bolts: For the following unless door blocking is provided:
 - 1) Surface hinges to doors.
 - 2) Closers to doors and frames.
3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.14 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
- C. Mounting Heights: Mount door hardware units at to comply with the following unless otherwise indicated or required to comply with governing regulations.
 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

- D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- E. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame. No not cut, notch or otherwise destroy the integrity of aluminum housing mounted seals. Install before other surface mounted hardware and template accordingly.
- H. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.2 DOOR HARDWARE SCHEDULE

Manufacturer List:

<u>Code</u>	<u>Name</u>
AB	ABH MANUFACTURING INC.
BE	BEST ACCESS SYSTEMS
BY	BY OTHERS
DJ	DON-JO
NA	NATIONAL GUARD
PR	PRECISION
SD	STANLEY DOOR CLOSERS
SH	STANLEY COMMERCIAL HARDWARE
SP	SPECIAL LITE
ST	STANLEY
TR	TRIMCO

Option List:

<u>Code</u>	<u>Description</u>
R	FULL SIZE ROUNDED PLASTIC COVER
CD	CYLINDER DOGGING
CS	CONCEALED SCREWS (8T ONLY)
S3	ANSI STRIKE PACKAGE
SN	SEX NUTS
3/4	3/4" THROW LATCH
CSK	COUNTER SINKING OF KICK AND MOP PLATES
NRP	NON REMOVEABLE PIN STD/HEAVY WT HINGE
SIA	ABRASIVE COATING-4" WIDTH-AL OR SS
SIA	ABRASIVE COATING-5" WIDTH-AL OR SS
STK	STANDARD STRIKE PACKAGE
C127	CYLINDER CAM
C181	CAM-ADAMS RITE MS CAM
R708	STRAIGHT CYLINDER RING - 1/2"
R804	TAPERED CYLINDER RING - 1/4"
J-MTG	"J" MTG (SHOULDER BOLT) - QTY. OF 2
SSMS/LA	STAINLESS MACHINE SCREWS/LEAD ANCHOR

Finish List:

<u>Code</u>	<u>Description</u>
AL	ALUMINUM
PC	PRIME COAT
SL	SILVER COATED
626	SATIN CHROMIUM PLATED
628	SATIN ALUMINUM, CLEAR ANODIZED
630	SATIN STAINLESS STEEL
689	ALUMINUM PAINTED
GREY	GREY
US26D	CHROMIUM PLATED, DULL
US32D	STAINLESS STEEL, DULL

Hardware Sets:**SET #1 - Entry**

3 Hinges	FBF179 4 1/2 X 4 1/2 NRP	US26D	ST
1 Entry Lockset	9K3-7AB15D PATD S3	626	BE
1 Door Closer HO	QDC112 R SN	689	SH
1 Kick Plate	K0050 10" X 1.5" LDW CSK B4E	630	TRI
1 Sweep	C627 LAR	A	NGP
1 Drip Cap	16 4" ODW	A	NGP
1 Gasketing	127N Head & Jambs	A	NGP
1 Threshold	425	US27	NGP

SET #2 – Entry (Pair)

6 Hinges	FBF179 4 1/2 X 4 1/2 NRP	US26D	ST
2 Flush Bolt	3917 12	626	TRI
1 Entry Lockset	9K3-7AB15D PATD S3	626	BE

1	Door Closer HO	QDC112 R SN	689	SH
2	Kick Plate	K0050 10" X 1.5" LDW CSK B4E	630	TRI
1	Astragal	By Hollow Metal Dr. Mfg.		
2	Sweep	C627 LAR	A	NGP
1	Drip Cap	16 4" ODW	A	NGP
1	Gasketing	127N Head & Jambs	A	NGP
1	Threshold	425	US27	NGP

END OF SECTION

SECTION 089000
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fixed extruded-aluminum louvers.
- B. Related Sections:
 - 1. Division 7 – Section “Joint Sealants”.
 - 2. Division 8 – Section “Hollow Metal Doors and Frames”.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
- C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft. (1436 Pa), acting inward or outward.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 2. Show mullion profiles and locations.
- C. Samples for Initial Selection: For units with factory-applied color finishes.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209 Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Include supports, anchorages, and accessories required for complete assembly.
- C. Provide subsills made of same material as louvers or extended sills for recessed louvers.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Drainable-Blade Louver:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Airolite Company, LLC (The).
 - b. Construction Specialties, Inc.
 - c. Greenheck Fan Corporation.
 - d. Industrial Louvers, Inc.
 - e. Nystrom Building Products.
 - f. Ruskin Company; Tomkins PLC.
 - 2. Louver Depth: 4 inches (100 mm).

3. Frame and Blade Nominal Thickness: Not less than 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames.
4. Mullion Type: Exposed.
5. Louver Performance Ratings:
 - a. Free Area: Not less than 8.0 sq. ft. (0.74 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver (50%).
6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 1. Screen Location for Fixed Louvers: Interior face.
 2. Screening Type: Bird screening.
- B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 1. Metal: Aluminum.
- D. Louver Screening for Aluminum Louvers:
 1. Bird Screening: Aluminum, 1/2-inch-square mesh, 0.063-inch wire.

2.5 BLANK-OFF PANELS

- A. Insulated, Blank-Off Panels: Laminated panels consisting of insulating core surfaced on back and front with metal sheets and attached to back of louver.
 1. Thickness: 1 inch (25 mm).
 2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
 3. Insulating Core: Rigid, glass-fiber-board insulation or extruded-polystyrene foam.
 4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard frames, with corners mitered and with same finish as panels.
 5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
 6. Panel Finish: Same finish applied to louvers.
- B. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.6 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 092900
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes metal stud wall framing; metal channel ceiling framing; gypsum board and joint treatment; gypsum sheathing; and acoustic insulation.
- B. Related Sections:
 - 1. Division 07 – Joint Sealers.

1.2 REFERENCES

- A. ASTM C36 - Gypsum Wallboard.
- B. ASTM C475 - Joint Compound and Joint Tape for Finishing Gypsum Board.
- C. ASTM C645 - Non-Load Bearing (Axial) Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
- D. ASTM C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
- E. ASTM C840 - Application and Finishing of Gypsum Board.
- F. ASTM E119 - Test Methods for Fire Tests of Building Construction and Materials.
- G. GA-216 (Gypsum Association) - Recommended Specifications for the Application and Finishing of Gypsum Board.
- H. GA-600 (Gypsum Association) - Fire Resistance Design Manual.
- I. UL (Underwriters Laboratories, Inc.) - Fire Resistance Directory.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate special details associated with installation.
- B. Product Data: Submit data on metal framing, gypsum board, joint tape; acoustic accessories and all trim pieces.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C840, ASTM C1280, GA-214, GA-216 and GA-600.

1.5 QUALIFICATIONS

- A. Installer: Company specializing in performing Work of this section with minimum five years documented experience.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

- A. Manufacturers:
 - 1. National Gypsum Co.
 - 2. G-P Gypsum Corp.
 - 3. Celotex Building Products.
 - 4. United States Gypsum Co.

2.2 COMPONENTS

- A. Studs: ASTM C645; nominal 25-guage; 0.0179" minimum thickness of base metal for interior assemblies except 20-guage 0.0328" minimum thickness for reinforcement at door frames and ceramic wall tile assemblies.
- B. Depth of Section: As indicated on the drawings.
- C. Runners: Match studs; provide type recommended by stud manufacturer for floor and ceiling support of studs. Top track connection to structural steel frame shall be by deep leg tracks, metal angle clips or zee sections as required.
- D. Coating: All members shall be galvanized per ASTM A525 and ASTM A591.
- E. Furring, Framing, and Accessories: ASTM C645, GA-216 and GA-600.
- F. Fasteners: ASTM C514, ASTM C1002 and GA-216 as recommended by board manufacturer.
- G. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- H. Adhesive: ASTM C557, GA-216 and as recommended by board manufacturer
- J. Gypsum Board Materials:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - i. American Gypsum Co.
 - ii. G-P Gypsum.
 - iii. National Gypsum Company.

iv. USG Corporation.

2. Standard Gypsum Board: ASTM C36; 5/8 inch thick, maximum available length in place; ends square cut, tapered edges.
3. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
 - a. Thickness: 1/2 inch.
 - b. Long Edges: Tapered.

2.3 ACCESSORIES

- A. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.
- B. Corner Beads: Metal.
- C. Edge Trim: GA-216; Type LC, L, LK, U exposed reveal bead. Shape as required.
- D. Joint Materials: ASTM C475; GA-201 and GA-216; reinforcing tape, joint compound, adhesive, and water.
- E. Fasteners: ASTM C1002, Type S12 and GA-216 as recommended by accessory manufacturer.
- F. Drywall Suspension System: For ceilings provide Direct Suspension as manufactured by U. S. Gypsum Company or approved equal. Install per manufacturer's directions.
- G. Preformed Drywall Trims:
 1. Reveals: Gordon Series 400 #412-518 Pittcon Model SWR-0630-063, where indicated on drawings.
- H. Screws: ASTM C1002, with corrosion resistant treatment

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that site conditions are ready to receive work and opening dimensions are as instructed by the manufacturer.

3.2 INSTALLATION

- A. Metal Stud Installation:

1. Install studs in accordance with ASTM C754, GA-216 and GA-600.
 2. Metal Stud Spacing: 16 inches on center.
 3. Extend stud framing to bottom of roof deck or structure. Attach ceiling runner securely to framing in accordance with details indicated. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
 4. Door Opening Framing: Install double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.
 5. Blocking: Screw wood blocking to studs. Bolt or screw steel channels to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, etc.
- B. Ceiling Framing Installation:
1. Install in accordance with ASTM C754.
 2. Coordinate location of hangers with other work.
 3. Install ceiling framing independent of walls, columns, and above ceiling work.
 4. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
 5. Laterally brace entire suspension system.
- C. Acoustic Accessories Installation:
1. Install acoustic sealant within partitions.
- D. Gypsum Board Installation:
1. Install gypsum board in accordance with GA-216 and GA-600.
 2. Erect single layer gypsum board in most economical direction, with ends and edges occurring over firm bearing. Extend board 4 inches above ceiling or to roof deck, whichever is lower.
 3. Erect exterior gypsum sheathing in accordance with ASTM C1280, horizontally, with edges butted and ends occurring over firm bearing.
 4. Use screws when fastening gypsum board to metal furring or framing.
 5. Treat cut edges and holes in moisture resistant gypsum board with sealant.

6. Place control joints consistent with lines of building spaces as indicated or as directed.
7. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
8. Gypsum Board Application and Finishing Standard: Install and finish gypsum board to comply with ASTM C840.
 - a. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24 inches in alternate courses of board.
 - b. Install ceiling boards across framing in the manner which minimizes the number of end-butt joints, and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24 inches.
 - c. Install wall/partition boards in manner which minimizes the number of end-butt joints or avoids them entirely where possible. At high walls, install boards horizontally with end joints staggered over studs.
 - d. Do not install imperfect, damaged or damp boards.
 - e. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors and doors over 32 inches wide. Apply spot grout at each jamb anchor clip just before inserting board into frame.
 - f. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide ¼ inch to ½ inch space and trim edge with “L” or “LC” edge trim. Seal joints with acoustical sealant.
9. Install reveal moldings where board abuts dissimilar materials.

E. Joint Treatment:

1. Finish in accordance with GA-214 Level (1) above ceilings only, behind ceramic tile or (2 and 3) above ceilings only, (4) storage and utility areas, (5) all public, classroom, and office areas.
2. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
3. Feather coats on to adjoining surfaces so that camber is per finish level (i.e., 1/32 inch for level (4) and no camber for level (5)).
4. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.

END OF SECTION

SECTION 099000
PAINTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and field application of paints, stains, varnishes, and other coatings.

- C. Work includes, but is not limited to:
 - 1. Painting and finishing of interior and exterior exposed items and surfaces including surface preparation and priming. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.
 - 2. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
 - 3. Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect will select these from standard colors or finishes available.
 - 4. Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
 - 5. Painting includes field painting exposed-to-view bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment except as specified in Divisions 21-25 and/or 26.
 - 6. All existing painted items/ rooms to receive new paint in this project.

1.2 REFERENCES

- A. ASTM D16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM D823-95 Standard Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products.

- C. ASTM D5150-92 (1997) e1 Standard Test Method for Hiding Power of Architectural Paints Applied by Roller.
- D. ASTM D3276-96 Standard Guide for Painting Inspectors- (metal substrates).

1.3 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this section.

1.4 SUBMITTALS

- A. Product Data: Submit data on all finishing products. Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use.
- B. Samples: Provide a listing of material and application for each coat of each finish sample. Submit samples for Architect's review of color and texture only. Submit two paper chip samples, illustrating range of colors and textures available for each surface finishing product scheduled.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.6 QUALIFICATIONS

- A. Applicator: Company specializing in performing the work of this section with minimum five years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain, fog, mist, or snow when relative humidity is outside the humidity ranges, or moisture content of surfaces exceed those required by the paint product manufacturer.

- C. Minimum Application Temperature for Varnish: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- D. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 degrees F.
- E. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
- F. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 PRODUCTS

2.1 PAINTS AND COATINGS

- A. Provide materials as manufactured by Sherwin-Williams, PPG, Duron, Tnemec, or Benjamin Moore.
- B. The quality of paint shall be equal to Sherwin Williams or Tnemec product numbers as specified in the schedule below.

2.2 SCHEDULE

- A. Exterior Ferrous Metal:
 - 1. First Coat: SW-KEM Kromik Universal Metal Primer, B5ONZ6
 - 2. Second Coat: SW-Silicone Alkyd enamel, B-56 Series
 - 3. Third Coat: SW-Silicone Alkyd enamel, B-56 Series
- B. Interior Drywall (Walls):
 - 1. Prime Coat (New Walls): SW ProMar 200 Zero VOC Latex Primer, B28W2600, at 1.0 mils dry, per coat.
 - 2. Prime Coat (Existing Walls): SW Multipurpose Primer B51W00453
 - 3. Intermediate Coat: ProMar 200 (Zero VOC) Semi-Gloss B31-2600.
 - 4. Top Coat: ProMar 200 (Zero VOC) Semi-Gloss B31-2600.
- C. Interior Drywall (Ceilings and Soffits):
 - 1. Prime Coat: ProMar 200 Zero VOC Latex Primer, B28W2600.
 - 2. Intermediate Coat: ProMar 200 Zero VOC Interior Latex Flat, B30-2600 Series.
 - 3. Top Coat: ProMar 200 Zero VOC Interior Latex Flat, B30-2600 Series.

- D. Interior Ferrous Metal: (Other than AESS) Gloss Finish (Water Base)
 - 1. 1st Coat: S-W Pro-Cryl® Universal W/B Primer, B66-310 series (2-4 mils dry)
 - 2. 2nd Coat: S-W Water-based Industrial Enamel, B53-300 Series
 - 3. 3rd Coat: S-W Water-based Industrial Enamel, B53-300 Series
- E. Interior Concrete Floor Sealer
 - 1. System Type: Water-based epoxy floor coating.
 - 2. Surface Prep: Clean, dry, sound.
 - 3. Two Coats: SW Armorseal 8100.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.
- B. Test shop applied primer for compatibility with subsequent cover materials.
- C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below 8%.

3.2 PREPARATION

- A. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- B. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove or repair existing coatings that exhibit surface defects.
- C. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials.
- D. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- E. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

- F. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- G. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster.
- H. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- I. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing. Sand lightly between coats and protect from dust while drying.
- J. Metal Doors Scheduled for Painting: All hollow metal frames shall receive one field prime coat, front and back, before erection (color to be medium gray); after erection, touch-up all abrasive marks; this prime coat is in addition to factory prime coat and to the two coats of finish painting specified under Paragraph 2.2. Protect from dust while drying.
- K. Apply a bead of sealant where hollow metal door frames abut adjacent wall surfaces.

3.3 APPLICATION

- A. Spray painting will be permitted wherever practical; however, excess thinning will not be permitted and complete surface coverage shall be equal to that of first class brush work. Do not spray paint concrete block unless it is immediately back-rolled.
- B. Do all touch-up and clean-up at the completion of this work to leave all surfaces in a finished condition.
- C. Where exposed, painting contractor shall paint all ducts, piping, conduit and mechanical and electrical equipment without factory finish, including those in mechanical and electrical rooms.
- D. Visible surfaces on interior of ducts behind louvers, diffusers, registers and grilles shall be primed and then painted with one coat of flat black metal enamel.

- E. Belt guards and other protective guards on equipment shall be painted with two coats of safety yellow metal enamel.
- F. Insulated pipes and ducts with paper or canvas jacket shall be painted with one coat of paint equal to Sherwin Williams SW-Preprite 200 Latex Wall Primary, and insulated surfaces with aluminum foil jacket shall be painted with one coat of Zinc Chromate Primer prior to two coats of finish paint. Armaflex type insulation on exposed pipes shall be painted with two coats of latex base paint equal to SW-PROMAR 200 Latex flat wall paint tinted to match background color.
- G. Mechanical equipment surfaces with asphalt or bitumen coating shall be sealed with an approved asphalt sealer and painted with two coats of SW-KemKromik universal/metal primer, B5ONZ6.
- H. The Architect shall have the right to select in addition to scheduled colors, deep, accent colors for one or more walls, bulkheads, columns, or other features in any of the spaces on the project, up to 2500 sq ft of area.
- I. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- J. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
- K. Sand wood and metal surfaces lightly between coats to achieve required finish.
- L. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior applying next coat.
- M. Paint front and back sides of access panels, and removable or hinged covers.
- N. Protect work of other trades, whether being coated or not, against damage from coating.

3.4 CLEANING

- A. Collect waste material that may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 SCHEDULE - COLORS

- A. Color schemes will be prepared by the Architect after receipt of approved manufacturer's color samples. See Architectural Finish Schedule and Finish Plans for the number of paint colors used- 12 colors.
- B. Samples of work receiving natural or stained finish shall be submitted for Architect's review and selection.

END OF SECTION

SECTION 107300 PROTECTIVE COVERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, General Requirements, of these Specifications, apply to work specified in this section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Covered walkway system; including frames, drainage system and roof deck assembly.
 - 2. Pitched roof with roll-formed aluminum roof panels.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 03, "Cast-in-Place Concrete," for concrete for post footings.
 - 2. Division 26, Electrical, for lighting mounted to soffit of walkway system.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design, engineer, fabricate, and install covered walkway system to withstand the structural loads required under the State Building Code without exceeding the allowable design working stresses of the materials involved, including anchors and connections.

1.4 SUBMITTALS

- A. Product Data: Submit for each type of protective cover and accessory indicated. Indicate roof panel type, fascia profile, framing components and accessories.
- B. Shop Drawings: Submit shop drawings indicating layout of covered walkway coordinated with field measurements and including frame heights, roof slopes, overall dimensions, connections and relationship to adjoining work, accessories, types of materials, and finishes. Indicate work by others required for complete installation.
- C. Certification: Submit design calculations prepared and sealed by registered (structural) Professional Engineer licensed in the State of Virginia indicating structure complies with wind criteria of ANSI/ASCE 7-88, stability and loading requirements of building code and all other governing criteria.
- D. Color Samples: Submit printed or coated metal samples of complete color range offered for Architects selection.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer to perform unit of work of this section who has specialized in the installation of types of protective covers similar to that required for this project and who is acceptable to, or certified by, manufacturer of protective covers.
- B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel" and D1.3 "Structural Welding Code - Sheet Steel."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Check actual dimensions of construction affecting protective covers by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work. Provide approved layout drawings and column base inserts or form-outs for installation of concrete foundations.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Peachtree Protective Covers, Inc.
 - 2. Dittmer Architectural Aluminum
 - 3. Mapes Architectural Products
 - 4. Perfection Architectural Systems Inc.
 - 5. Superior Metal Products Co.

2.2 MATERIALS

- A. Aluminum Sheet: ASTM B 209
- B. Aluminum Tubing: ASTM B 429, 6063 - T6, schedule 40.
- C. Aluminum Extrusions: ASTM B 429, 6063 - T6.
- D. Cast Aluminum (end caps): 319 alloy.
- E. Fasteners: Vibration-proof, of size and material standard with manufacturer.

2.3 CONSTRUCTION

- A. Smoothly round corners, edges, and exposed fasteners to eliminate snagging and pinching hazards. Form exposed sheet metal with flat, flush surfaces, true to line and level, and without cracking and grain separation. Perform welding by operators and processes complying with AWS requirements.

2.4 COVERED WALKWAY

- A. General: Provide manufacturer's standard prefinished metal roofing covered walkway system fabricated to comply with requirements indicated. Provide all

roof deck, fascia, and frames ("bents") consisting of beams and columns with integral (internal) rainwater drainage system. Include all accessories, closure and trim pieces, anchors and connection devices required for complete assembly.

- B. Frame Height: Sloped roof deck, heights as indicated on drawings.
- C. Support Structure: All structural fabrication shall be extruded anodized aluminum sections made of 6063-T6 aluminum alloy, and having a minimum wall thickness of 0.125 inches. Provide frames ("bents") fabricated from anodized beams and columns as either all-welded rigid frames or mechanically joined sections as determined by manufacturer (fabricator) and in accordance with final shop drawings. Provide column sleeves for presetting into concrete foundation structure.
 - 1. Finish: Provide factory applied 2-coat, thermocured coating system ("Kynar") composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70% polyvinylidene fluoride resin by weight; conforming to AAMA 2605 (formerly 605.2). Finish color will be selected from manufacturer's full range of color offerings.
 - 2. Provide frame configuration indicated for installation, including those required for angled or corner conditions.
 - 3. Provide extruded aluminum wall angle for wall supported applications as indicated.
- D. Extruded Aluminum Roof Deck: Provide interlocking structural deck system fabricated of anodized 6063-T6 aluminum alloy and having a minimum wall thickness of 0.065 inches. All splices shall occur at supports; splices in other locations will not be permitted.
 - 1. Provide manufacturer's standard 3-1/2" deep flat bottom deck section for flat soffit.
 - 2. Provide manufacturer's standard anodized extruded aluminum fascia of profile indicated.
 - 3. Metal Roofing Finish: Provide factory applied 2-coat, thermocured coating system ("Kynar") composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70% polyvinylidene fluoride resin by weight; conforming to AAMA 2605 (formerly 605.2). Finish color will be selected from manufacturer's full range of color offerings.
 - 4. Hardware: All connections shall be made with standard corrosion resistive fasteners.
 - 5. Drainage: Internal drainage in column shall connect to site drainage below grade. Provide 3" diameter aluminum pipe extension welded to column.

2.5 FOUNDATIONS FOR COVERED WALKWAYS

- A. Provide concrete foundations complying with criteria specified in Section 03 30 00, "Cast-in-Place Concrete." Footings for the bent frame assembly shall provide sufficient bearing area at the bottom to support all loads of the covered walkway. Footing design is based on 3,000 PSF allowable soil pressure unless otherwise instructed in the soil data, such as, but not limited to, adverse soil conditions, high water table, underground obstructions and other conditions, to permit bidders reasonable evaluation of the site conditions. Foundation concrete shall attain minimum working strength of 3,000 pounds per square inch at 28 days.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install protective covers to comply with manufacturer's instructions and final shop drawings. Provide accessories indicated and anchors, fasteners, inserts, and other items required for installation of units and permanent attachment of units to adjoining construction.
- B. Adjust frames prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and wall angles to building construction as follows:
 - 1. Anchor posts in concrete by means of column sleeves preset and anchored into concrete. Insert posts into sleeves, and fill annular space between post and sleeve solid with non-shrink nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's directions. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8 inch build-up, sloped away from post. For installations exposed on exterior, or to flow of water, seal anchoring material to comply with grout manufacturer's directions.
 - 2. Anchor wall angles into wall construction with lead expansion shields and bolts or alternate expansion devices sufficient to support loading.

3.2 CLEANING AND PROTECTION

- A. Clean installed protective covers on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensures that protective covers are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 220517
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.
 - 6. Silicone sealants.

1.3 SPECIAL REQUIREMENTS FOR THIS PROJECT

- A. Use of PVC or other types of plastic sleeves are not allowed in return air plenums.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, with plain ends and integral welded waterstop collar.

2.2 STACK-SLEEVE FITTINGS

- A. Description: Manufactured, Dura-coated or Duco-coated galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig minimum.
3. Sealing Elements: EPDM-rubber High-temperature-silicone Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.
- B. Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.
- C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

5. Use silicone sealant to seal the space around outside of stack-sleeve fittings.

- B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Use grout or silicone sealant to seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Schedule 40 black steel.
 - b. Piping and Larger: Schedule 40 black steel.
 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 3. Interior Partitions:
 - a. Piping Smaller Than NPS 6: PVC pipe sleeves or Black Steel.

END OF SECTION

SECTION 220519
METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Liquid-in-glass thermometers.
2. Thermowells.
3. Pressure gages.
4. Gage attachments.
5. Test plugs.
6. Test-plug kits.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.
2. Case: Cast aluminum; 6-inch nominal size.
3. Case Form: Back angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
6. Window: Glass or plastic.
7. Stem: Aluminum or brass and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
8. Connector: 3/4 inch, with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Sealed type; plastic; 4-1/2-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

A. Valves: Brass or stainless steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

A. Description: Test-station fitting made for insertion into piping tee fitting.

B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

- C. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
- D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- E. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.6 TEST-PLUG KITS

- A. Furnish one test-plug kit(s) containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- B. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.
- C. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted pressure gages on panel.
- G. Install valve and snubber in piping for each pressure gage for fluids.
- H. Install test plugs in piping tees.
- I. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Inlet and outlet of each pressure-reducing valve.
 - 3. Suction and discharge of each domestic water pump.
 - 4. As indicated on Drawings.

3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:
 - 1. Liquid-filled, bimetallic-actuated type.
 - 2. Metal case, compact -style, liquid-in-glass type.
 - 3. Test plug with chlorosulfonated polyethylene synthetic EPDM self-sealing rubber inserts.
- B. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping:
 - 1. 0 to 100 deg F.
- B. Scale Range for Domestic Hot-Water Piping:
 - 1. 30 to 240 deg F.

3.6 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at discharge of each water service into building shall be one of the following:
 - 1. Liquid-filled Sealed, -mounted, metal case.
- B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:
 - 1. Liquid-filled Sealed, -mounted, metal case.
 - 2. Test plug with chlorosulfonated polyethylene synthetic EPDM self-sealing rubber inserts.
- C. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:

1. Liquid-filled Sealed, -mounted, metal case.
2. Test plug with chlorosulfonated polyethylene synthetic EPDM self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Water Service Piping:
 1. 0 to 200 psi.
- B. Scale Range for Domestic Water Piping:
 1. 0 to 100 psi.

END OF SECTION

SECTION 221116
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Copper tube and fittings.
 - 2. Ductile-iron pipe and fittings.
 - 3. Piping joining materials.
 - 4. Transition fittings.
 - 5. Dielectric fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.

1.5 FIELD CONDITIONS

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.
- G. Appurtenances for Grooved-End Copper Tubing:
 - 1. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75/B 75M copper tube or ASTM B 584 bronze castings.
 - 2. Mechanical Couplings for Grooved-End Copper Tubing:
 - a. Copper-tube dimensions and design similar to AWWA C606.
 - b. Ferrous housing sections.
 - c. EPDM-rubber gaskets suitable for hot and cold water.
 - d. Bolts and nuts.
 - e. Minimum Pressure Rating: 300 psig.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

- F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Standard: ASSE 1079.
2. Pressure Rating: 125 psig minimum at 180 deg F.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Standard: ASSE 1079.
2. Factory-fabricated, bolted, companion-flange assembly.
3. Pressure Rating: 125 psig minimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Nonconducting materials for field assembly of companion flanges.
2. Pressure Rating: 150 psig.
3. Gasket: Neoprene or phenolic.
4. Bolt Sleeves: Phenolic or polyethylene.
5. Washers: Phenolic with steel backing washers.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- H. Install domestic water piping level without pitch and plumb.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

- M. Install piping to permit valve servicing.
- N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- O. Install piping free of sags and bends.
- P. Install fittings for changes in direction and branch connections.
- Q. Install PEX tubing with loop at each change of direction of more than 90 degrees.
- R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."
- T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."
- U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- G. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- H. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Square cut groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- I. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- J. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Piping: Join according to ASTM D 2855.
- K. Joints for PEX Tubing: Join according to ASTM F 1807 for metal insert and copper crimp ring fittings and ASTM F 1960 for cold expansion fittings and reinforcing rings.
- L. Joints for PEX Tubing: Join according to ASSE 1061 for push-fit fittings.
- M. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges flange kits.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install hangers for copper piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- C. Install vinyl-coated hangers for PEX tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Support horizontal piping within 12 inches of each fitting.
- E. Support vertical runs of copper piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- F. Support vertical runs of PEX tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 - 4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.9 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. Hard or soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
- F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed soldered joints.
- G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L ASTM B 88, Type M; cast- or wrought-copper, solder-joint fittings; and brazed soldered joints.

END OF SECTION

SECTION 221519
GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Lubricated, reciprocating air compressors.
2. Oil-flooded, rotary-screw air compressors.
3. Inlet-air filters.

1.2 DEFINITIONS

- A. Actual Air: Air delivered from air compressors. Flow rate is delivered compressed air measured in acfm.
- B. Standard Air: Free air at 68 deg F and 1 atmosphere before compression or expansion and measured in scfm.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.

2.2 GENERAL REQUIREMENTS FOR PACKAGED AIR COMPRESSORS AND RECEIVERS

- A. General Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors and receivers that deliver air of quality equal to intake air.
- B. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 and UL 508.
 - 1. Enclosure: NEMA ICS 6, Type 12 control panel unless otherwise indicated.
 - 2. Motor Controllers: Full-voltage, combination magnetic type with undervoltage release feature and motor-circuit-protector-type disconnecting means and short-circuit protective device.
 - 3. Control Voltage: 120-V ac or less, using integral control power transformer.
 - 4. Motor Overload Protection: Overload relay in each phase.
 - 5. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
 - 6. Automatic control switches to alternate lead-lag compressors for duplex sequence lead-lag compressors for multiplex air compressors.
 - 7. Instrumentation: Include discharge-air pressure gage, air-filter maintenance indicator, hour meter, compressor discharge-air and coolant temperature gages, and control transformer.
 - 8. Alarm Signal Device: For connection to alarm system to indicate when backup air compressor is operating.
- C. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 1. Pressure Rating: At least as high as highest discharge pressure of connected compressors, and bearing appropriate code symbols.
 - 2. Interior Finish: Corrosion-resistant coating.
 - 3. Accessories: Include safety valve, pressure gage, drain, and pressure-reducing valve.
- D. Mounting Frame: Fabricate mounting and attachment to pressure vessel with reinforcement strong enough to resist packaged equipment movement during a seismic event when base is anchored to building structure.

2.3 LUBRICATED, RECIPROCATING AIR COMPRESSORS

- A. Compressor(s): Lubricated, reciprocating-piston type with lubricated compression chamber and crankcase.
 - 1. Submerged gear-type oil pump.
 - 2. Oil filter.
 - 3. Combined high discharge-air temperature and low lubrication-oil pressure switch.
 - 4. Belt guard totally enclosing pulleys and belts.
- B. Capacities and Characteristics:

1. Discharge-Air Pressure: 175 psig.
2. Mounting: Freestanding.
3. Motor (Each Air Compressor):
4. Receiver: ASME construction steel tank.

2.4 INLET-AIR FILTERS

- A. Description: Combination inlet-air filter-silencer, suitable for remote installation, for each air compressor.
 1. Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.
 2. Capacity: Match capacity of air compressor, with filter having collection efficiency of 99 percent retention of particles larger than 10 micrometers.
- B. Description: Combination inlet-air filter-silencer, suitable for remote installation, for multiple air compressors.
 1. Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.
 2. Capacity: Match total capacity of connected air compressors, with filter having collection efficiency of 99 percent retention of particles larger than 10 micrometers.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Equipment Mounting:
 1. Install air compressors and air dryers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
 2. Install water-cooled, compressed-air aftercoolers and desiccant compressed-air dryers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
 3. Comply with requirements for vibration isolation and seismic control devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment"
 4. Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."
- B. Install compressed-air equipment anchored to substrate.
- C. Arrange equipment so controls and devices are accessible for servicing.
- D. Maintain manufacturer's recommended clearances for service and maintenance.

E. Install the following devices on compressed-air equipment:

1. Thermometer, Pressure Gage, and Safety Valve: Install on each compressed-air receiver.
2. Pressure Regulators: Install downstream from air compressors and dryers.
3. Automatic Drain Valves: Install on aftercoolers, receivers, and dryers. Discharge condensate over nearest floor drain.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221513 "General-Service Compressed-Air Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to machine, allow space for service and maintenance.

3.3 IDENTIFICATION

- A. Identify general-service air compressors and components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

END OF SECTION

SECTION 230000
BASIC HVAC REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes Basic Mechanical Requirements applicable to all Division 23 Sections.

1.2 REQUIREMENTS FOR THIS PROJECT

- A. Contractor shall be familiar with the required Codes as required to perform the Work.
- B. Contractor shall be familiar with Owner's requirements.

1.3 PRODUCTS

- A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

1.4 MANUFACTURER INSTALLATION INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting and finishing to Architect/Engineer in quantities specified for product data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.5 MANUFACTURER CERTIFICATES

- A. When specified in individual specification sections, submit certification by manufacturer to Architect/Engineer in quantities specified for product data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or product but must be acceptable to Architect/Engineer.

1.6 REGULATORY REQUIREMENTS

- A. Conform to:
 - 1. The Virginia Uniform Statewide Building Code (VUSBC) including referenced codes and standards.
 - 2. Industry Standards, Codes and Specifications:
 - a. ANSI: American National Standards Institute.
 - b. ARI: Air-Conditioning and Refrigeration Institute.

- c. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers.
- d. ASME: American Society of Mechanical Engineers.
- e. ASTM: American Society for Testing and Materials.
- f. AWS: American Welding Society.
- g. AWWA: American Water Works Association.
- h. CISPI: Cast Iron Soil Pipe Institute.
- i. ICC: International Code Council, Inc.
- j. MSS: Manufacturers Standardization Society of the Valve & Fittings Industry, Inc.
- k. NAIMA: North American Insulation Manufacturers Association.
- l. NBS: National Bureau of Standards.
- m. NFPA: National Fire Protection Association.
- n. SMACNA: Sheet Metal and Air Conditioning Contractors.
- o. UL: Underwriters Laboratories, Inc.
- p. USASI: United States of America Standards Institute.
- q. VDOT: Virginia Department of Transportation.

B. Obtain permits and request inspections from authority having jurisdiction.

1.7 PROJECT/SITE CONDITIONS

- A. Install work in locations shown on drawings, unless prevented by project conditions. The drawings show the general arrangement of all piping, ductwork, equipment and appurtenances and shall be followed as closely as actual building construction and the work of other trades will permit. The work shall conform to the requirements shown on all of the drawings. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange the work accordingly, providing such fittings, valves, offsets, transitions and other accessories as may be required to meet such conditions.
- B. Prepare drawings showing proposed re-arrangement of work to meet project conditions, including changes to work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

1.8 EXCAVATION AND BACKFILLING FOR HVAC WORK

- A. Provide excavation and backfilling required for HVAC work in accordance with the requirements of Division 31 Sections.

1.9 PAINTING

- A. Refer to Section 099000 Painting: Product and execution requirements for painting specified by this section.
- B. HVAC equipment, related piping, ductwork and materials do not require painting except as indicated below:
 - 1. Painting is not required for equipment having a factory applied finish except touch-up with matching finish where factory finish is damaged.

2. Piping (except insulated and jacketed piping), fabricated supports, and any unfinished or unprotected materials located outdoors shall be painted with a suitable primer and compatible finish paint. Color shall be as directed by Architect/Engineer.
 3. Paint inside of ductwork with matte black paint where visible behind air inlets and outlets.
- C. Protection of work: Painting shall be done with care to protect work and work of other trades. All damage caused by the painting operations shall be corrected, repaired and cleaned as required. Hardware, special control items, gages, thermometers, nameplates, instrument glass and other similar items shall be removed or properly protected during the painting operation to ensure that these items are not covered or splattered with paint.

1.10 ELECTRICAL PROVISIONS

- A. Low voltage (less than 100 volts) control wiring and connections for equipment specified in Division 23 shall be provided per Division 23.
- B. All line voltage (100 volts and greater) field control wiring and connections for equipment furnished per Division 23, and all power wiring, and all related electric supply and disconnecting equipment and wiring shall be provided per Division 26.
- C. Line voltage field wiring for equipment furnished under Division 23 shall be accomplished under the supervision of the Division 26 subcontractor.

1.11 WARRANTY

- A. All materials and workmanship shall be warranted to be free from defects for a minimum period of one (1) year from date of acceptance and Contractor shall make good, without additional cost to the Owner, any defects which may appear within that period. Manufacturer's warranties extending beyond one year shall be processed and turned over to the Owner.
- B. Refer to specific specification sections for additional warranty requirements.

1.12 CLOSEOUT PROCEDURES: OPERATION AND MAINTENANCE MANUALS

- A. Comply with requirements of Division 1 Sections and the following requirements.
- B. Submit data on 8-1/2 x 11-inch pages in a digital format using "pdf" type files.
- C. Prepare cover sheet with printed title "Operation and Maintenance Instructions", title or project, and subject matter of binder when multiple binders are required.
- D. Internally subdivide the binder contents with permanent page dividers, logically organized, with minimum content as described below.
- E. Contents:
 1. Name of manufacturer.

2. Name, address and telephone number of nearest manufacturer's representative.
 3. Copy of latest approved submittal including all review comments.
 4. Manufacturer's installation, operation and maintenance instructions including lubrication data.
 5. Parts numbers for all replaceable items.
 6. Serial numbers of all principal items of equipment.
 7. Control diagrams and sequence of operation.
 8. Manufacturer's written warranties that extend beyond the Contractor's one year warranty.
- F. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect/Engineer will return copy with comments.
- G. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect/Engineer [and Commissioning Authority] will comment on whether general scope and content of manual are acceptable. Revise content of all document sets as required prior to final submittal.
- H. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect/Engineer will return copy with comments.

PART 2 PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. Dimensions: The Contractor shall verify that items to be furnished fit the space available. He shall make field measurements to ascertain space requirements, including those for connections and maintenance, and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the drawings and specifications. Should he conclude that there is insufficient space for installation of specified materials, he shall immediately notify the Architect/Engineer of the conflict and shall stop affected work until he receives instructions as to how to proceed from the Architect/Engineer.
- B. When substitution of equipment or materials requires changes or revisions to the arrangement, layout or design of any system, drawings showing these changes or revisions shall be submitted for review, along with other required submittal data. The costs of all such changes and revisions shall be borne by the Contractor.
- C. Similar items shall be provided by a single manufacturer.

2.2 EQUIPMENT ACCESSORIES

- A. The Contractor shall furnish and install all equipment, accessories, connections and incidental items necessary to fully complete the work ready for use, occupancy and operation by the Owner.
- B. Equipment or Connections Different from those Shown: Where equipment requiring different arrangement of connections from those shown is proposed by the Contractor, and is acceptable to the Architect/Engineer, it shall be the responsibility of the Contractor to install the equipment to operate properly and in harmony with the intent of the drawings and specifications. The Contractor shall make all incidental changes in piping, ductwork, supports, insulation, heaters, controls and other associated facilities. He shall provide all additional equipment required for proper operation of the system, including all required changes in affected trades. The Contractor shall be responsible for the proper location of rough-in and connections. All such changes shall be made at no increase in cost to the Owner.
- C. Supports: The Contractor shall support plumb, rigid, and true to line all work and equipment furnished. The Contractor shall study thoroughly all general, structural and HVAC (mechanical) drawings, shop drawings and catalog data to determine how equipment, fixtures, piping, ductwork, etc., are to be supported, mounted or suspended and shall provide extra steel bolts, inserts, pipe stands, brackets and accessories for proper support whether or not shown on the drawings. When directed, the Contractor shall submit drawings showing supports for review by the Architect/Engineer.
- D. Concrete Equipment Bases (Housekeeping Pads): Refer to Section 230529 Hangers and Supports for HVAC Piping and Equipment.

PART 3 EXECUTION

3.1 INSTALLATION OF EQUIPMENT

- A. All equipment and materials specified in this Division shall be installed in accordance with the manufacturer's instructions including, but not limited to, the following:
 - 1. Storage, handling, rigging, and installation shall be accomplished using means and methods recommended by the manufacturer.
 - 2. Location and orientation of equipment shall provide the indicated operation and performance and shall also provide the recommended unobstructed clearances around equipment for maintenance and repair.
 - 3. Provide accessories and incidental materials recommended by the manufacturer.

3.2 COORDINATION

- A. Offsets, transitions and changes in direction in pipes and ducts shall be made as required to maintain proper head room, clearances and pitch of sloping lines whether or not indicated on the drawings. The Contractor shall furnish and install

all fittings, traps, drains, air vents, etc., as required to effect these offsets, transitions and changes in direction.

- B. Ductwork: Exact arrangement and routing of ductwork shall be determined at the job site prior to beginning fabrication of any ductwork. The Contractor shall provide offsets and transitions, and change the cross-sectional dimensions of ductwork when required to meet job conditions but shall maintain at least the same equivalent cross-sectional area. The Contractor shall secure the approval of the Architect/Engineer prior to fabrication of ductwork requiring such changes.
- C. Drawings by the Contractor: When directed by the Architect/Engineer, the Contractor shall submit for review drawings clearly showing certain portions of the HVAC work and the relation to the work of other trades before commencing shop fabrication or erection at the project site.

3.3 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to project site identified with names, model numbers, types, grades, compliance labels, and other information needed for distinct identification; adequately packaged and protected to prevent damage during shipment, storage and handling. Protect stored equipment and materials from damage. Comply with manufacturer's rigging and moving instructions for unloading equipment and moving into final location.

3.4 HEATING SYSTEMS START-UP

- A. When the initial start-up of heating systems occurs during cold weather, the Contractor shall provide and operate temporary heating equipment to heat the building, or the appropriate areas within the building, to the following minimum temperatures prior to the initial heating systems start-up:
 - 1. All other systems: 55 degrees F.

3.5 COOLING SYSTEMS START-UP

- A. When the initial start-up of cooling systems occurs during warm weather, the Contractor shall provide and operate portable cooling or dehumidification equipment to reduce the indoor air dewpoint to less than 55 degrees F prior to start-up of the building cooling systems.

3.6 DEMOLITION

- A. HVAC work necessary for demolition and renovation in the existing building shall be provided under this section.
 - B. Existing underground utilities serving the building shall remain in service, with relocations and reconnections as necessary for coordination with the new work.
 - C. Work necessary to be performed in, or otherwise affecting the use or comfort of the remaining existing building, shall be coordinated with the occupants' schedule.
- END OF SECTION

SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers - metal, trapeze type.
2. Pipe hangers - FRP.
3. Fastener system - mechanical expansion anchors.
4. Equipment supports.
5. Equipment stands - outdoor type.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.2 MATERIALS

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.
- D. Stainless Steel: ASTM A240/A240M.
- E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.
- F. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000 psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry static loads within specified loading limits. Minimum static design load used for strength determination is to include weight of supported components plus 200 lb.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

- A. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- B. Install lateral bracing with pipe hangers and supports to prevent swaying.
- C. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger. Coordinate location of concrete inserts before concrete is placed.
- D. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- E. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- F. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Thermal hanger shield inserts may be used as an option. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields are to span an arc of 180 degrees.
 - a. Thermal hanger shield inserts may be used as an option. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches long and 0.048 inch thick.
 - b. NPS 4 (DN 100): 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches long and 0.105 inch thick.
 5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
- G. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- H. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 2. Field fabricate in accordance with ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel in accordance with AWS D1.1/D1.1M.
- I. FRP Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.
- J. Strut System Installation: Metal, rod type. Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems. Install in accordance with manufacturer's written installation instructions.
- K. Thermal Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- L. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick after concrete is placed and cured. Use installers that are trained and certified by power tool manufacturer.
 2. Install mechanical-expansion anchors after concrete is placed and completely

- cured.
- 3. Install fasteners in accordance with manufacturer's written instructions.
- 4. Install lag screw wood fasteners in accordance with manufacturer's written instructions.
- M. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- N. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- O. Equipment Support Installation:
 - 1. Fabricate from welded-structural-steel shapes.
 - 2. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
 - 3. Grouting: Place grout under supports for floor-mounted equipment, and make bearing surface smooth.
 - 4. Provide lateral bracing, to prevent swaying.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup:

1. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping

system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with

- insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Use powder-actuated fasteners instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 230548.13
VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric hangers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device component.
3. Annotate to indicate application of each product submitted and compliance with requirements.
4. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads: .

1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
2. Size: Factory or field cut to match requirements of supported equipment.
3. Pad Material: Oil- and water-resistant rubber.
4. Infused nonwoven cotton or synthetic fibers.
5. Sandwich-Core Material: Resilient and elastomeric.
 - a. Infused nonwoven cotton or synthetic fibers.

2.2 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods: .

1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.

2. Damping Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel-to-steel contact.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF VIBRATION AND WIND-LOADCONTROL DEVICES

- A. Provide vibration control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Device Schedules on Drawings, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
- B. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- C. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- D. Equipment Restraints:
 1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
- E. Piping Restraints:
 1. Comply with requirements in MSS SP-127.
 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 3. Brace a change of direction longer than 12 feet.
- F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

- H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- I. Post-Installed Concrete Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.3 ADJUSTING

- A. Adjust isolators after system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION

SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: stainless steel, 0.025-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
2. Letter and Background Color: As indicated for specific application under Part 3.
3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
5. Fasteners: Stainless steel rivets or self-tapping screws.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.
- B. Letter and Background Color: As indicated for specific application under Part 3.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive

backing.

- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:
 - 1. Pipe size.
 - 2. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.
 - 3. Lettering Size: Size letters in accordance with ASME A13.1 for piping.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Locate identifying devices so that they are readily visible from the point of normal approach.

3.2 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

- A. Permanently fasten labels on each item of mechanical equipment.
- B. Sign and Label Colors:
 - 1. White letters on an ANSI Z535.1 safety-blue background.
- C. Locate equipment labels where accessible and visible.
- D. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where arc-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E.

3.3 INSTALLATION OF PIPE LABELS

- A. Install pipe labels showing service and flow direction with permanent adhesive on pipes.
- B. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Within 3 ft. of each valve and control device.
 - 2. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 3. Within 3 ft. of equipment items and other points of origination and termination.
 - 4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft.

in areas of congested piping, ductwork, and equipment.

- C. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.
- D. Flow-Direction Arrows: Use arrows to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- E. Pipe-Label Color Schedule:
 - 1. Refrigerant Piping: White letters on an ANSI Z535.1 safety-blue background.

END OF SECTION

SECTION 230719
HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulation for HVAC piping systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied, if any).

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of manufacturer, fabricator, type, description, and size.

1.4 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.5 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authority having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of

applicable testing agency.

1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials are applied.
- B. Products do not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.
- F. Calcium Silicate: Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C533, Type I.
- G. Flexible Elastomeric: Closed-cell, or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534/C534M, Type I, for tubular materials, Type II for sheet materials.
- H. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.
 1. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ.
 2. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
 3. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 INSULATING CEMENTS

- A. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.
- B. Glass-Fiber and Mineral Wool Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

2.4 ADHESIVES

- A. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.
- B. ASJ Adhesive and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.

2.5 MASTICS AND COATINGS

- A. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 - 2. Service Temperature Range: 0 to plus 180 deg F.
 - 3. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
 - 4. Color: White.

2.6 LAGGING ADHESIVES

- A. Lagging Adhesives: Adhesives comply with MIL-A-3316C, Class I, Grade A, and are compatible with insulation materials, jackets, and substrates.
 - 1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 - 2. Service Temperature Range: 20 to plus 180 deg F.

2.7 SEALANTS

- A. Joint Sealants:
 - 1. Permanently flexible, elastomeric sealant.
 - a. Service Temperature Range: Minus 150 to plus 250 deg F.
 - b. Color: White or gray.
- B. FSK and Metal Jacket Flashing Sealants:
 - 1. Fire- and water-resistant, flexible, elastomeric sealant.
 - 2. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 3. Color: Aluminum.

2.8 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

2.9 FIELD-APPLIED JACKETS

- A. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Adhesive: As recommended by jacket material manufacturer.
 - 2. Color: White.
 - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- B. Metal Jacket:
 - 1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.10 FIELD-APPLIED FABRIC REINFORCING MESH

- A. Woven Glass-Fiber Mesh: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

2.11 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Cloth: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.12 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
- B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

2.13 SECUREMENTS

- A. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.

3.2 PREPARATION

- A. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - 2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- B. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.
- D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
 - 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-

- sealing lap. Staple laps with outward-clinching staples along edge at 2 inches o.c.
4. For below-ambient services, apply vapor-barrier mastic over staples.
 5. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
 6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using prefabricated fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with prefabricated fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation conforms to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF CALCIUM SILICATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure single-layer insulation with stainless steel bands at 12-inch intervals, and tighten bands without deforming insulation materials.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless steel bands at 12-inch intervals.
3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.
4. Finish flange insulation same as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When prefabricated insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
3. Finish fittings insulation same as pipe insulation.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install pipe insulation, quads, hex sections, or beveled lag segments, adhered together, of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
2. Install insulation to flanges as specified for flange insulation application.
3. Finish valve and specialty insulation same as pipe insulation.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands

- without deforming insulation materials.
- 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
- 3. For insulation with jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
- 4. For insulation with jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

- 1. Install prefabricated pipe insulation to outer diameter of pipe flange.
- 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
- 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.
- 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

- 1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
- 2. When preformed sections of insulation are not available, install mitered or routed sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

- 1. Install prefabricated sections of cellular-glass insulation to valve body.
- 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
- 3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

- 1. Install pipe insulation to outer diameter of pipe flange.
- 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
- 3. Fill voids between inner circumference of flange insulation and outer

- circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
 2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF GLASS-FIBER AND MINERAL WOOL INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
 4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install prefabricated pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap

seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless steel bands at 12-inch intervals, and tighten bands without deforming insulation materials.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless steel bands at 12-inch intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets with vapor retarder on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block

insulation of same material and thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated insulation sections, or mitered or routed fittings, of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.10 INSTALLATION OF POLYISOCYANURATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with tape or bands and tighten without deforming insulation materials. Orient longitudinal joints between half sections in 3- and 9-o'clock positions on the pipe.
2. For insulation with jackets with vapor barriers, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive or tape, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic.
3. All insulation is tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, and same thickness as that of adjacent pipe insulation, not to exceed 1-1/2-inch thickness.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyisocyanurate block insulation of same thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.

C. Insulation Installation on Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of polyisocyanurate insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.11 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.12 INSTALLATION OF POLYSTYRENE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation with tape or bands and tighten bands without

deforming insulation materials. Orient longitudinal joints between half sections in 3- and 9-o'clock positions on the pipe.

2. For insulation with jackets with vapor barriers, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive or tape, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic.
3. All insulation is tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, and make thickness same as that of adjacent pipe insulation, not to exceed 1-1/2 inches.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polystyrene block insulation of same thickness that of as pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated section of polystyrene insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.13 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.

5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated and for horizontal applications, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.
- E. Where PVDC jackets are indicated, install as follows:
 1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
 2. Wrap presized jackets around individual pipe insulation sections, with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
 3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
 4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
 5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.14 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless steel jackets.

3.15 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- E. All insulation applications will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

3.16 PIPING INSULATION SCHEDULE, GENERAL

- A. Insulation conductivity and thickness per pipe size comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.
- B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.17 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
 - 1. All Pipe Sizes: Insulation is the following:
 - a. Flexible Elastomeric: 3/4 inch thick.
- B. Refrigerant Suction and Hot-Gas Piping:
 - 1. All Pipe Sizes: Insulation is the following:

- a. Flexible Elastomeric: 1 inch thick.
- C. Refrigerant Suction and Hot-Gas Flexible Tubing:
 - 1. All Pipe Sizes: Insulation is the following:
 - a. Flexible Elastomeric: 2 inches thick.
- D. Refrigerant Liquid Piping:
 - 1. All Pipe Sizes: Insulation is the following:
 - a. Flexible Elastomeric: 1 inch thick.

3.18 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping:
 - 1. All Pipe Sizes: Insulation is the following:
 - a. Flexible Elastomeric: 2 inches thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing:
 - 1. All Pipe Sizes: Insulation is the following:
 - a. Flexible Elastomeric: 2 inches thick.
- C. Refrigerant Liquid Piping:
 - 1. All Pipe Sizes: Insulation is the following:
 - a. Flexible Elastomeric: 1 inch thick.

3.19 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
 - 1. PVC: 20 mils thick.

3.20 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
 - 1. Aluminum, Smooth: 0.020 inch thick.

END OF SECTION

SECTION 233113
METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings - single wall.
2. Sheet metal materials.
3. Sealants and gaskets.
4. Hangers and supports.
5. Strut support system for ductwork - metal, cable type.

B. Related Requirements:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Airstream Surfaces: Surfaces in contact with airstream comply with requirements in ASHRAE 62.1.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- D. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 RECTANGULAR DUCTS AND FITTINGS

A. Rectangular Ducts and Fittings - Single Wall:

1. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on static-pressure class indicated on the Drawings.
 - a. Construct ducts of galvanized sheet steel.
2. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
 - b. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
3. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
4. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods. Sheet metal materials are to be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 1. Galvanized Coating Designation: G90.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
 3. Lockforming Quality: Sheet steel and galvanized coating is to be able to be formed with back-to-back bends in seams such as the Pittsburgh lock at high speed without cracking or flaking of the coating on the outside of the bend.

- C. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.
- D. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish is to be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.
- E. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- F. Factory- or Shop-Applied Antimicrobial Coating:
 - 1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating is to be applied to the exterior surface.
 - 2. Antimicrobial compound is to be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 - 3. Coating containing the antimicrobial compound is to have a hardness of 2H, minimum, when tested in accordance with ASTM D3363.
 - 4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
 - 5. Shop-Applied Coating Color: Black.
 - 6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.
- G. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- H. Tie Rods: Galvanized steel, 1/4-inch- minimum diameter for lengths 36 inches or less; 3/8-inch- minimum diameter for lengths longer than 36 inches.

2.4 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
- D. Steel Cables for Stainless Steel Ducts: Stainless steel complying with ASTM A492.
- E. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- G. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless Steel Ducts: Stainless steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.
- H. Strut Support System for Ductwork - Metal, Cable Type:
 - 1. Source Limitations: Obtain metal cable type strut support system for ductwork from single manufacturer.
 - 2. Description: Factory-fabricated ductwork support system consisting of cable clamps, slotted channel brackets, wire-rope suspension components, and associated accessories for a complete ductwork suspension system. No tools required for manual assembly in the field to support ductwork routing.
 - 3. Components:
 - a. Brackets: Slotted steel channels furnished in pre-cut lengths to suit specific system application for Project.
 - b. Suspension Components: Hanging cables with adjustable fasteners.
 - 1) Wire Rope: High-tensile-steel wire rope, complying with ASTM A1023; lengths, diameters, and wire construction to accommodate design loads.
 - a) Foot attachment type to suit application.
 - b) End Fix Type: Loop , strap hook , eyelet or.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and

perpendicular to building lines.

- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.
- K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation.
- M. Elbows: Use long-radius elbows wherever they fit.
 - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
 - 2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.
- N. Branch Connections: Use lateral or conical branch connections.
- O. Installation of Metal, Cable-Type Strut Support System for Ductwork: Install in accordance with manufacturer's written installation instructions.

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC."
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 ft..
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 INSTALLATION OF SEISMIC-RESTRAINT DEVICES

- A. See Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraint installation requirements.

3.5 FIELD QUALITY CONTROL

- A. Visually (light source) inspect exhaust duct for leaks.
 - 1. Test for leaks before applying external insulation.

3.6 DUCT SCHEDULE (if not pre-assembled manufactured system)

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
 - 1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
- B. Exhaust Ducts:
 - 1. Ducts Connected to Fans Exhausting:
 - a. Pressure Class: Negative 1-inch wg.

END OF SECTION

SECTION 233300
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Backdraft and pressure relief dampers.
 2. Flexible connectors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Construction details, material descriptions, and dimensions of individual components.
 2. For dampers, include housings, linkages, and operators.

PART 2 - PRODUCTS

2.1 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Description: Gravity balanced with adjustable counterweight or with spring.
- B. Performance:
1. Maximum Air Velocity: 2000 fpm.
 2. Maximum System Pressure: 3 inches wg.
 3. Leakage:
 - a. Class II: Leakage is not to exceed 10 cfm/sq. ft. against 1 inch wg differential static pressure.
- C. Construction:
1. Frame:
 - a. Hat shaped.
 - b. 16-gauge- thick, galvanized sheet steel, with welded or mechanically attached corners and mounting flange.
 2. Blades:
 - a. Multiple single-piece blades.
 - b. Center pivoted, maximum 6-inch width, 16-gauge- thick, galvanized sheet

steel with sealed edges.

- 3. Blade Action: Parallel.
- D. Blade Seals: Extruded vinyl, mechanically locked.
- E. Blade Axles:
 - 1. Material: Stainless steel.
 - 2. Diameter: 0.50 inch.
- F. Tie Bars and Brackets: Galvanized steel.
- G. Counterbalance: Adjustable counterweight.
- H. Bearings: Steel ball or synthetic pivot bushings.
- I. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Chain pulls.
 - 4. 90-degree stops.
 - 5. Screen:
 - a. Mounting:
 - 1) Front mounted in sleeve.
 - a) Sleeve Thickness: 20 gauge minimum.
 - b) Sleeve Length: 6 inches minimum.
 - b. Material: Aluminum.
 - c. Type: Bird.

2.2 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Performance:
 - a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1 inch wg differential static pressure.
 - 2. Construction:
 - a. Linkage out of airstream.
 - b. Suitable for horizontal or vertical airflow applications.
 - 3. Frames:

- a. Hat-shaped, 16-gauge- thick, galvanized sheet steel
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 4. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized steel; 16 gauge thick.
- 5. Blade Axles: Galvanized steel.
- 6. Bearings: Oil-impregnated stainless steel sleeve.
 - a. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.
- 7. Tie Bars and Bracks: Galvanized steel.
- 8. Locking device to hold damper blades in a fixed position without vibration.

2.3 DUCT FLEXIBLE CONNECTORS

- A. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials are to have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.
- B. Airstream Surfaces: Surfaces in contact with the airstream are to comply with requirements in ASHRAE 62.1.
- C. Materials: Flame-retardant or noncombustible fabrics.
- D. Coatings and Adhesives: Comply with UL 181, Class 1.
- E. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- F. Indoor System, Duct Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.

2.4 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G90.

- 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304, and having a No. 2 finish for concealed ducts.
- C. Aluminum Sheets: Comply with ASTM B209/B209M, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

PART 3 - EXECUTION

3.1 INSTALLATION OF AIR DUCT ACCESSORIES

- A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install flexible connectors to connect ducts to equipment.
- F. Install duct test holes where required for testing and balancing purposes.
- G. Install in indoor applications only. Do not install flexible duct in locations where it will be exposed to UV rays.
- H. Where flexible duct is to be installed in locations where it will be exposed to UV rays, install only duct that is specifically made for this use and is has been so marked by the manufacturer.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

END OF SECTION

SECTION 233400
HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fans, centrifugal, inline - square.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
 - a. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
 - b. Rated capacities, furnished specialties, and accessories for each fan.
 - c. Fans:
 - 1) Certified fan performance curves with system operating conditions indicated.
 - 2) Certified fan sound-power ratings.
 - 3) Fan construction and accessories.
 - 4) Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 5) Fan speed controllers.
 - d. Material thickness and finishes, including color charts.
 - e. Dampers, including housings, linkages, and operators.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fans and ventilators, include the following:

1. Operation in normal and emergency modes.
2. Operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.

C. Capacities and Characteristics:

1. Fan Type: Square, inline, centrifugal.
2. Blade Type: Backward inclined, curved.
3. Airflow: 41.
4. Total Static Pressure: 0.25 in..
5. Class: AMCA 99, Section 14, Class I.
6. Drive Type: Direct.
7. Discharge Arrangement: Inline.
8. Housing Material: Reinforced steel.
9. Housing Coating: None.
10. Wheel Size (Diameter): 11 in.
11. Wheel Material: Aluminum.
12. Wheel Coating: None.
13. Brake Horsepower: 0.05.
14. Fan rpm: 1250.
15. Motor:
 - a. Motor Enclosure: Totally enclosed, air over.
 - b. Suitable for Use with Variable-Frequency Drive: Yes.

2.2 FANS, CENTRIFUGAL, INLINE - SQUARE

A. Source Limitations: Obtain square inline centrifugal fans from single manufacturer.

B. Description: Square-housing in-line centrifugal fans.

C. Standards: Comply with UL 705.

D. Housing:

1. Housing Material: Aluminum.
2. Housing Construction: Side panels are to be easily removable for service. Include inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

E. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

F. Fan Wheels: Aluminum airfoil blades welded to aluminum hub.

G. Motor Enclosure: Totally enclosed, air over.

H. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.

2. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
3. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
4. Companion Flanges: For inlet and outlet duct connections.
5. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
6. Motor: Epoxy-coated steel.

2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230500 "Common Work Results for HVAC."

2.4 SOURCE QUALITY CONTROL

- A. AMCA Certification for Fan Sound Performance Rating: Test, rate, and label in accordance with AMCA 311.
- B. Fan Operating Limits: Classify fans in accordance with AMCA 99, Section 14.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install fans level and plumb.
- B. Disassemble and reassemble units, as required for moving to the final location, in accordance with manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. Equipment Mounting:
 1. Support duct-mounted and other hanging fans directly from the building structure, using suitable hanging systems as specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
 2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Install units with adequate clearances for service and maintenance.
- F. Label fans in accordance with requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 ELECTRICAL CONNECTIONS

- A. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate is to be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
 - 2. Nameplate is to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.3 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.

3.4 CLEANING

- A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Test and adjust controls and safeties.
 - 3. Fans and components will be considered defective if they do not pass tests and inspections.
 - 4. Prepare test and inspection reports.

END OF SECTION

SECTION 238126
SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Split-system air-conditioners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product:

1. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

- a. For Compressor: Five year(s) from date of Substantial Completion.
- b. For Parts: One year(s) from date of Substantial Completion.
- c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SPLIT-SYSTEM AIR-CONDITIONERS

A. Indoor Units (5 tons (18 kW) or Less):

1. Concealed Evaporator-Fan Components:

- a. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
- b. Insulation: Faced, glass-fiber duct liner.
- c. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
- d. Fan Motors:
 - 1) Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230500 "Common Work Results for HVAC."
 - 2) Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - 3) Wiring Terminations: Connect motor to chassis wiring with plug connection.
- e. Filters: Permanent, cleanable.
- f. Condensate Drain Pans:
 - 1) Fabricated with 1 percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - a) Depth: A minimum of 2 inches deep.
 - 2) Single-wall, stainless steel sheet.
 - 3) Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - a) Minimum Connection Size: NPS 1.
 - 4) Pan-Top Surface Coating: Asphaltic waterproofing compound.
 - 5) Units with stacked coils are to have an intermediate drain pan to collect condensate from top coil.

B. Outdoor Units (5 tons (18 kW) or Less:

1. Air-Cooled, Compressor-Condenser Components:

- a. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
- b. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor is to have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - 1) Compressor Type: Scroll.
 - 2) Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - 3) Refrigerant Coil: Copper tube, with mechanically bonded aluminum

fins and liquid subcooler. Comply with ARI 206/110.

- c. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
- d. Fan: Aluminum-propeller type, directly connected to motor.
- e. Motor: Permanently lubricated, with integral thermal-overload protection.
- f. Low Ambient Kit: Permits operation down to 45 deg F.
- g. Mounting Base: Polyethylene.

C. Accessories:

1. Thermostat:

- a. Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:
 - 1) Compressor time delay.
 - 2) 24-hour time control of system stop and start.
 - 3) Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
 - 4) Fan-speed selection including auto setting.

- 2. Automatic-reset timer to prevent rapid cycling of compressor.
- 3. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- 4. Drain Hose: For condensate.

PART 3 - EXECUTION

3.1 INSTALLATION OF SPLIT-SYSTEM AIR-CONDITIONERS

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.
- D. Equipment Mounting:
 - 1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
 - 2. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
 - 3. Comply with requirements for vibration isolation devices specified in Section

230548.13 "Vibration Controls for HVAC."

- E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 23 8239.16
PROPELLER UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Propeller unit heaters with hot-water, steam, or electric-resistance heating coils.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 PROPELLER UNIT HEATERS

- A. Heaters: Assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 2021.

2.2 PERFORMANCE REQUIREMENTS

- A. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PROPELLER UNIT HEATERS

- A. Install propeller unit heaters to comply with NFPA 90A.
- B. Install propeller unit heaters level and plumb.
- C. Suspend propeller unit heaters from structure with all-thread hanger rods and elastomeric hangers. Hanger rods and attachments to structure are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Section 230548.13 "Vibration Controls for HVAC."
- D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust initial temperature set points.

END OF SECTION

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Connectors and splices.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Copper building wire.
2. Connectors and splices.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

D. Conductor Insulation:

1. Type THHN and Type THWN-2. Comply with UL 83.
2. Type XHHW-2. Comply with UL 44.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as

defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
2. Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors must be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

1. Copper:
 - a. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
 - b. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

C. ASD Output Circuits Cable: Extra-flexible stranded for all sizes.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway Type XHHW-2, single conductors in raceway.
- B. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION, GENERAL

- A. Complete raceway installation between conductor and cable termination points in accordance with Section 26 05 33.13 "Conduits for Electrical Systems" prior to pulling conductors and cables.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

- E. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inch of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of *assembly*.

END OF SECTION

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grounding and bonding conductors.
2. Grounding and bonding clamps.
3. Grounding and bonding connectors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment Grounding Conductor:

1. General Characteristics: 600 V, wire or cable, green color, in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

2.2 GROUNDING AND BONDING CLAMPS

- A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications.

B. Performance Criteria:

1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2.3 GROUNDING AND BONDING CONNECTORS

A. Performance Criteria:

1. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

3.2 INSTALLATION OF GROUNDING AND BONDING

- A. Comply with manufacturer's published instructions.

3.3 PROTECTION

- A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Support, anchorage, and attachment components.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Sockets.
 - e. Eye nuts.
 - f. Fasteners.
 - g. Anchors.
 - h. Brackets.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch diameter holes at a maximum of 8 inch on center in at least one surface.

PART 3 - EXECUTION

3.1 SELECTION

- A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:
1. NECA NEIS 101
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERM as required by NFPA 70.

3.2 INSTALLATION OF SUPPORTS

- A. Comply with NECA NEIS 101

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 05 50 00 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M. Submit welding certificates.
- D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION

SECTION 260533
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 ACTION SUBMITTALS

A. Product Data: For the following:

1. Wireways and auxiliary gutters.
2. Surface metal raceways.
3. Surface nonmetallic raceways.
4. Cabinets, cutout boxes, and miscellaneous enclosures.

PART 2 - PRODUCTS

2.1 TYPE EMT-S RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 797 and UL Category Control Number FJMX.

2.2 TYPE LFMC RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 360 and UL Category Control Number DXHR.

2.3 TYPE LFNC RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 1660 and UL Category Control Number DXOQ.

2.4 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and

marked for intended location and use.

2.5 SURFACE METAL RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 5 and UL Category Control Number RJBT.

2.6 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 514A and UL Category Control Number QCIT.

B. Metallic Outlet Boxes:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Description: Box with provisions for mounting wiring device directly to box.

2.7 CABINETS, CUTOUT BOXES, JUNCTION BOXES, PULL BOXES, AND MISCELLANEOUS ENCLOSURES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics:
 - a. Non-Environmental Characteristics: UL 50.
 - b. Environmental Characteristics: UL 50E.

B. Indoor Sheet Metal Cabinets:

1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.

C. Indoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

D. Indoor Cast-Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2.8 COVER PLATES FOR DEVICES BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

PART 3 - EXECUTION

3.1 SELECTION OF RACEWAYS

3.2 Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements. SELECTION OF BOXES AND ENCLOSURES

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:

1. Outdoors:
 - a. Type 3R unless otherwise indicated.
2. Indoors:
 - a. Type 1 unless otherwise indicated.

3.3 INSTALLATION OF RACEWAYS

A. Installation Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
3. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
4. Comply with NECA NEIS 101 for installation of steel raceways.
5. Comply with NECA NEIS 102 for installation of aluminum raceways.

B. Raceways Penetrating Rooms or Walls with Acoustical Requirements:

1. Seal raceway openings on both sides of rooms or walls with acoustically rated putty.

3.4 INSTALLATION OF SURFACE RACEWAYS

- A. Install surface raceways only where indicated on Drawings.

3.5 INSTALLATION OF BOXES AND ENCLOSURES

- A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
- B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements.
- C. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- D. Locate boxes so that cover or plate will not span different building finishes.
- E. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
- F. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
- G. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
- H. Set metal floor boxes level and flush with finished floor surface.
- I. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- J. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
 1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
 2. Provide gaskets for wallplates and covers.

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating

recommended by manufacturer.

3.8 CLEANING

- A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION

SECTION 260533.13
CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type ERM-C duct raceways, elbows, couplings, and nipples.
2. Type FMC-S and Type FMC-A duct raceways.
3. Type LFMC duct raceways.
4. Type PVC duct raceways and fittings.
5. Fittings for conduit, tubing, and cable.
6. Electrically conductive corrosion-resistant compounds for threaded conduit.
7. Solvent cements.

1.2 DEFINITIONS

- A. Conduit: A structure containing one or more duct raceways.
- B. Duct Raceway: A single enclosed raceway for conductors or cable.
- C. Duct Bank: An arrangement of conduit providing one or more continuous duct raceways between two points.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Type ERM-C duct raceways, elbows, couplings, and nipples.
2. Type FMC-duct raceways.
3. Type PVC duct raceways and fittings.
4. Fittings for conduit, tubing, and cable.
5. Electrically conductive corrosion-resistant compounds for threaded conduit.
6. Solvent cements.

B. Sustainable design submittals.

1. Solvent cements.

PART 2 - PRODUCTS

2.1 TYPE EMT-S DUCT RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN FJMX; including UL 797.

B. Raceway Color Codes:

Red- Fire Alarm

Orange- Telcom

Blue- 208/120V Power

Purple- Security

2.2 TYPE LFMC DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DXHR; including UL 360.

2.3 TYPE PVC DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DZYR; including UL 651.

2.4 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- 2.

2.5 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 2. Listing Criteria: UL CCN DWTT; including UL 514B.
- B. Source Quality Control:
1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
 2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
- C. UL DWTT - Solvent Cements for Type PVC Duct Raceways and Fittings:

PART 3 - EXECUTION

3.1 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.

3.2 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
1. Type ERM-C-S: Article 344 of NFPA 70 and NECA NEIS 101.
 2. Type FMC-S: Article 348 of NFPA 70 and NECA NEIS 101.
 3. Type LFMC: Article 350 of NFPA 70 and NECA NEIS 101.
 4. Type PVC: Article 356 of NFPA 70 and NECA NEIS 111.
 5. Expansion Fittings: NEMA FB 2.40.
 6. Consult Architect for resolution of conflicting requirements.
- C. Interfaces with Other Work:
1. Coordinate installation of new products for with existing conditions.

END OF SECTION

SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Labels.
2. Extruded insulating tubing.
3. Bands.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 LABELS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN PGDQ2 for components; including UL 969.

B. UL PGDQ2 - Self-Adhesive Labels: thermal, transfer-printed.

2.2 BANDS

A. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

2.3 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.4 CABLE TIES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN ZODZ; including UL 1565 or UL 62275.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 SELECTION OF COLORS AND IDENTIFICATION MARKINGS

- A. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded conductors.
1. Colors for 208Y/120 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 2. Colors for 480Y/277 V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 3. Color for Neutral (Grounded Conductor): White.
 4. Color for Equipment Ground: Green.
- B. Color-Coding Instructional Signs: Self-adhesive labels, including color code for grounded and ungrounded conductors.
- C. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage.
- D. Cover Plates: Label individual cover plates with self-adhesive labels. Place label at top of cover plate. Label cover plate with the following information, in the order listed:
1. Panelboard designation.
 2. Colon or dash.
 3. Branch circuit number.
- E. Equipment Identification Labels:

1. Black letters on white field.
2. Indoor Equipment: Self-adhesive label
3. Outdoor Equipment: Laminated acrylic or melamine sign

F. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 SELECTION OF SIGNS AND HAZARD MARKINGS

- A. Comply with 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs.
- B. Electrical Hazard Warnings:
 1. Arc-Flash Hazard Warning: Self-adhesive labels. Comply with NFPA 70E

3.4 INSTALLATION

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
- D. Verify identity of item before installing identification products.
- E. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- F. Apply identification devices to surfaces that require finish after completing finish work.
- G. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- H. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.
- I. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.
- J. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

- K. Laminated Acrylic or Melamine Plastic Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

END OF SECTION

SECTION 262416 PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. New and existing panelboards.
2. Disconnecting and overcurrent protective devices.

1.2 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Disconnecting and overcurrent protective devices.

B. Shop Drawings: For each panelboard and related equipment.

1. Detail bus configuration, current, and voltage ratings.
2. Short-circuit current rating of panelboards and overcurrent protective devices.

1.4 CLOSEOUT SUBMITTALS

A. Warranty documentation.

PART 2 - PRODUCTS

2.1 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- ##### A. MCCB: Comply with UL 489, with interrupting capacity matching existing breaker type and AIC ratings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering breakers for existing panelboards.

3.2 INSTALLATION

- A. Comply with manufacturer's published instructions.

3.3 IDENTIFICATION

- A. Breaker Labels: Faceplate must list current rating, UL and IEC certification standards, and AIC rating.
- B. Circuit Directory:
 - 1. Provide computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
 - a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.

3.4 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Nonconforming Work:
 - 1. Panelboards will be considered defective if they do not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- C. Collect, assemble, and submit test and inspection reports, including certified report that identifies panelboards included and that describes scanning results, with comparisons of two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 262726
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General-use switches.
2. General-grade duplex straight-blade receptacles.
3. Receptacles with ground-fault protective devices.

1.2 ACTION SUBMITTALS

A. Product Data:

1. General-use switches.
2. General-grade duplex straight-blade receptacles.
3. Receptacles with ground-fault protective devices.

PART 2 - PRODUCTS

2.1 GENERAL-USE SWITCHES, DIMMER SWITCHES, AND FAN-SPEED CONTROLLER SWITCHES

A. Toggle Switch:

1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Options:
 - a. Device Color: As indicated on architectural Drawings.
3. Accessories:
 - a. Cover Plate high-impact thermoplastic (nylon) with smooth finish and color: matching wiring device; from same manufacturer as wiring device.
 - b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.2 GENERAL-GRADE SINGLE STRAIGHT-BLADE RECEPTACLES

A. Single Straight-Blade Receptacle

1. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- 2. General Characteristics:
 - a. NEMA 5-20R.

PART 3 - EXECUTION

3.1 INSTALLATION OF SWITCHES

- A. Comply with manufacturer's instructions.

3.2 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

- A. Comply with manufacturer's instructions.
- B. Identification:
 - 1. Identify cover or cover plate for device with panelboard identification and circuit number

END OF SECTION

SECTION 265119
LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaires.
 - 4. Include emergency lighting units, including batteries and chargers.
 - 5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
- B. Product Schedule: For luminaires and lamps.
- C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 LUMINAIRE SUPPORT

- A. Comply with manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Supports:
 - 1. Sized and rated for luminaire weight.

2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.

END OF SECTION

SECTION 270528
PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings.
 - 2. Nonmetallic conduits and fittings.
 - 3. Optical-fiber-cable pathways and fittings.
 - 4. Metallic surface pathways.
 - 5. Tele-power poles.
 - 6. Hooks.
 - 7. Boxes, enclosures, and cabinets.
 - 8. Polymer-concrete handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid conduit.
- C. IMC: Intermediate metal conduit.
- D. RTRC: Reinforced thermosetting resin conduit.

1.4 ACTION SUBMITTALS

- A. Product data for the following:
 - 1. Surface pathways
 - 2. Wireways and fittings.
 - 3. Tele-power poles.
 - 4. Boxes, enclosures, and cabinets.
 - 5. Underground handholes and boxes.
- B. Shop Drawings: For custom enclosures and cabinets and custom underground handholes and boxes. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of pathway groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
 - 3. Underground ducts, piping, and structures in location of underground enclosures and handholes.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Data: Seismic rating Provide seismic bracing for all pathway racks, enclosures, cabinets, equipment racks, and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
 - 2. Alpha Wire.
 - 3. Southwire Company.
 - 4. Thomas & Betts Corporation; A Member of the ABB Group.
- C. General Requirements for Metal Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
 - 2. Comply with TIA-569-D.
- D. GRC: Comply with ANSI C80.1 and UL 6.

- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: die cast.
 - b. Type: compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- H. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Description: Nonmetallic raceway of circular section with manufacturer-fabricated fittings.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
 - 2. Carlon; a brand of Thomas & Betts Corporation.
 - 3. RACO; Hubbell.
 - 4. Thomas & Betts Corporation; A Member of the ABB Group.
- C. General Requirements for Nonmetallic Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 - 2. Comply with TIA-569-D.
- D. RNC: Type EPC-40-PVC Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material.
- F. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Description: Comply with UL 2024; flexible-type pathway with a circular cross section, approved for plenum riser or general-use installation unless otherwise indicated.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Alpha Wire.
 - 2. Carlson; a brand of Thomas & Betts Corporation.
 - 3. Endot Industries Inc.
 - 4. IPEX USA LLC.
- C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with TIA-569-D.

2.4 SURFACE METAL PATHWAYS

- A. Description: Galvanized steel with snap-on covers, complying with UL 5.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. MonoSystems, Inc.
 - 2. Niedax Inc.
 - 3. Panduit Corp.
 - 4. Wiremold / Legrand.
- C. Finish: Manufacturer's standard enamel finish in color selected by Architect.
- D. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- E. Comply with TIA-569-D.

2.5 TELE-POWER POLES:

- A. Description: Prefabricated, finished metal pole with prewired power and communications outlets.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. MonoSystems, Inc.
 - 2. Panduit Corp.
 - 3. Wiremold / Legrand.
- C. Material: Galvanized steel with ivory baked-enamel finish.

- D. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.
- E. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- F. Comply with TIA-569-D.

2.6 HOOKS

- A. Description: Prefabricated sheet metal cable supports for telecommunications cable.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. MonoSystems, Inc.
 - 2. Panduit Corp.
 - 3. Wiremold / Legrand.
- C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with TIA-569-D.
- E. Galvanized steel.
- F. J shape.

2.7 BOXES, ENCLOSURES, AND CABINETS

- A. Description: Enclosures for communications.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Erickson Electrical Equipment Company.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. RACO; Hubbell.
 - 4. Thomas & Betts Corporation; A Member of the ABB Group.
 - 5. Wiremold / Legrand.
- C. General Requirements for Boxes, Enclosures, and Cabinets:
 - 1. Comply with TIA-569-D.
 - 2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
 - 3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
 - 4. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

- 5. Gangable boxes are allowed.
- D. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- E. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- F. Metal Floor Boxes:
 - 1. Material: Cast metal.
 - 2. Type: Fully adjustable.
 - 3. Shape: Rectangular.
 - 4. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum galvanized, cast iron with gasketed cover.
- I. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4, with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures:
 - a. Material: Plastic.
 - b. Finished inside with radio-frequency-resistant paint.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- J. Cabinets:
 - 1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.8 POLYMER-CONCRETE HANDHOLES

- A. Description: Molded of sand and aggregate; bound together with polymer resin; and reinforced with steel, fiberglass, or a combination of the two.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. [Armorcast Products Company.](#)
2. [NewBasis.](#)
3. [Oldcastle Enclosure Solutions.](#)
4. [Quazite: Hubbell Power Systems, Inc.](#)

C. General Requirements for Polymer Concrete Handholes:

1. Boxes and handholes for use in underground systems shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
3. Comply with TIA-569-D and SCTE 77.

D. Configuration: Designed for flush burial with integral closed bottom unless otherwise indicated.

E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.

1. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
2. Cover Legend: Molded lettering, "COMMUNICATIONS" "FIBER" "PHONE" "CABLE".

F. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

G. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.9 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed Conduit: RNC, Type EPC-80-PVC.
2. Concealed Conduit, Aboveground: IMC.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried concrete encased.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums
3. Concealed in Ceilings and Interior Walls and Partitions: EMT or innerduct.
4. Damp or Wet Locations: GRC.
5. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, communications-cable pathway.
6. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: Riser-type, communications-cable pathway.
7. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: EMT.
8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel units in institutional and commercial kitchens and damp or wet locations.

C. Minimum Pathway Size: 3/4-inch trade size for copper and aluminum cables, and 1 inch for optical-fiber cables.

D. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use set-screw or compression, steel fittings. Comply with NEMA FB 2.10.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:
 - 1. NECA 1.
 - 2. NECA/BICSI 568.
 - 3. TIA-569-D.
 - 4. NECA 101
 - 5. NECA 102.
 - 6. NECA 105.
 - 7. NECA 111.
- B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- C. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- D. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems" for hangers and supports.
- E. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling" for sleeves and sleeve seals for communications.
- F. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- G. Complete pathway installation before starting conductor installation.
- H. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- I. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.
- J. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within 12 inches of enclosures to which attached.
- L. Pathways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
 - 3. Arrange pathways to keep a minimum of 2 inches of concrete cover in all directions.

4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 5. Change from nonmetallic conduit and fittings to GRC or IMC and fittings before rising above floor.
- M. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for pathways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- O. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- Q. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.
- R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.
- S. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- T. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.
- U. Surface Pathways:
1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
 2. Install surface pathway with a minimum 2-inch radius control at bend points.
 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- V. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
 2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.

3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- W. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.
- X. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service pathway enters a building or structure.
 3. Where otherwise required by NFPA 70.
- Y. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- Z. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT that is located where environmental temperature change may exceed 100 deg F, and that has straight-run length that exceeds 100 feet.
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

AA. Hooks:

1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.
2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
3. Hook spacing shall allow no more than 6 inches of slack. The lowest point of the cables shall be no less than 6 inches adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
4. Space hooks no more than 5 feet o.c.
5. Provide a hook at each change in direction.

BB. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.

CC. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

DD. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

EE. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

GG. Set metal floor boxes level and flush with finished floor surface.

HH. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe of less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end

of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."

4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete around conduit for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 270553 "Identification for Communications Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line, 24 inches below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- F. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 310513
SOIL MATERIALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Subsoil materials.
- B. Topsoil materials.

1.2 RELATED SECTIONS (include but are not limited to)

- A. Appendix:
 - 1. Subsurface Investigation (Geotechnical) report; bore hole locations and findings of subsurface materials.
- B. Section 013300 – Submittal Procedures.
- C. Section 014000 – Quality Requirements: Testing soil fill materials.
- D. Section 310516 – Aggregate Materials.
- E. Section 312216 – Rough Grading.
- F. Section 312513 – Erosion and Sediment Control: Slope protection and erosion control.
- G. Section 312323 – Backfill.
- H. Section 312317 –Trenching.
- I. Section 329119 – Landscape Grading.

1.3 REFERENCES

VIRGINIA DEPARTMENT OF TRANSPORTATION

- A. VDOT, “Road & Bridge Standards & Specifications,” latest edition.

AMERICAN SOCIETY OF TESTING AND MATERIALS

- B. ASTM D698 – Std. Test Method for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ASTM D2487 – Classification of Soils for Engineering Purposes.
- D. ASTM D2922 – Std. Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

- E. ASTM D3017 – Std. Test Method for Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- F. ASTM D4318 – Std. Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits).

1.4 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures.
- B. Materials Source: Submit name of imported materials source, to Geotechnical Engineer.
- C. Samples: Submit, in air-tight containers, 10 lb (4.5 kg) sample of each type of fill to appropriate testing laboratory.

1.5 QUALITY ASSURANCE

- A. Furnish each individual soil material from single source throughout the work.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

- A. Subsoil Type S1:
 - 1. Excavated and re-used material, imported borrow, or select or local borrow.
 - 2. Graded.
 - 3. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris; Less than 1% (by weight) of organic matter or other deleterious material.
 - 4. Conforming to ASTM D2487 Group Symbol CL or better.

2.2 TOPSOIL MATERIALS (See Section 329119 – Landscape Grading for Schedule)

- A. Topsoil Type T1:
 - 1. On-site topsoil, excavated and reused material, conforming to Virginia Stormwater Management Handbook Standard & Spec. C-SSM-02 TOPSOILING.
 - 2. Graded.
- B. Topsoil Type T2:
 - 1. Imported borrow.
 - 2. Natural, fertile, friable loamy soil (loam, sandy loam, silty loam, sandy clay loam, or clay loam), of 20-70% sand, 10-60% silt, and 5-30% clay.
 - 3. Characteristic of productive soils in the vicinity which produce desirable vegetation and obtained from naturally well-drained areas.

4. Reasonably free of roots, rocks larger than 1 inch (25 mm) in longest dimension, subsoil, debris, large weeds, and foreign matter.
5. Free of toxic substances or any other material or substance which might be harmful to plant growth or a hindrance to grading maintenance operations.
6. Acidity range (adjusted pH) of 6.0 to 7.0.
7. Containing a minimum of 2 percent organic matter.
8. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.
9. With additives as recommended in soil analysis report.

2.3 SOURCE QUALITY CONTROL

- A. Section 014000 – Quality Requirements: Testing and analysis of soil material.
- B. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698 (Standard Proctor) and D2487 (Classification of Soils).
- C. Testing and Analysis of Topsoil Material: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of, inorganic matter (sand, silt, & clay), deleterious material, pH, and mineral and plant nutrient content of topsoil. Report suitability of topsoil for growth of applicable planted material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil.
- D. If tests indicate materials do not meet specified requirements, change material and retest.
- E. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

- A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth.
- B. Remove lumped soil, boulders, and rock.
- C. Stockpile excavated material, suitable for reuse, in area designated on site.
- D. Remove excess material not being used from site.
- E. Remove excavated materials not meeting requirements for reuse from site.

3.2 STOCKPILING

- A. Stockpile materials on site at locations indicated on Drawings.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.

- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Prevent intermixing of soil types or contamination.
- E. Direct surface waters away from stockpile site to prevent erosion or deterioration of materials.
- F. Stockpile topsoil 8 feet (2.5 m) high maximum.
- G. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.
- B. If a borrow area is utilized, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.

END OF SECTION

SECTION 310516
AGGREGATE MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Course Aggregate Materials.
 - 2. Fine Aggregate Materials.
- B. RELATED SECTIONS (including but not limited to:)
 - 1. Appendix: Subsurface Investigation (Geotechnical) report; recommended needs for aggregate materials.
 - 2. Section 013300 – Submittal Procedures.
 - 3. Section 014000 – Quality Requirements: Testing aggregate fill materials.
 - 4. Section 312213 – Rough Grading.
 - 5. Section 312513 – Erosion and Sediment Control: Slope protection and erosion control.
 - 6. Section 312323 – Backfilling.
 - 7. Section 312317 – Trenching.
 - 8. Section 321216 – Asphalt Paving.
 - 9. Section 321313 – Concrete Paving.
 - 10. Section 331116 – Water Distribution System.
 - 11. Section 334600 – Subdrainage: Filter aggregate.
 - 12. Section 334100 – Storm Drainage.
 - 13. Section 333100 – Sanitary Sewer System.

1.2 REFERENCES

AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS

- A. AASHTO - M147 - Materials for Aggregate and Soil-Aggregate.

AMERICAN SOCIETY OF TESTING AND MATERIALS

- A. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- D. ASTM D3017 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

VIRGINIA DEPARTMENT OF TRANSPORTATION

- E. VDOT "Road & Bridge Standards & Specifications," latest edition.
- F. VDOT "Special Provision for Flowable Backfill" dated March 11, 2010.

1.3 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures.
- B. Manufacturer's Certificate: Submit name of imported materials suppliers to Geotechnical Engineer.

1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from a single source throughout the work.

PART 2 PRODUCTS

2.1 AGGREGATE MATERIALS

- A. Coarse Aggregate Type A1 (Utility Bedding, Haunching, & Initial Cover): Conforming to VDOT Std. #68, 7, or 78.
- B. Coarse Aggregate Type A2 (Drainage Fill): Conforming to VDOT Std. #57.
- C. Coarse Aggregate Type A3 (Base for Concrete Flatwork): Conforming to VDOT Std. #5, 56, or 57.
- D. Coarse Aggregate Type A4 (Aggregate Base under Bituminous Pavement): Conforming to VDOT Std. #21A or B, Type II (A or B as indicated in pavement sections on the Drawings).
- E. Fine Aggregate Type A5 (Sand for Bedding): Conforming to VDOT Std. Grade "C" Fine Aggregate, VDOT Std. #10 Course Aggregate, or equivalent. A minimum of 100% (by weight) must pass a 3/8" laboratory square opening sieve, 94-100% passing a No. 4 sieve, and a maximum of 25% (by weight) may pass a No. 50 sieve.
- F. Course Aggregate "Rip-Rap" (as referenced on plans by d50 value): A well graded rip-rap, in accordance with DCR and VDOT standards, consisting of field stone of approximately rectangular shape. Specific gravity of individual stones shall be 2.5 minimum. Mean stone diameter shall be as denoted by the "d50" value. The diameter of the largest stone size shall not be larger than 1.5 times the d50 size. The diameter of the smallest stone size shall not be smaller than 0.3 times the d50 size. Small fines will not be permitted.

2.2 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Source testing and analysis of aggregate material.
- B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698.
- C. If tests indicate materials do not meet specified requirements, change material or material source and retest.
- D. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 STOCKPILING

- A. Stockpile in sufficient quantities to meet Project schedule and requirements.
- B. Separate differing materials with dividers or stockpile apart to prevent mixing.
- C. Direct surface water away from stockpile site so as to prevent deterioration of materials.

3.2 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.
- B. If a borrow area is utilized, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.

END OF SECTION

SECTION 310900
GEOTECHNICAL ENGINEERING, INSPECTION AND TESTING

PART 1 GENERAL

1.1 DESCRIPTION

- A. Geotechnical investigation report.
- B. Earthwork quality assurance.
- C. Underground utility quality assurance.

1.2 RELATED SECTIONS (including but not limited to:)

- A. Section 312213 – Rough Grading.
- B. Section 312316 – Excavation.
- C. Section 312323 – Backfill.
- D. Section 312317 – Trenching.
- E. Division 33 Underground Utility Sections.
- F. Appendix: Subsurface Exploration Report.

1.3 GEOTECHNICAL INVESTIGATION REPORT

- A. A geotechnical investigation report has been prepared for the site of this work by an independent geotechnical engineer.
- B. A copy of the full geotechnical investigation report for this project is bound at the end of the Project Manual in the Appendix.
- C. This geotechnical investigation report was obtained only for the Architect's/ Engineer's use in design and is not a part of the Contract Documents.
- D. The report is provided for bidder's information, but is not a warranty of subsurface conditions. Owner assumes no responsibility for conditions of site or continuation of those conditions existing at the time of report generation.
- E. Bidders should visit the site and acquaint themselves with existing conditions.
- F. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but such investigations may be performed only under time schedules and arrangements approved in advance by the Architect.

1.4 EARTHWORK QUALITY ASSURANCE

- A. A qualified independent Soils Testing Laboratory, which staffs a Professional Geotechnical Engineer, registered in Virginia (herein after Geotechnical Engineer), will be retained by the Owner to observe and report performance or work in connection with Rough Grading, Excavating, Backfill, & Trenching , and any other earthwork related concern.
- B. The Geotechnical Engineer shall perform the following:
 - 1. Make a site inspection, review governing requirements for this work and the test results and make recommendations on applicable portions of the Work (traffic bearing areas, building foundation, , etc., as may be applicable to this project),
 - 2. All required tests to determine bearing capacity of soil (subgrade suitability) prior to placement of all footings, slabs, tanks, utilities, etc.
 - 3. Inspections,
 - 4. Testing of all proof-rolling and filling operations,
 - 5. Determination of materials (suitable, unsuitable, rock, etc., as may be applicable to this project),
 - 6. Quantify materials involving unit price payments as applicable,
 - 7. Submit certifications of all such tests and inspections as may be herein required, with a proper description of tested or inspected locations, to the Architect/Engineer with a copy to the Contractor. Location maps shall be submitted with each report identifying areas where testing occurred.
- C. All testing performed by the Geotechnical Engineer is solely in the interest of and for the protection of the Owner.
- D. The density of all finally placed or excavated material shall be as specified herein and as determined suitable by the Geotechnical Engineer.
- E. The Contractor shall be responsible for notifying the Geotechnical Engineer of his readiness for all tests in a timely manner and for providing access to the site so as to cause no delay to the project.
- F. All instructions and directions provided by the Geotechnical Engineer to the Contractor shall be in writing and immediately communicated to the Owner and Architect.
- G. When a soils test requested by the Contractor fails to meet the requirements of these specifications, the cost of all re-testing required shall be borne by the Contractor.
- H. Notwithstanding any tests, instructions, or decisions made by the Geotechnical Engineer, the Contractor shall not be relieved of his obligation to perform all grading and compaction work in accordance with the Contract Documents.
- I. The Contractor may, at his option, hire his own Soils Testing Service to assure himself that his work is in accordance with the Contract Documents.

1.5 UNDERGROUND UTILITY QUALITY ASSURANCE

- A. The Architect or a representative retained by the Owner, will observe and report performance on work in connection with Underground Utility installation and testing.
- B. The following shall be performed:
 - 1. Review governing requirements for installation of this work,
 - 2. Upon accepting condition of trench for pipe installation, observe placement of bedding, haunching, pipe, any anchorage or thrust blocking required, and initial cover to assure that pipe is installed in accordance with those requirements,
 - 3. Verification of appropriate pipe, joint, and fitting materials,
 - 4. Observation of all required tests to determine suitability of said pipe installation, and
 - 5. Submit certifications of all such inspections and observations as may be herein required, with a proper description of tested locations, to the Architect/Engineer with a copy to the Contractor.
- C. All utility inspection related work performed by the Architect or Owner's Representative is solely in the interest of and for the protection of the Owner.
- D. The Contractor shall be responsible for notifying the Architect of his readiness for all inspections and observations in a timely manner and for providing access to the site so as to cause no delay to the project.
- E. Approvals and Disapprovals provided by the during inspection to the Contractor shall be in writing and immediately communicated to the Owner and Architect/Engineer.
- F. When an inspection/observation requested by the Contractor fails to meet the requirements of these specifications, the cost of all re-inspection/observation required shall be borne by the Contractor.
- G. Notwithstanding any tests, instructions, or decisions made during inspections, the Contractor shall not be relieved of his obligation to perform all utility work in accordance with the Contract Documents.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 311000
SITE PREPARATION AND CLEARING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparation.
- B. Protection: Protect improvements and vegetation to remain within and beyond/outside limits of disturbance.
 - 1. Barriers, warnings, shoring, etc.
 - 2. Adjacent properties, waterways and the air
 - 3. Reference points,
 - 4. Existing improvements,
 - 5. Existing utilities, and
 - 6. Trees and vegetation.
- C. Demolition, Clearing & Grubbing:
 - 1. Remove surface debris.
 - 2. Demolish and remove existing site improvements. Designated paving and curbs.
 - 3. Clear site of plant life and grass.
 - 4. Remove trees and shrubs, including root systems, unless designated to remain.
- D. Topsoil Stripping: Excavate and stockpile topsoil.
- E. Removal: Clean up, remove and dispose of undesirable material off-site.
- F. Restoration: Restore existing finished surfaces disturbed to that of proposed finishes (preconstruction condition as a minimum).
- G. Utility Adjustments: Adjust new and existing utility tops to meet proposed finish grades.
- H. Definitions.
- I. Project Record Documents.

1.2 RELATED SECTIONS (including but not necessarily limited to)

- A. Appendix:
 - 1. Subsurface Investigation Report.
- B. Division 01: Permits, Fees, & Notices: Land Disturbing Permit.
- C. Division 01: Temporary Utilities: Water Service.
- D. Division 01: Temporary Controls: Surface Water and Dewatering. Dust. Noise.

Air pollution.

- E. Section 310900 – Geotechnical Engineering, Inspection, & Testing. Geotechnical Engineer.
- F. Section 310513 – Soil Materials: Definitions of subsoil and topsoil materials.
- G. Section 31 15 00 – Work Area Protection, MOT, Access.
- H. Section 31 22 13 – Rough Grading: Site subgrade contouring. References this section for Preparation, Protection, and Clean up, Removal and Disposal.
- I. Section 31 25 13 - Erosion and Sediment Control: Requirements for land disturbance, protection of stockpiles topsoil.
- J. Section 32 91 19 - Landscape Grading: Coordination of soil materials stockpile removal for finish grading and preparation for landscaping/seeding.

1.3 REFERENCES

- A. Virginia ~~Erosion & Sediment Control (ESC) Manual~~ Stormwater Management Handbook, latest edition: Temporary seeding, construction entrances and other measures or practices which may apply.
- B. Virginia Department of Health (VDH) "Waterworks Regulations", latest edition: Well or Monitoring Well abandonment.
- C. Virginia Department of Transportation (VDOT) "Road & Bridge Standards & Specifications", latest edition: Safety Items.
- D. Manual on Uniform Traffic Control Devices (MUTCD), latest edition (including the Virginia Supplement): Pavement Marking and Signage within right-of-way.

1.4 REGULATORY REQUIREMENTS

- A. Conform to all applicable codes. These include but shall not be limited to those pertaining to erosion and sediment control and disposal of debris.
- B. Obtain all required permits from authorities having jurisdiction.
- C. Erosion & Sediment Control (ESC): See Section 312513 - Erosion & Sediment Control for plan preparation, review, approvals, regulatory requirements, etc.
- D. Utility Companies: Administrative Requirements: Coordination & Meetings: Coordinate clearing Work with utility companies. Verify locations of existing utilities. Notify them prior to starting and comply with their requirements.
- E. Existing Signage within Right-of-Way: Any existing signs shall be relocated as necessary meeting all state and local ordinances including conformance in design and placement with the Virginia Supplement to the Manual on Uniform Traffic Control Devices (MUTCD), latest edition. Edge of signs shall be 12 feet off edge of

pavement or 6 feet off shoulder or 2 feet behind face of curb. Clear height shall be 7 feet above grade. Reference document shall take precedence.

1.5 DEFINITIONS

- A. Limit of Disturbance or Construction Limits: The extent that proposed contours, erosion and sedimentation control measures, subsurface utility work and surface improvements are indicated on the Drawings or as delineated as limits on Drawings plus Contractor trailer, storage and parking as defined in the Contract Documents.

1.6 PROJECT RECORD DOCUMENTS

- A. Accurately record on Project Record Documents the actual locations of utilities to remain, by horizontal dimensions from landmarks to remain, depth or elevations of inverts, and slope gradients while preparing for land disturbance and in providing protection of utilities.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Erosion and Sediment Control Materials: See Section 312513 - Erosion and Sediment Control for approved materials and products.
- B. See Section 310513 – Soil Materials: Definitions of subsoil and topsoil materials.

PART 3 EXECUTION

3.1 PREPARATION

- A. Accept premises as found. Owner assumes no responsibility for conditions of site or continuation of conditions existing at time of advertisement.
- B. Assure that all pertinent required permits have been obtained.
- C. Verify all site conditions pertinent to this work.
- D. Locate, identify and flag/mark for protection all bench marks, property corners and reference points. Verify that survey bench mark and intended elevations for the Work are as indicated.
- E. Contractor shall lay out all work and be responsible for all lines, elevations and measurements.
- F. Verify that existing trees/plant life designated to remain, are conspicuously marked as such.
- G. Drawings do not purport to show all objects existing on the site. Before commencing work, verify with the Architect all improvements to be protected, salvaged, relocated, removed or demolished. Existing utilities are indicated on the

Drawings in accordance with available records.

- H. Before any work is started, the Contractor shall contact all corporations, companies, individuals and local authorities owning, maintaining or regulating utilities, conduits, wires and pipes running to or on the property to make suitable arrangements for locating, protection, handling, relocation, adjusting, and/or removal and disposal/salvage of such lines or structures. Verify locations and elevations.
- I. Contact MISS UTILITY at least 48 hours in advance of land disturbing activities.
- J. Before any work is started, the Contractor shall contact all state and local authorities owning, maintaining or regulating adjacent rights-of-way to make suitable arrangements for protection, handling, relocation, and/or removal and disposal/salvage of such improvements involved in this Work (signs, structures, etc.). Verify locations, elevations and applicable codes.

3.2 PROTECTION

- A. General: Erect and maintain temporary bracing, shoring, lights, barricades, warning signs, etc., all in accordance with applicable rules and regulations.
- B. Protection of adjacent properties, waterways and the air:
 - 1. Prior to any land disturbance activity install Erosion and Sediment Control measures conforming to Section 312513 - Erosion and Sediment Control (ESC). See Site Drawings for specific practices required to prevent soil from washing from areas disturbed during clearing operations. Maintain all ESC measures required.
 - 2. Clearing shall be restricted to the area within the right-of-way, easements, and Construction Limits indicated on the Drawings.
 - 3. Any material which will result in dust shall be wet down during removal.
- C. Protection of Reference Points: Protect and maintain all bench marks, property corners, monuments and other reference points from damage or displacement. Do not cover. Obtain accurate replacement of any that is disturbed, destroyed or moved due to the work and furnish a certificate by a professional civil engineer or land surveyor that all such items have been relocated accurately.
- D. Protection of Existing Improvements:
 - 1. Conduct site clearing operations to ensure minimum interference with roads, streets, walks, utilities, and other adjacent improvements to remain. Do not close or obstruct streets, walks or other facilities without written permission from authorities having jurisdiction and prior approval by the Owner.
 - 2. Use all means necessary to protect existing improvements designated to remain. In the event of damage, immediately make all necessary repairs and replacements as directed by the Architect.
- E. Protection of Existing Utilities:
 - 1. Existing utilities, encompassing all water systems, storm and sanitary

sewer systems, gas lines, electric systems, telephone and communication systems, underground storage tanks, etc., and all accessories thereto, underground, on the surface or overhead, located in or affected by the construction of the work shall be relocated as required

2. Protect existing utilities noted to remain.
3. Coordinate the timing of utility adjustments to ensure that all new and existing utility tops are adjusted to proposed finish grades prior to stone base applications in paved areas, and prior to topsoil applications within lawn spaces.
4. Give advance notice to the Utility Owner of work to be removed or relocated. The work shall be performed by the Contractor or Utility Owner with arrangements and payment for this work being made by the Contractor.
5. If existing concealed utilities not shown or correctly indicated by the Contract Documents are encountered, the Contractor shall stop work in that area and notify the Architect and Utility Owner. Do not proceed until written instructions are received from the Architect.
6. The Contractor shall excavate with care to determine the exact location of existing utilities, including sizes and inverts. Also, stake and flag at this time for protection. This work shall precede pipe laying, grading, excavation and other construction as far as practicable, to permit adjustments where required.

F. Protection of Existing Trees and Vegetation:

1. Contractor shall assume that all existing vegetation on the premises is intended to remain unless specifically noted otherwise.
2. Protect existing trees, plant growth, and features against compacting the root zone, unnecessary cutting, breaking, skinning of roots, or bruising of bark, or damage from dust, debris, or chemicals. Conform to details and specifications of the ~~Virginia Erosion & Sediment Control~~ Stormwater Management Handbook for methods of protection.
3. Disposal of any adhesives, concrete, plaster, paints, thinners, or other volatile liquids or substances detrimental to vegetation shall be done in proper locations away from existing or new plant materials.
4. Repair or replace trees and vegetation damaged by construction operations, but not intended for demolition, in a manner acceptable to the Architect

3.3 DEMOLITION, CLEARING AND GRUBBING

- A. Removal of utilities may cause excavations beneath proposed buildings and improvements. All excavations performed for demolition purposes shall be backfilled and tested in accordance with the specifications.
- B. Clear areas required for access to site and execution of Work. Honor described or indicated Limits of Construction and Disturbance.
- C. Remove existing walks, pavement, fencing, curbs, minor buildings and structures where required for excavation or new construction or as indicated on the Site Drawings. Existing pavement to be removed or connected to shall be neatly cut in

straight lines at necessary locations required to accomplish required work. Existing pavement to be trenched through by the open cut method shall be neatly cut in straight lines at minimum width required to accomplish required work.

- D. Where asphalt or concrete walks or pavement are removed in locations proposed as lawn or planting beds, all existing bedding stone shall be removed. Underlying subsoil shall be loosened and prepared to receive fill, topsoil, or mulch as applicable.
- E. Upon encountering and well within limits of disturbance, verify first with A/E that well is not in use and that Owner desires it to be formally abandoned. If so desired Contract price will be adjusted by Change Order. Abandon well in accordance with Virginia Department of Health "Waterworks Regulations", Section 3.8 - Observation, Monitoring and Remediation Wells and Section 3.11 - Well Abandonment. Adjust top elevation of casing as required to maintain three (3) feet of cover from finished grade.
- F. Abandon in place, in accordance with applicable codes, all utility lines, septic tanks, drain fields, septic pits, dry wells, etc., not intended to remain, if it poses no conflict with the Work, will have three (3) feet of cover at finished grade and, in the opinion of the Architect, remaining in place does not have an adverse impact upon the project or intended use.
- G. Remove utility lines & structures, septic tanks, drain fields, septic pits, dry wells, etc., which conflict with the work or do not meet the preceding conditions. Provide for the relocation, raising or lowering of existing electric and telephone poles where required.
- H. Remove grass, trees, stumps, shrubs, roots, vines, weeds, brush, surface rocks, debris and all other extraneous material or objects from areas to be built upon or graded. Remove all vegetation to a sufficient depth to prevent regrowth.
- I. Conduct demolition, clearing and grubbing operations in such a manner as to minimize disturbance to subsoil and creation of dust. Remove existing foundation walls, floor slabs and footings in such a manner as to avoid disturbing underlying subgrade.
- J. Where trees are indicated to be left standing, stop topsoil stripping at drip line to prevent damage to main root system. Use only hand grubbing inside the driplines of trees to remain.
- K. Fill depressions caused by demolition, clearing and grubbing operations with controlled fill unless further excavation or grading is indicated and immediately follows.
- L. Do not allow water to pond in any excavation or depression. See Dewatering in Division 01: Temporary Controls.

3.4 STRIPPING TOPSOIL

- A. Excavate topsoil from areas to be further excavated, re-landscaped, or re-graded as indicated on the Drawings. Excavate to whatever depths encountered in a manner to prevent intermingling with underlying sub-soil or other objectionable material. Comply with the following:
 - 1. Do not excavate wet topsoil.
 - 2. Avoid including debris, stones and other extraneous matter in topsoil which will make it "unsuitable" under Section 31 05 13 – Soil Materials: Topsoil Materials.
 - 3. Leave subsoil surface free of trash, debris and foreign materials.
- B. Stockpile on site in an area approved by the Architect/Engineer. Comply with Section 31 25 13 - Erosion & Sediment Control; Topsoil Stockpile.

3.5 CLEANUP, REMOVAL & DISPOSAL

- A. Clean up debris resulting from site clearing and grading operations (earthwork related) continuously with the progress of the Work.
- B. Remove debris, rock, extracted plant life, unsatisfactory, and/or surplus (not being reused) soil materials, etc. from site.
- C. Any debris, rock, extracted plant life, etc. designated to be removed from the site shall become the property of the Contractor and shall be disposed at the Contractor's expense.
- D. Dispose of all material in accordance with all local, state and federal regulations governing same.

END OF SECTION

SECTION 311500
WORK AREA PROTECTION, MAINTENANCE OF TRAFFIC (MOT), AND ACCESS

1. General

- 1.1. Traffic Maintenance - All traffic control shall be subject to approval by the City Traffic Engineer (Transportation Department 540-853-2385). The City Traffic Engineer is not the City Project Manager or City Engineer. Changes to the traffic control plan, as directed by the City Traffic Engineer, shall not be a basis for additional compensation. The Contractor shall submit a traffic control plan sealed by a Professional Engineer registered in Virginia for review and approval prior to mobilization. All lane and street closures and detours shall be coordinated with the Transportation Department. Note that the Engineering and Transportation Departments are separate departments. Traffic control plans shall be submitted within the specified number of days outlined in the Submittals (Section 01 30 00) portion of this specification.
- 1.2. Any sign, to be posted on the job site/work zone for more than 72 hours, must be anchored into the ground with a steel/wooden post. Placing signs on trees, existing road sign posts, or mailbox posts, etc. shall not be allowed.
- 1.3. Work Area Protection – The Contractor shall maintain the work area in accordance with the Virginia Work Area Protection Manual, latest edition. The City shall not be responsible for any portion of work area protection or safety.
- 1.4. If a temporary road closure is required on the project, a traffic control plan conforming to the Virginia Work Area Protection Manual shall be submitted to the City of Roanoke for approval prior to starting construction. Contractor shall be required to provide all signage and devices in accordance with the Virginia Work Area Protection manual. In addition, the Contractor shall provide and maintain all signs for road/alley detours. **The City of Roanoke shall not provide any signs.**
- 1.5. Access - Coordinate citizens' access to driveways as much as possible. Access to properties along the project route shall be maintained during construction.
- 1.6. Contractor shall be responsible for providing all signage for the project. The Contractor shall not rely on City personnel to provide or maintain any signage.
- 1.7. There may be other Contractors in the adjoining areas. Incidental coordination with the Contractors may be required.

2. Products – Not Used

3. Execution – Not Used

END OF SECTION

SECTION 312213
ROUGH GRADING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Site Subgrade Contouring. General cutting, grading, filling, and rough contouring of the site for access drives, parking, site structures, building pads, landscaping features, etc., as applicable.
- B. Furnish all labor, materials, equipment, and incidentals necessary for earthmoving, grading, cutting, filling, and compaction to provide subgrade elevations as specified herein from finish grades indicated on the Drawings.
- C. Unauthorized excavation defined.

1.2 RELATED SECTIONS

- A. Appendix: Geotechnical Report, Subsurface Investigation.
- B. Section 310513 - Soil Materials.
- C. Section 310516 - Aggregate Materials.
- D. Section 311000 - Site Preparation and Clearing.
- E. Section 312316 - Excavating: Building excavation.
- F. Section 312323 - Backfilling: General building area backfilling.
- G. Section 312317 - Utility Trenching & Backfilling: Trenching and backfilling for utilities.
- H. Section 329119 - Landscape Grading: Finish grading with topsoil to contours.

1.3 REFERENCES

AMERICAN SOCIETY OF TESTING & MATERIALS

- A. ASTM C136 - Method For Sieve Analysis of Fine and Coarse Aggregates.
- B. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- D. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

- E. ASTM D2419 - Test Method For Sand Equivalent Value of Soils and Fine Aggregate.
- F. ASTM D2434 - Test Method For Permeability of Granular Soils (Constant Head).
- G. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- H. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.4 DEFINITIONS

- A. "Finish grade" refers to contours and spot grades indicated on the Drawings.
- B. "Subgrade" or "rough grade" refers to bottom of footings at foundation walls and columns, bottom of aggregate fill within trenches or under slabs-on-grade and paving, and finish grade less specified topsoil depth elsewhere. Refer to applicable Drawings and Schedules for distances below finish grade. "Subgrade" may also refer to the subsoil base upon which fill is to be placed
- C. "Unsuitable material" refers to any material beneath proposed subgrade in cut conditions and existing subgrade in fill conditions which in the opinion of the Geotechnical Engineer, after observing proof-rolling or other testing/observation, will not be a satisfactory base for supporting the proposed work above.

1.5 CLASSIFICATION OF EXCAVATION

- A. All cutting, filling, excavating and backfilling to the limits of rough grade as defined herein is "unclassified" except for Rock and Unsuitable Soils and it shall be the Contractor's responsibility to determine the subsurface character. Bidders are expected to examine the site and then decide for themselves the character of materials to be encountered. Claims for extra compensation arising from latent, subsurface conditions within the area defined will not be considered.
- B. Excavation beyond the indicated subgrade elevations or excavation side dimensions shall be replaced at Contractor's expense with material per schedule this section.

1.6 SUBGRADE SUITABILITY

- A. The Geotechnical Engineer shall inspect all subgrades below footings and below slabs on grade and the results of such inspections shall be reported to the Architect and Owner.
- B. As determined by the Geotechnical Engineer, any unsuitable material below limits of subgrade elevations shall be removed and replaced per schedule this section. Contract Price will be adjusted as identified on the Bid Form except as indicated in "C" below.

- C. Once any subgrade has been approved by the Geotechnical Engineer for pouring of footings, slabs, etc., if the pouring of concrete is delayed by the Contractor, for any reason, resulting in subsequent disapproval of said subgrade by the Geotechnical Engineer, any additional excavation required as a result of such subsequent disapproval shall be provided by the Contractor at no additional cost to the Owner.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Topsoil: Type T1 or T2 as specified in Section 310513.
- B. Subsoil Fill: Type S1 as specified in Section 310513.
- C. Structural Fill: Type S1 as specified in Section 310513.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 013000 – Administrative Requirements: Coordination.
- B. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 PREPARATION, PROTECTION, & CLEANUP

- A. Control water in accordance with Division 01 – Temporary Controls. Ponding water will not be permitted.
- B. Comply with Section 311000 - Site Preparation & Clearing: Preparation, Protection, Field Measurements, Cleanup.
- C. The Contractor shall be responsible for controlling on-site construction traffic to prevent softening or rutting of completed controlled fill work. Additional work required due to improper traffic control will be at the Contractor's expense.
- D. Identify required lines, levels, contours, and datum.
- E. Locate, identify, and protect above and below grade utilities that remain, from damage.
- F. Notify utility company to remove and/or relocate utilities, as applicable.

- G. Protect plant life, lawns, and other features remaining as a portion of final landscaping.
- H. Protect bench marks, survey control points, any existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 PROOF-ROLLING

- A. After all demolition, clearing, grubbing, and topsoil and organics stripping the exposed subgrade shall be proof-rolled. Proof-rolling shall be with a tandem axle dump truck or similar pneumatic tired equipment weighing at least 10 tons (20 tons max) to locate soft or other unsuitable areas. The number and direction of passes shall be as required by the Geotechnical Engineer.
- B. Any soft or compressible areas or unsuitable material encountered shall be removed and replaced per schedule this section. The Geotechnical Engineer shall observe the removal, document the volume, observe and test the replacement and immediately forward copies of documentation to the Architect/Engineer.
- C. Unless approved by the Geotechnical Engineer proof-rolling shall be a continuous operation until the entire site is complete.
- D. When extensive excavation is required to bring the site to rough grade, proof-rolling shall occur simultaneously with the excavation work, if possible.
- E. The Contractor shall provide assistance to the Geotechnical Engineer or his representative as required to accomplish this work and to accurately track the progress of proof-rolling.
- F. After proof-rolling the subgrade, areas to receive fill shall be uniformly scarified to a depth of 2". Water shall be added to the loosened material or it shall be allowed to dry as required so that the moisture content is within necessary limits of the optimum as judged or tested by the Geotechnical Engineer.

3.4 SUBSOIL EXCAVATION (Cutting)

- A. Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded.
- B. Work within 15 feet of any structure to remain shall be handled under Section 312316 – Excavating & Filling. Should the Architect or Geotechnical Engineer determine the structure to be in jeopardy by grading operations this distance may be increased.
- C. Do not excavate wet subsoil unless determined to be "unsuitable material".
- D. When excavating through roots of trees to remain, perform work by hand and cut roots with sharp ax.

- E. If rock is encountered, it shall be excavated to 12" below rough grade and replaced per schedule this section.
- F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.5 STOCKPILING

- A. Stockpile suitable excavated material per Section 312513 - Erosion & Sediment Control: Topsoil/Soil Materials Stockpile.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements. Stockpile materials on site at locations acceptable to Architect/Engineer. Avoid drainage ways and drip areas of trees. Remove excess material and material unsuitable for reuse as fill from site.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Prevent intermixing of soil types or contamination.

3.6 FILLING

- A. Before fill is placed, existing grade shall be prepared as specified in Section 311000, shall be dry and clean of all debris, and shall be proof-rolled in accordance with this section.
- B. Scarify proof-rolled, existing subgrade to a depth of 2" prior to placing fill.
- C. All fill materials shall be tested and approved by the Geotechnical Engineer prior to placement and shall meet or exceed the requirements as specified in schedule this section.
- D. Place fill to subgrade contours and elevations allowing for later placement of topsoil and pavements.
- E. Furnish additional fill material from off site if required to complete the work. Fill material from off-site is subject to approval of the Architect and Geotechnical Engineer.
- F. Filling operations for embankments having a slope greater than 1' vertically to 4' horizontally or other similar areas noted on the site plan shall be stepped or benched in 8" vertical lifts. Carry fill slope at least three feet horizontally beyond design rough grade, then cut back to well compacted material at subgrade elevations indicated on the Drawings.
- G. Do not place fill in water or mud or on frozen or frosty ground.
- H. Surfaces of new grades shall be left clean and ready to receive applicable finished surface. Remove all ruts and depressions to give a smooth and uniform subgrade.

- I. To avoid delay of the project, when wet weather will not permit placement of soil fill material under the building area, Contractor will be permitted the option of using structural fill type A3 or as acceptable to the Geotechnical Engineer, as the fill material at no additional cost to the Owner.
- J. Fill areas to contours and elevations with unfrozen materials.
- K. Place fill material on continuous layers and compact in accordance with the schedule at end of this section.
- L. Maintain optimum moisture content of fill materials to attain required compaction density.
- M. Slope grade away from building minimum 2 inches in 10 ft (1.5:100), unless noted otherwise. This is also the minimum for grassed areas.
- N. Make grade changes gradual. Blend slope into level areas.
- O. Remove surplus fill materials from site.

3.7 RESTORATION OF GRADES

- A. Restore to original grades and conditions all properties damaged by any activity related to this work and take adequate precautions to avoid settlements or cave-ins of properties higher than site, and settling, eroding or other damage to properties lower than site.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

3.8 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 0.1 foot (30 mm) within 100 feet of buildings, under all pavement and site improvements (such as athletic/play fields); and 0.25 foot (75 mm) on surrounding fields and slopes.

3.9 COMPACTION OF FILLS

- A. Required compaction tests shall be carried out according to ASTM D698 Standard Proctor Test by the Geotechnical Engineer.
- B. Field testing methods shall be as determined by the Geotechnical Engineer.
- C. Contractor shall be responsible for notifying Geotechnical Engineer as each lift is installed. Contractor shall not place additional lifts until tests indicate the fill is compacted to specified densities. Should any lifts be placed prior to approval of lower lifts, the work shall be removed at no additional cost to the Owner.
- D. Materials and densities shall be in accordance with schedule this section.

- E. The moisture content of the fill material shall be within 3% of the optimum range for maximum compaction during compaction. Add water as required. If excess water exists, it shall be reduced by harrowing, dicing and natural evaporating.

3.10 FIELD QUALITY CONTROL

- A. Testing: In accordance with ASTM D698.
- B. Work performed which does not meet technical or design requirements as determined by the Geotechnical Engineer will be removed, replaced and retested at no additional cost to the Owner. No deviations from the Contract Documents shall be permitted without specific and written approval from the Architect/Engineer.
- C. Thickness of lifts prior to compaction and distribution of tests, unless otherwise required by the Geotechnical Engineer, shall be accordance with the following table:

AREA	MAX. LIFT THICKNESS	TEST DISTRIBUTION (PER LIFT)
Lawn & unpaved areas	8"	1 per 10,000 s.f.
Backfills (Exterior)	8"	1 per 2,500 s.f.
Embankments (3H:1V & >)	8"	1 per 2,500 s.f.
Under Paving, Curbs, Walks, Footings, and Slabs on Grade	8"	1 per 1,000 s.f.

- D. Lift thickness given are for heavy compaction equipment. If hand operated equipment is used then lift thickness shall be one-half of those given above.
- E. Test distributions are minimum requirements with more required if deemed necessary by the Geotechnical Engineer. If fill area is linear in shape and less than 50' wide, provide one (1) test per 50 linear feet of the fill areas.
- F. Density requirements under slabs, footings and pavement shall be carried ten feet (10') beyond exterior edges.

3.11 STOCKPILE CLEANUP

- A. Comply with Section 329119 - Landscape Grading for finish grading and preparation of stockpile areas for landscaping/seeding.
- B. Comply with state and local erosion and sediment control ordinances by having stabilized all disturbed areas at completion of work.

3.12 SCHEDULES

- A. Fill Under Slab-On-Grade Building to 10 Feet Outside:
 - 1. Fill Type S1, to subgrade elevation, compacted to 95 percent,
 - 2. Inside foundation wall cover with Fill Type A3 (Base for Concrete Flatwork), 4 inches (100 mm) thick (unless detailed otherwise), compacted to 95 percent.
- B. Fill Under Grass Areas:
 - 1. Fill Type S1, to specified depth of topsoil below finish grade, compacted to 90 percent. See Section 329119 - Landscape Grading for topsoil depth.
- C. Fill Under Landscaped Areas:
 - 1. Fill Type S1, to specified depth of topsoil below finish grade, compacted to 90 percent.
- D. Fill For Landscape Berms:
 - 1. Fill Type S1, to specified depth of topsoil below finish grade, compacted to 85 percent.
- E. Fill Under Vehicular Asphalt or Concrete Paving, Pavers, Curbs and Concrete Dumpster Pad:
 - 1. Compact subsoil to 95 percent of its maximum dry density.
 - 2. Fill Type S1, to within two (2) feet of pavement subgrade, compacted to 95 percent.
 - 3. Fill Type S1, to pavement subgrade as indicated in applicable pavement section or schedule description, compacted to 98 percent.
- F. Fill Under Non-Vehicular Concrete Paving or Pavers (Walks):
 - 1. Compact subsoil to 95 percent of its maximum dry density.
 - 2. Fill Type S1, to pavement subgrade as indicated in applicable pavement section or schedule description, compacted to 95 percent.
- G. Fill to Correct Over-excavation:
 - 1. Fill Type A1, flush to subgrade elevation, compacted to 95 percent.
- H. Fill Over-Excavation of Demolished or Grubbed Material:
 - 1. Under Grassed Areas: Fill Type S1, to specified depth of topsoil below finish grade, compacted to 90 percent. See Section 329119 - Landscape Grading for topsoil depth.
 - 2. Under other improvements: Same as fill to Correct Over-Excavation or for specified surface.
- I. Topsoil Fill: See Section 329119 - Landscape Grading.

END OF SECTION

SECTION 312316 EXCAVATING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Excavating for building foundations.
- B. Excavating for slabs-on-grade, curbing, walks, landscaping, etc.
- C. Excavating for site structures.

1.2 RELATED SECTIONS

- A. Appendix: Geotechnical report; bore hole locations and findings of subsurface materials.
- B. Section 310900 - Geotechnical Engineering, Inspection, and Testing
- C. Section 312213 - Rough Grading: Classification of excavation. Topsoil and subsoil removal from site surface.
- D. Section 312323 - Backfilling.
- E. Section 312317 - Utility Trenching & Backfilling: Excavating for utility trenches.
- F. Section 312513 - Erosion & Sediment Control: Slope protection and erosion control.

1.3 DEFINITIONS

- A. Finish grade refers to contours and spot grades indicated on the Drawings.
- B. Subgrade or rough grade refers to bottom of footings at foundation walls and columns, bottom of crushed stone fill within trenches or under slabs-on-grade and paving, and finish grade less specified topsoil depth elsewhere. Refer to applicable Drawings and Schedules for distances below finish grade. Subgrade may also refer to the subsoil base upon which fill is to be placed.
- C. Where rock is encountered, Contractor shall over-excavate 12 inches below defined subgrade.
- D. Unsuitable material refers to any material beneath proposed subgrade in cut conditions and existing subgrade in fill conditions, which in the opinion of the Geotechnical Engineer, after observing proof-rolling or other testing/observation, will not be a satisfactory base for supporting the proposed work above.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that survey bench mark and intended elevations for the Work are as indicated. Identify required lines, levels, contours, and datum locations.

3.2 EXCAVATING

- A. Underpin adjacent structures which may be damaged by excavating work.
- B. Work within 15 feet of any structure to remain shall be handled under Excavation. Should the Architect or Geotechnical Engineer determine the structure to be in jeopardy by grading operations this distance may be increased.
- C. Excavate subsoil to accommodate building foundations, slabs-on-grade, curbing, and site structures, construction operations, etc.
- D. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 312323.
- E. Slope banks with machine to angle of repose or less until shored.
- F. Do not interfere with 45 degree bearing splay of foundations.
- G. Grade top perimeter of excavation to prevent surface water from draining into excavation. Hand trim excavation. Remove loose matter.
- H. Notify Architect/Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- I. Do not excavate wet subsoil unless authorized as "unsuitable material".
- J. When excavating through roots, perform work by hand and cut roots with sharp ax.

3.3 TOLERANCES

- A. Bottom of Footings: Excavate in excess of required dimension on detail from true line and grade.
- B. Sides of Footings: Excavate in excess of required dimension on detail from centerline of true alignment.
- C. Excavation for Misc. Structures: Plus or minus 0.04 foot (0.5 in) (13 mm) from true line and grade.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Assurance: Field inspection and testing. Geotechnical Engineer.
- B. Prevent soil in excavated areas previously considered suitable from becoming "unsuitable" due to rainfall or surface runoff and ponding. Measures to protect subgrade shall include, but not be limited to, delaying final excavation of bottom 8" of material to just prior to finished product placement, or installing a protective layer of lean concrete.
- C. Provide for visual inspection of bearing surfaces. Place no footing until soil bearing capacity has been verified by the Geotechnical Engineer.

3.3 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

SECTION 312317
UTILITY TRENCHING AND BACKFILLING

PART 1 GENERAL

1.1 SECTION INCLUDES (But is not limited to)

- A. Excavating trenches for utilities from inlets to indicated points of connection to municipal utilities, source, outfall, etc., as applicable.
- B. Compacted backfill from top of utility cover bedding/initial backfill to subgrade elevations.

1.2 RELATED SECTIONS

- A. Section 310900 - Geotechnical Engineering, Inspections, and Testing.
- B. Section 310513 - Soil Materials.
- C. Section 310516 - Aggregate Materials.
- D. Section 311000 - Site Preparation and Clearing: Preparation for land disturbance. Protection of the work. Demolishing structures. Clearing and grubbing. Stripping and stockpiling topsoil.
- E. Section 312213 - Rough Grading: Subgrade Suitability, Correction of Over-excavation.
- F. Section 329119 - Landscape Grading: Depth of topsoil.
- G. Division 33 - Water, Sanitary Sewer, Storm Drainage, Foundation Drainage Sections, as applicable.
- H. Division 23 - Underground Steam, Condensate, Chilled Water, Refrigerant, Fuel System Sections, etc., as applicable
- I. Division 26 - Underground Electrical and Communication Conduits

1.3 REFERENCES

- A. VDOT "Special Provision for Flowable Backfill" dated March 11, 2010.
- B. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.
- C. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- D. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

- E. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.4 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.
- B. Bedding: Fill placed under pipe to provide support.
- C. Haunching: Fill placed from bedding to spring line of the pipe, also considered bedding, which further supports pipe in both the horizontal and vertical.
- D. Cover Bedding/Initial Backfill: Fill placed above haunching to protect pipe prior to further backfill.

1.5 FIELD MEASUREMENTS

- A. Verify that survey bench mark, control point, and intended elevations for the Work are as shown on the Drawings.

1.6 COORDINATION

- A. Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

1.7 PROJECT RECORD DOCUMENTS

- A. Accurately record on Project Record Documents the actual locations of existing utilities encountered, by horizontal dimensions, elevations or inverts, and general direction.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Backfill: Type S1 as specified in Section 310513 – Soil Materials.
- B. Coarse Aggregate (Utility Bedding): Type A1 as specified in Section 310516 - Aggregate Materials.
- C. Flowable Backfill: As specified in VDOT "Special Provision for Flowable Backfill" dated March 11, 2010.
- D. Concrete: Lean concrete with a compressive strength of 1,000 psi (7 MPa).

2.2 ACCESSORIES

- A. Buried Utility Warning and Identification Tape: Provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape or manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved, with warning and identification

imprinted in bold black letters continuously over entire tape length. Warning and identification shall be "CAUTION BURIED WATER LINE/SANITARY SEWER/STORM SEWER BELOW" or similar, as applicable. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

- B. Should Local Governing Authority require separate Detection Wire and Warning/ Identification Tape, meet the local requirements regarding materials, function, and placement.

PART 3 EXECUTION

3.1 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Verify that all prerequisite work has been completed. Verify location and elevation of points of connection. Notify Miss Utility.
- C. Protect plant life, lawns and other features remaining as a portion of final landscaping.
- D. Protect bench marks, and any existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Maintain and protect above and below grade utilities which are to remain.

3.2 EXCAVATING

- A. Excavate subsoil required for utilities from origin to destination as indicated.
- B. Cut trenches sufficiently wide to enable safe installation and allow inspection. Remove water or materials that interfere with Work.
- C. Install trench forms of sufficient height and minimum width to reduce the amount of lateral excavation. Portions of excavations may approach adjacent property lines, pins, landscaping and tree root systems which shall be protected.
- D. Do not interfere with 45 degree bearing splay of foundations or as otherwise indicated by Geotechnical Engineer in Soils Report or from their field inspection.
- E. Hand trim excavation, including joints, as necessary. Remove loose matter.
- F. Remove any lumped subsoil, large stones, or other hard matter which could damage pipe or impede consistent backfilling or compaction.
- G. Cut out soft areas of subgrade not capable of compaction in place. See Section 312213 – Rough Grading for Subgrade Suitability. Backfill per schedule this section.
- H. Correct areas over-excavated in accordance with Section 312213 – Rough Grading.

- I. Stockpile excavated material, if suitable for use and required for rough grading, in area designated on site, and remove excess material from site.

3.3 BEDDING & HAUNCHING

- A. Place Geotextile fabric, if applicable, as indicated in details in coordination with appropriate lifts of fill.
- B. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place bedding and haunching to spring line of pipe and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.

3.4 BACKFILLING

- A. Backfill trenches with unfrozen fill materials per applicable utility trench section to proposed subgrade per finished contours and elevations allowing for topsoil or pavement as applicable.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Backfill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.
- D. Employ a placement method that does not disturb or damage utilities in trench or any adjacent work.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Place Buried Utility Warning and Identification Tape continuous over each separate run of piping. Bury tape with printed side up and at the location indicated in the trench sections on the Drawings.
- G. Remove surplus fill materials from site.
- H. Leave fill material stockpile areas completely free of excess fill materials and restore to applicable proposed finished surface condition.

3.5 COMPACTING

- A. Percentage of maximum density requirements:
 - 1. Compact virgin subsoil (bottom of excavated trench) and each layer of backfill due to over-excavation to 95 percent of maximum dry density at +/-3% optimum moisture content as determined by ASTM D698 (Standard Proctor).
 - 2. Compact each layer of backfill to not less than the scheduled percentages of maximum dry density at +/-3% optimum moisture content as determined by ASTM D698 (Standard Proctor).
- B. Equipment: Use power-driven hand tampers for compacting materials adjacent

to structures and in trenches. Provide equipment capable of adding moisture to the soil material or for aerating the soil as determined necessary by moisture-density tests.

- C. Moisture Conditioning: Uniformly apply water in such a manner as to prevent free water appearing on the surface, either during or subsequent to compaction operations. Compaction by flooding is prohibited.
- D. Re-fill, re-grade and re-finish any area that becomes unsatisfactory due to freeze-thaw, erosion or settling. All areas or portions thereof that do not meet minimum density requirements shall be reworked and compacted until they meet the project density requirements.

3.6 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1-1/2 inches (0.12 ft) (37 mm) from required elevations.
- B. This tolerance shall not relieve the Contractor from providing minimum sections of finish surfaces or meeting critical spot grades shown on drawings.

3.7 FIELD QUALITY CONTROL

- A. Compaction testing will be performed in accordance with ASTM D698 (Standard Proctor) and ASTM D3017 (Moisture Content).
- B. Field testing methods shall be as deemed appropriate by the Project Geotechnical Engineer.
- C. Request inspection prior to and immediately after placing bedding.
- D. Frequency of Compaction Tests: One per lift per 200 LF of trench or fraction thereof.
- E. If tests indicate Work does not meet specified requirements, remove unacceptable Work, replace, compact, and retest.

3.8 PROTECTION OF FINISHED WORK

- A. Re-fill, re-grade and re-stabilize any area that becomes unsatisfactory due to freeze-thaw, erosion or settling, or vehicular traffic during construction.

3.9 SCHEDULE: See applicable trench sections on Drawings.

- A. Backfill Under Asphalt Pavement, Concrete Flatwork, and Road Shoulders:
 - 1. To pavement subgrade, compacted to 100 percent.
- B. Backfill Through Embankments Under Grass Areas:
 - 1. To specified depth of topsoil below finish grade, compacted to 90 percent. See Section 329119 - Landscape Grading.
- C. Backfill Under Grass:

1. To specified depth of topsoil below finish grade, compacted to 90 percent.
See Section 329119 - Landscape Grading.
- D. Backfill Under Landscaped Areas:
1. To 12 inches (300 mm) below finish grade, compacted to 90 percent.
- E. Backfill to Correct Over-excavation:
1. Flush to required subgrade elevation, compacted to 95 percent. On a case by case basis, as approved by the Engineer, lean concrete to minimum compressive strength of 1000 psi (7 MPa) may be allowed.

END OF SECTION

SECTION 312318 ROCK REMOVAL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Removal of identified and discovered rock during excavation.
- B. Expansive tools to assist rock removal.
- C. Blasting is prohibited.

1.2 RELATED SECTIONS

- A. Appendix: Subsurface Investigation Report: Rock and weathered rock locations and depths.
- B. Section 312213 - Rough Grading: Subsoil materials. Backfilling.
- C. Section 312316 - Excavating: Building component excavation.
- D. Section 312323 - Backfilling: Backfill materials.
- E. Section 312513 - Utility Trenching & Backfilling: Utility excavation, backfill and compaction.

1.3 UNIT PRICE –PAYMENT

- A. Excavation and replacement of Rock shall be performed in accordance with the Bid Form. Identification and in situ measurement by the project Geotechnical Engineer shall be prerequisites for payment.

1.4 DEFINITIONS

- A. Definitions of Rock provided within the Subsurface Geotechnical Investigation located within the Appendix of the Project Manual shall not be used. Definitions of Rock for this project shall be as defined herein and below.
- B. Rock: Hard rock excavation material for Mass or Trench Rock. In open excavations and mass grading, rock requiring hard rock excavation methods for removal is defined as any material which cannot be dislodged by a Caterpillar D-8N heavy duty track type tractor, rated at not less than 285 hp flywheel power and equipped with a single-shank hydraulic ripper, capable of exerting not less than 45,000 lbs breakout force or equivalent without use of drilling or blasting or hoe-ramming. In confined excavation, such as footing or trench excavation, it is defined as any material which cannot be dislodged by a Caterpillar 215D LC track type hydraulic excavator, equipped with a 24-inch wide short-tip radius rock bucket, rated at not less than 120 hp flywheel power with bucket curling force of not less than 25,000 lbs and stick-crowd force of not less than 18,000 lbs should be used. Boulders or masses of rock exceeding one cubic yard in volume shall also be considered rock

excavation. This classification does not include materials such as loose rock, concrete, or other materials that can be removed by means other than hoe-ramming, but which for reasons of economy in excavating, the contractor chooses to remove by hoe-ramming techniques

1.5 SCHEDULING

- A. Schedule Work to avoid disruption to work in occupied buildings nearby.

PART 2 PRODUCTS

- 2.1 Rock Splitting Mortar – Da-mite, as manufactured by Daigh Company, 2393 Canton Hwy. Ste 400 Cumming, GA 30040, 1-770-886-4711, or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Division 01.
- B. Verify site conditions and note subsurface irregularities affecting work of this section.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Deliver materials to job-site in their original, unopened containers, with all labels intact and legible at the time of use and bearing the manufacturer's warnings to be observed in the handling and use of chemicals.
- C. Provide adequate protection of all materials and equipment before, during and after execution of the Work.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

- A. Excavate and remove rock by the mechanical method.
- B. Drill holes and utilize expansive tools, wedges, or mechanical disintegration compound to fracture rock.
- C. Cut away rock at bottom of excavation to form level bearing.
- D. Remove shaled layers to provide sound and unshattered base for foundations.
- E. In utility trenches, excavate to 12 inches (300 mm) below invert elevation of pipe and 24 inches (600 mm) wider than pipe diameter.

- F. Remove excavated materials from site.
- G. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 312323 - Backfilling.

3.4 FIELD QUALITY CONTROL

- A. Provide for visual inspection of foundation bearing surfaces and cavities formed by removed rock

END OF SECTION

SECTION 312323
BACKFILLING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Building perimeter and site structure backfilling to subgrade elevations.
- B. Site backfilling.
- C. Fill under slabs-on-grade.
- D. Fill in landscaped beds/areas.
- E. Fill for over-excavation.
- F. Consolidation and compaction as scheduled.

1.2 RELATED SECTIONS

- A. Appendix: Geotechnical report; bore hole locations and findings of subsurface materials.
- B. Section 310900 - Geotechnical Engineering, Inspection, and Testing: Geotechnical Engineer.
- C. Section 310513 - Soil Materials.
- D. Section 310516 - Aggregate Materials.
- E. Section 312316 - Excavating.
- F. Section 312317 - Utility Trenching & Backfilling: Backfilling of utility trenches.
- G. Section 334600 - Subdrainage: Filter aggregate and filter fabric.
- H. Section 329119 - Landscape Grading: Filling of topsoil to finish grade elevation.
- I. Section 033000 - Cast-in-Place Concrete: Concrete materials.

1.3 REFERENCES

- A. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

- C. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- D. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- E. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.4 SUBMITTALS FOR REVIEW

- A. Samples: Submit to testing laboratory, in air-tight containers, 10 lb (4.5 kg) sample of each type of subsoil fill from each source to be used.
- B. Samples: Submit to testing laboratory, in air-tight containers, 10 lb (4.5 kg) sample of each type of aggregate fill from each source to be used.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Refer to specific trench sections detailed on the Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify sub-drainage, damp proofing, or waterproofing installation has been inspected.
- B. Verify structural ability of unsupported walls to support loads imposed by the fill. Allow necessary time for curing and provide adequate bracing prior to backfilling.

3.2 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Type A4 fill and compact to density equal to or greater than requirements for subsequent fill material.
- C. Scarify and proof roll subgrade surface to a depth of 1 inch (13 mm) to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

- A. Backfill areas to contours and elevations with unfrozen materials.

- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Place geotextile fabric over Type A2 fill prior to placing next lift of fill.
- D. Soil Fill Type S1: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.
- E. Employ a placement method that does not disturb or damage other work.
- F. Maintain optimum moisture content of backfill materials to attain required compaction density.
- G. Backfill against supported foundation walls and retaining walls. Do not backfill against unsupported walls.
- H. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- I. Maintain minimum grade away from building per Section 312213 – Rough Grading.
- J. Make gradual grade changes. Blend slope into level areas.
- K. Stockpile in sufficient quantities to meet Project schedule and requirements where specified in Section 312213 – Rough Grading. Remove excess material and material unsuitable for reuse as fill from site.

3.4 TOLERANCES

- A. Top Surface of Backfill (Subgrade): Plus or minus 0.1 foot (30 mm) within 100 feet of buildings, under all pavement and site improvements (such as athletic/play fields); and 0.25 foot (75 mm) on surrounding fields and slopes.

3.5 FIELD QUALITY CONTROL

- A. Section 310900 - Geotechnical Engineering, Inspection, and Testing.
- B. Compaction testing will be performed in accordance with ASTM D698.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

- D. Frequency of Tests: Meeting requirements listed in Section 312213 – Rough Grading

	<u>Max. Lift Thickness</u>	<u>Tests (per Lift)</u>
Backfills (Exterior)	8"	1 per 2,500 s.f.
Under Paving, Curbs, Walks, Footings, and Slabs on Grade	8"	1 per 1,000 s.f.

3.6 PROTECTION OF FINISHED WORK

- A. Reshape and re-compact fills subjected to vehicular traffic.

3.7 SCHEDULE

- A. Interior Crawl Spaces:
1. Fill Type S1, sufficient to equalize load on wall exterior, compacted to 90 percent.
- B. Interior Slab-On-Grade:
1. Fill Type S1, per section on Drawings, compacted to 95 percent,
 2. Cover with Fill Type A3, per section on Drawings, compacted to 95 percent.
- C. Exterior Side of Foundation Walls, Retaining Walls and Over (geotextile protected) Granular Filter Material and Foundation Perimeter Drainage Stone:
1. Fill Type S1, per structural details to subgrade elevation, each lift, compacted to 90 percent.
- D. Fill Under Grass Areas:
1. Fill Type S1, to rough grade, compacted to 90 percent.
- E. Fill Under Landscaped Areas:
1. Fill Type S1, to rough grade, compacted to 90 percent.
- F. Fill For Berming:
1. Fill Type S1, to rough grade, compacted to 95 percent.
- G. Fill Under Asphalt or Concrete Paving:
1. Compact subsoil to 100 percent of its maximum dry density.
 2. Fill Type A4, to depth of pavement below finish paving elevation per pavements sections, compacted to 100 percent.
- H. Fill to Correct Over-excavation:
1. Lean concrete to minimum compressive strength of 1000 psi (7 MPa), OR
 2. Fill Type A4, flush to required elevation, compacted to 100 percent.

END OF SECTION

SECTION 312513
EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 WORK INCLUDED (But is not limited to)

- A. Furnish all labor, equipment and materials to complete and maintain Erosion and Sediment Control (ESC) measures necessary to prepare for and control proposed land disturbance per local and state regulations.
- B. Responsible Land Disturber defined.
- C. Install ESC Structures and Measures.
- D. Maintain Effectiveness of Structures and Measures.
- E. Control Water Run-off.
- F. Control Dust Accumulation.
- G. Control Amount of Disturbed/Unstabilized Area.
- H. Temporary and Permanent Stabilization of Disturbed Areas.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 00 & 01: Permits, Fees, & Notices: Land Disturbing Permit.
- B. Section 311000 – Site Preparation & Clearing: Topsoil Stripping and Stockpiling.
- C. Section 312213 – Rough Grading: Site subgrade contouring.
- D. Section 312316 – Excavating and Filling: Excavating for other than linear utility work.
- E. Section 312323 – Backfilling: Backfilling for other than linear utility work.
- F. Section 312317 – Utility Trenching & Backfilling.
- G. Section 334100 – Site Storm Drainage System.
- H. Section 329119 – Landscape Grading: Topsoiling.
- I. Section 329219 – Seeding: Temporary Seeding. Permanent Seeding. Dry-Seeding Mulch. Hydroseeding Mulch. Liquid Mulch Binder. Erosion Control/Revegetation Mats. Staples. Hydroseeding. Soil Supplements.
- J. Section 329223 – Sodding.

1.3 REFERENCES

- A. ~~Virginia Erosion & Sediment Control (ESC)~~ Stormwater Management (VSM) Handbook: Temporary seeding, construction entrances and other measures or practices which may apply.
- B. Virginia Department of Transportation (VDOT) "Road & Bridge Standards & Specifications": Outlet Protection, Channel Sections, Materials, Installation of Measures, etc. (but excluding references to measurement and payment).

1.4 DEFINITIONS

- A. Local Governing Authority (LGA) - The state agency, plan approving authority, municipal department or other entity which legally has jurisdiction over the referenced work or activity. This usually means the field official who makes or controls onsite inspections of the Work.

1.5 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all requirements of the Virginia Erosion & Sediment Control Law pertaining to this project as presented in the ~~Virginia Erosion & Sediment Control~~ VSM Handbook.
- B. Erosion & Sediment Control (ESC):
 - 1. The Contractor shall employ a Responsible Land Disturber who is certified by the Department of Conservation and Recreation. The name of this person is to be designated in writing by the Contractor to the State ESC plan approving authority (LGA) and the Owner along with copies of their certification prior to any land disturbance. The Responsible Land Disturber for this project shall be in charge of and is responsible for carrying out the land-disturbing activities on this project. The certified Responsible Land Disturber may change at any time during the life of this project, as long as the State ESC plan approving authority is notified in advance and in writing.
 - 2. Obtain and pay for such land disturbing permits as required by the plan approving authorities, including fees and bonds, per Division 0 & 1.
 - 3. The Contractor shall not begin land disturbance until all required permits have been obtained and, if required, posted at the site. Permits may include, but are not limited to, the following:
 - a) Local (or State) Land Disturbance Permit.
 - b) Virginia Stormwater Management Program (VSMP) Permit.
 - 4. The plans have been drawn according to specifications of the ~~Virginia Erosion and Sediment Control~~ VSM Handbook (Latest Edition) and pertinent state regulations. The ESC Narrative shall be considered part of these Contract Documents as required by the State ESC plan approving authority (LGA).

1.6 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures: Submittals.
- B. All products identified in PART 2 of this specification.

- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All Erosion and Sediment Control materials shall conform to the standards set forth in the ~~ESG~~ VSM Handbook unless indicated as VDOT Std. in which case they shall conform to the "Road & Bridge Stds. & Specs."
- B. Construction Entrance Stone: Provide in accordance with the ~~ESG~~ VSM Handbook ~~Std. & Spec. 3.02~~ C-SCM-03.
- C. Construction Road Stabilization Stone: Provide in accordance with ~~ESG~~ VSM Handbook ~~Std. & Spec. 3.03~~ C-SCM-02. Within areas to be paved and once rough grade has been obtained, the Contractor may use pavement base material as specified and/or indicated in the pavement section on Drawings.
- D. Outlet Protection or Storm Water Conveyance Channel Stone: Provide in accordance with VDOT Std. EC-1 Erosion Control Stone and Spec. 414.03(e) Erosion Control Stone. Stone shall be sound, durable, non-erodible shot rock or rock excavation free from seams, cracks, and other structural defects. Also see sized indicated on the Drawings.
- E. Outlet Protection Stone Geotextile Fabric for bedding shall conform to VDOT Std. & Spec. Section 245, which includes but is not limited to meeting the following requirements: apparent size opening equal to or greater than No. 50 sieve as tested per ASTM D4751, tensile strength @ 20% maximum elongation of 30 lbs/linear inch minimum as tested per VTM-52, puncture strength of 80 lbs minimum as tested per ASTM D4833, and have seams equal in strength to the basic material. Submit written documentation of test results from an independent commercial lab verifying that material meets specified requirements.
- F. Silt Fence: Woven fabric for use as silt fence around inlets or to protect slopes.
 - 1. Manufacturer - Product:
 - a) Amoco - Propex Silt Stop
 - b) Mirafi, Inc. - Mirafi 100X, Envirofence
 - c) Exxon - GTF 101-S
 - 2. Posts for staking silt fence shall be 1" x 2" wood with a minimum length of 48".
- G. Filter Fabric: Non-woven fabric for use in foundation drain systems, dry wells, lining beneath EC Stone, etc..
 - 1. Manufacturer - Product:
 - a) TC Mirafi – Mirafi 180N
 - b) Amoco Fabrics and Fibers Co. – ProPex 4547
 - c) Reemay, Inc. – Typar 3401

- H. Temporary & Permanent Seeding and Related Items: Provide in accordance with Section 329219 – Seeding.
- I. Water: Water shall be potable and provided in accordance with Section 015100 – Temporary Utilities: Temporary Water.

PART 3 EXECUTION

3.1 GENERAL

- A. Accept premises as found. Owner assumes no responsibility for conditions of the site or continuation of conditions existing at the time of advertisement.
- B. Temporary erosion and sediment control measures are required during construction and shall be installed prior to any clearing, grading or other construction, and to the minimum standards and specifications of the ~~ESC~~ VSM Handbook. Comply with all minimum standards of the Virginia Erosion and ~~Sediment Control~~ Stormwater Management Regulations, ~~4VAC50-30-40~~ 9VAC25-875 of the Code of Virginia.
- C. Permanent storm water management measures are required for the project and shall be installed to the minimum standards and specifications of the ~~ESC~~ VSM Handbook. Comply with all minimum standards of the Virginia Erosion and Stormwater Management Regulations, ~~4VAC3-20~~ 9VAC25-875 et seq.
- D. The erosion control and storm water management plans as approved by the LGA shall be made part of these Contract Documents. This includes the ESC Narrative.
- E. Prior to initial disturbance of earth, comply with all applicable standards and ordinances to prevent soil erosion and siltation. Install, construct and maintain such measures as shown on Drawings and all others as required by the inspecting authorities having jurisdiction.
- F. Be responsible for satisfying any and all erosion control and storm water management requirements for any land disturbing activities, including but not limited to on-site or off-site borrow, on-site or off-site stockpiling or disposal of waste materials. Before undertaking any land disturbing activity for which the Contract Documents do not specifically address erosion control and storm water management (such as off-site borrow and waste areas), contact the Regional Office of the Division of Soil and Water Conservation (SWC) or other LGA to determine what Erosion Control and storm water management measures are necessary. Completely satisfy all requirements of the LGA, including payment of design, review, and permit expenses, before continuing with the concerned activity.
- G. Dust Control: Any material which will result in dust shall be wet down during the work.
- H. Use whatever means necessary to prevent mud and dirt from being carried onto public streets.
- I. Should mud and dirt accumulate on streets execute immediate cleaning methods to remove accumulation.

3.2 PREPARATION

- A. Assure that all pertinent required permits have been obtained.
- B. Notify LGA of intent to begin work.
- C. Verify that existing trees/plant life designated to remain, are conspicuously marked as such.

3.3 PROTECTION

- A. Protection of adjacent properties and waterways: Prior to any land disturbance activity install Erosion and Sediment Control measures. See Site Drawings for specific practices required to prevent soil from washing from areas disturbed during clearing operations. Maintain all ESC measures required.
- B. Protection of Existing Trees and Vegetation:
 - 1. Provide protection for existing trees, plant growth, and features designated to remain against compacting the root zone, unnecessary cutting, breaking, skinning of roots, or bruising of bark. Conform to details and specifications of the ~~ESC~~ VSM Handbook for methods of protection.
 - 2. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to the Architect.

3.4 EROSION & SEDIMENT CONTROL MEASURES

- A. General:
 - 1. The LGA reserves the right to require more ESC measures if field observation of in place measures shows they are inadequate for the task.
 - 2. Maintain erosion control during construction until permanent pavement, plantings and restoration of natural areas is effective in controlling erosion.
 - 3. Plan and execute construction by methods to control surface drainage from cut, fill, borrow and grading areas.
 - 4. Minimize amount of bare soil exposed at one time.
 - 5. Schedule operations so ground surface will be disturbed for shortest possible time before permanent construction is installed.
 - 6. Maintain large areas as flat as practicable to minimize soil transfer through surface flow.
 - 7. Storm Drainage System: Install as much of permanent system as soon as practicable and divert surface water into system, with remainder of system installed as soon as conditions allow. Coordinate with Section 334100 - Site Storm Drainage System.
 - 8. Repair washed and eroded areas. Re-establish required grades, densities, elevations, profiles and contours. Re-seed as required.
- B. Temporary Construction Entrance:
 - 1. A construction entrance is required at all locations where construction vehicles enter a public right-of-way. During wet weather conditions, clean the wheels of construction vehicles prior to their accessing public streets.
 - 2. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec.

- 3.02 C-SCM-03, to the extent shown on Drawings.
3. No point of vehicular access onto the disturbed earthen portion of the site shall be utilized other than the Construction Entrance (CE) shown on Drawings. Access is allowed from pavement directly onto Construction Road Stabilization (CRS) but not from CRS onto disturbed earth.
 4. Place stone to the dimensions shown on Drawings (default: 12' width x 70' length, minimum) and at a depth of 6 inches minimum. A wash rack and temporary water service may be required by the LGA at their discretion.
 5. In addition to periodically adding clean stone to the construction entrance and maintaining the edges, the Contractor is required to clean all mud, soil and debris from public roadways which originates from the project site on a daily basis.
- C. Construction Road Stabilization:
1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. 3.03 C-CSM-02, as required for the job trailer, construction parking, building access, and storage.
 2. Additionally 6-inch depth of roadway base stone shall be placed immediately after final subgrade elevations are established in the portions of the site indicated on Drawings. Should additional portions of the site require stabilizing, such as parking areas, the Contractor shall utilize the same stone size and depth as required herein for roads. See pavement sections on Drawings.
- D. Silt Fence:
1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. 3.05 C-PCM-04 to the extent shown on Drawings.
 2. Drive posts a minimum of 12 inches into the ground at a maximum spacing of 10 feet. Maximum height above grade shall be 36 inches.
 3. At the base of the posts on the up hill side, excavate a continuous shallow trench.
 4. Staple, wire or attach filter fabric to the post according to the manufacturer's instructions, leaving 8 inches of fabric along the bottom.
 5. Extend bottom surplus of fabric into the trench. Backfill and compact the soil over the trench providing a secure anchor.
- E. Storm Drain Inlet Protection for Drop Inlets:
1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. 3.07 C-SCM-04, using filter fabric as herein specified.
 2. Space posts around the perimeter of the inlet at 3 feet on center and drive 12 inches into the ground. The height above-grade of the posts shall be between 15 and 18 inches.
 3. Excavate a shallow trench around the perimeter of the posts.
 4. Staple, wire or attach fabric to the posts according to the manufacturer's recommendations, leaving 8 inches of surplus fabric along the bottom.
 5. Extend bottom of fabric into the trench, backfill and compact over the trench.
- F. Storm Drain Inlet Protection for Curb Drop Inlets:
1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. 3.07 C-SCM-04, using filter fabric as herein specified.
 2. Place fabric over throat of inlet such that at least 12 inches extends across

- the top surface of the structure and 12 inches extends across the flow line or gutter line.
3. Place VDOT #1 stone along the top and gutter line edges of the fabric to anchor the edges, then place stone along throat area of inlet.
- G. Storm Drain Inlet Protection for Culverts:
1. Install and maintain in accordance with ~~ESC Std.~~ & VSM Handbook Spec. ~~3.08~~ C-SCM-05, using material as herein specified.
 2. Space posts around the perimeter of the culvert inlet placed approximately 6 feet up stream from the culvert at a maximum of 3 feet on center and drive 12 inches into the ground. The height above-grade of the posts shall be between 16 and 36 inches.
 3. Excavate a shallow trench around the perimeter of the posts.
 4. Staple, wire or attach fabric to the posts according to the manufacturer's recommendations, leaving 8 inches of surplus fabric along the bottom.
 5. Extend bottom of fabric into the trench, backfill and compact over the trench.
 6. If the above proves of insufficient to provide protection from silt entering the culvert, replace with the Optional Stone Combination as detailed in ~~ESC~~ VSM Handbook ~~Plate 3.08-4~~ Figure C-SCM-05-1.
- H. Outlet Protection or Storm Water Conveyance Channel:
1. After surrounding area has been brought to subgrade, excavate to subgrade elevations for OP or SCC as indicated from finish grade on plans less EC Stone depth in detail.
 2. Compact subgrade to requirements for surrounding subgrade under applicable earthwork section.
 3. Install bedding geotextile fabric in accordance with detail, overlapping joints 6 inches minimum and stapling per manufacturer's recommendations and entrenching entire perimeter of fabric 9 inches. Compact fabric entrenchment to requirements of surrounding subgrade.
 4. Place, do not dump, Erosion Control Stone to the dimensions and configuration indicated on the applicable detail.
- I. Erosion Control/Re-vegetation Mat:
1. Install Erosion Control Mat in accordance with VDOT Std. EC-2 or EC-3 in the locations shown on Drawings or as otherwise indicated.
 2. Install Re-vegetation Mat in the locations shown on Drawings or otherwise indicated. Mat shall conform to Part 2 of Section 329219 - Seeding.
 3. Shape and grade the channel or slope; remove all rock and debris.
 4. Place and compact topsoil to the depth previously specified.
 5. Apply fertilizer, lime and seed at the rates specified for seeded lawn areas in Section 329219 – Seeding.
 6. Place and secure the mat as described in Part 3 of Section 329219 – Seeding.
- J. Temporary Check Dams in Swales:
1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.20~~ C-SCM-07.
 2. Place VDOT #1 stone in locations as necessary to control erosion such that the entire width of the swale is guarded. The maximum height of the dam shall not exceed 24 inches. The center portion shall be 6 inches lower than

- the outer edges.
3. Upstream and downstream faces of the dam shall be sloped 2 feet horizontally for every one foot of height.
- K. Temporary Right-of-Way Diversion
1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.14~~ C-SCM-07.
 2. Place VDOT #1 stone or compacted earth at a maximum of 18 inches in height.
 3. Spacing shall be as specified in Table ~~3.14.A~~ C-ECM-07-2 at a maximum and as shown on the Drawings.
 4. All diversions shall be directed to an adequate receiving channel, pipe, or system.
 5. Adjust locations based upon field observations and changing site conditions.
- L. Temporary Sediment Trap
1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.13~~ C-SCM-11.
 2. Coordinate locations with other diversion measures.
 3. Contributing drainage areas shall not exceed 3.0 acres. Field adjust measures and diversions during construction where conditions cause drainage areas to approach the maximum 3.0 acres of drainage area.
 4. Perform maintenance inspections regularly along with cleanout procedures when measures approach 50% of the accumulated sediment depth.
- M. Sediment Basin (temporary) / Detention Basin (permanent):
1. Install sediment basin in accordance with and at the location shown on the Drawings. This shall be part of the first work accomplished since it is the primary measure to control sediment from leaving the site from further land disturbance.
 2. Basin shall double as the permanent detention basin and as such shall be carefully constructed to assure the long-term water restraining integrity of the earthen berm. Berm construction shall be performed in accordance with Virginia Stormwater Management Handbook (Latest Edition), Section ~~3.04~~ P-SUP-01, Earthen Embankments.
 3. Extreme care shall be taken when closing the berm across the existing drainage channel since it drains a large, developed area.
 4. As a sediment basin, the primary outlets shall be modified as detailed on the plans to act as dewatering devices.
 5. Upon stabilization of the site, the sediment basin shall be converted to the detention basin by cleaning out any sediment, dressing to rough grade, topsoiling to finished grade, seeding, and landscaping. The dewatering device shall be removed and all orifices cleanly trimmed (square, sharp, without burrs, and removing any bends, tees or caps used for the dewatering device installation both inside and outside the outlet structure. Any concrete channel lining or pads proposed within the basin shall also be placed at this time.
- N. Temporary Seeding:
1. Temporary seeding shall be applied to denuded areas within seven (7) days after final grade has been established and to portions of the site which may

not be at final grade but which will remain inactive for more than ~~30~~ 14 days and less than one year. Lawn areas and slopes may be topsoiled and permanently seeded only if this can be accomplished during the correct time of year for the permanent seed mixture specified in Section 329219 – Seeding. Permanent Seeding is required for areas which will remain dormant for more than one year.

2. Where the area is compacted, crusted or hardened, the soil surface shall be loosened by disking, raking, harrowing or other means.
3. Apply lime at a rate of 50 pounds per 1000 sq. ft. and ~~5-10-10~~ 10-20-10 fertilizer at ~~40~~ 14 pounds per 1000 sq. ft. Thoroughly mix into loosened soil.
4. Seed shall be evenly applied at a rate of 1-2 lbs. per 1000 sq. ft. to the prepared ground and mulched.
5. Slopes greater than 3:1 shall be hydroseeded. Other areas may be hydroseeded or dry seeded at the Contractor's option.
6. Hydroseeding operations shall include seed, fertilizer, mulch and binder in one operation. Areas which are hydroseeded from 6/1 to 9/1 or 12/1 to 3/1 shall be mulched with straw. Wood fiber mulch shall not be used during these times.
7. After mulching of dry seeded areas, mulch shall be stabilized using a liquid binder. Portions which continue to lose mulch due to wind or runoff shall be further stabilized with mulch stabilization netting. Install netting according to Section 329219 – Seeding.
8. Areas which fail to establish initial vegetative cover adequate in checking erosion shall be re-seeded as soon as such areas are recognized. Matting and blankets shall be installed on areas which fail to establish subsequent vegetative efforts.

O. Topsoil/Soil Materials Stockpile: Do not stockpile in drainage ways or within the drip line of trees. Stockpile to a depth not exceeding 8 feet (2.5 m) and with side slopes not exceeding 2H:1V. Protect from wind and water erosion and from admixture of debris.

P. Tree Protection:

1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.38~~ C-SSM-01 to the extent shown on the Drawings, unless detailed otherwise. Also refer to Section 311000 – Site Clearing and Preparation and Section 312323 – Backfilling for filling within drip lines of vegetation to remain.
2. The limits of clearing shall be beyond the drip line of existing trees to remain.
3. Prior to clearing the site, protected trees shall be clearly identified with a bright colored surveyor's ribbon applied in a band circling the tree at heights of 4 and 8 feet.
4. No equipment, building materials or topsoil shall be placed within the drip line of protected trees.
5. 40 inch high snow fence shall be placed at the limits of clearing (drip line). Fence shall be maintained at all times.

3.5 REMOVAL OF TEMPORARY EROSION AND SEDIMENT CONTROLS

- A. Remove temporary erosion and sediment control measures within 30 days after permanent lawn areas have become substantially established as defined in Section 329219 - Seeding or after the temporary measures are no longer required as determined and authorized by the local program administrator. Permanently stabilize disturbed soil areas resulting from the disposition of temporary measures to prevent further erosion.

END OF SECTION

SECTION 313116
TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Soil treatment with termiticide.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of termite control product.
 - 1. Include the EPA-Registered Label for termiticide products.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For termite control products, from manufacturer.
- B. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Termiticide brand name and manufacturer.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes used, and rates of application.
 - 6. Areas of application.
 - 7. Water source for application.
- C. Warranties: Sample of special warranties.

1.5 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures: Submittals.
- B. All products identified in PART 2 of this specification.

- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- B. Source Limitations: Obtain termite control products from single manufacturer.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.8 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

- 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. BASF Corporation, Agricultural Products; Termidor.
 - b. Bayer Environmental Science; Premise 75.
 - c. FMC Corporation, Agricultural Products Group; Dragnet FT, Talstar, Prevail.
 - d. Syngenta; Demon TC, Prelude, Probuild TC.
2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified

concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

SECTION 321216
ASPHALT PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Asphaltic Concrete Paving; surface/wearing course and base/binder course.
- B. Surface sealer, primer/tack coat.
- C. Aggregate Base Course; depth and compaction.

1.2 RELATED SECTIONS

- A. Appendix: Subsurface Investigation/Geotechnical Report (for Contractor's use).
Geotechnical Engineer.
- B. Section 310900 - Geotechnical Engineering, Inspection, and Testing.
- C. Section 310513 - Soil Materials: Testing aggregate materials.
- D. Section 310516 - Aggregate Materials: Aggregate Base Course. Testing
aggregate materials.
- E. Section 312213 - Rough Grading: Site subgrade contouring. Preparation of site
for paving and base. Compaction testing.
- F. Section 312316 - Excavating: Excavating for other than linear utility work.
- G. Section 312323 - Backfilling: Backfilling for other than linear utility work.
- H. Section 312317 - Utility Trenching & Backfilling.
- I. Section 334100 - Site Storm Drainage Systems.
- J. Section 321723 - Pavement Marking & Signage.
- K. Section 329119 - Landscape Grading: Topsoil depth. Adjacent surface rough
grade.

1.3 DEFINITIONS

- A. Local Governing Authority (LGA) - The state agency, municipal department or
other entity which legally has jurisdiction over the referenced work or activity. This
usually means the field official who makes or controls onsite inspections of the
work.

1.4 REFERENCE STANDARDS

- A. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.
- B. Manual of Uniform Traffic Control Devices (MUTCD, including Virginia supplement), latest edition.
- C. Americans With Disabilities Act (ADA): 28 CFR Part 36, Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities; Final Rule dated July 26, 1991.
- D. Local Governing Authority Regulations pertaining to work of this section (i.e. handicapped parking marking and signage requirements, fire lane marking and signage requirements, etc.).

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with requirements of Reference Standards above. Refer to ACI 304 for any concrete related item not covered in Reference Standard.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with industry standards, the specified requirements and the methods for proper performance of the work of this section.
- C. Asphalt Mixing Plant: VDOT Certified.
- D. Obtain materials from same source throughout.

1.6 SUBMITTALS FOR REVIEW

- A. Submit certification from Asphalt batch plant for proposed mix design of each class of mix for information prior to beginning of work.
- B. All products identified in PART 2 of this specification.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not produce or place asphalt when the weather is rainy or foggy, when the base course is frozen or has excess moisture, or when the ambient temperature is less than 40 degrees F in the shade away from artificial heat.
- B. Other materials shall be placed or installed per manufacturer's recommendations.

1.8 BARRICADES AND SIGNALS

- A. Within public right-of-way, provide and maintain temporary signs, signals, lighting devices, markings, barricades, and channelizing and hand signaling devices in accordance with DOT D-6.1 to protect personnel and new construction from

damage by equipment and vehicles until the surface is approved by the VDOT Inspector, LGA, or Architect/Engineer, as applicable.

- B. On-site, provide and maintain temporary signs, signals, lighting devices, markings, and barricades to protect personnel and new construction from damage by equipment and vehicles until the surface is approved by the Architect/Engineer.

1.9 REGULATORY REQUIREMENTS

- A. VDOT review, approval and inspections per VDOT Stds.

PART 2 PRODUCTS

2.1 AGGREGATE BASE COURSE

- A. Aggregate Base under Asphalt Pavement: Coarse Aggregate Type A4 in accordance with Section 310516 - Aggregate Materials (see Pavement Sections on Drawings).

2.2 ASPHALTIC CONCRETE PAVING

- A. Primer, Tack & Seal Coats: In accordance with VDOT Section 210, Asphalt Materials.
- B. Asphalt Base Course: In accordance with VDOT Section 212.20, Type BM-25.0 bituminous concrete.
- C. Asphalt Surface Course: In accordance with VDOT Section 212.17, Type SM-12.5D bituminous concrete.

2.3 SOURCE QUALITY CONTROL AND TESTS

- A. Section 310900 – Geotechnical Engineering, Inspection, and Testing: Aggregate and asphalt testing. Compaction testing. Geotechnical Engineer.
- B. Have required tests made by Geotechnical Engineer (in lieu of VDOT) per Reference Standard. Submit all required information and results to the Owner. Test asphalt samples for depth and density.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate the Work and verify base conditions. Verify that all pre-requisite work (subsurface utilities, etc.) has been completed and is ready to receive the work of this section. Verify that compacted subgrade is dry and ready to support paving/surfacing and imposed loads. Verify that gradients and elevations of base are correct.
- B. Ensure that all existing utility structures, new or existing, have been adjusted to meet proposed finished grades prior to paving.

3.2 PLACING AGGREGATE BASE COURSE

- A. For Asphalt Pavement: Begin spreading base material at the point nearest the source of supply. Permit traffic and hauling over the base. Fill ruts formed by traffic and reroll. After base course placement, continue machining and rolling until surface is smooth, compacted, well bonded, and true to the designed cross section. Compact to 100 percent ASTM D-698 maximum dry density. Maintain the base smooth and true to grade and cross section until asphaltic concrete placement.

3.3 PREPARATION

- A. Protect finished surfaces adjacent to asphalt work from overspray, damage by equipment, etc.
- B. For repair work, cut existing surface back to undisturbed material to provide uniform division lines between existing and new work.
- C. Butt new work to existing surfaces to result in smooth transitions and uniform sections.
- D. Before placing surface, inspect the subgrade and base for conformity with the specified section. If necessary, remove or add material to bring all portions of the subgrade and base to proper section and correct elevation. Thoroughly compact and inspect the adjusted section after correcting.
- E. Asphalt Pavement - Primer:
 - 1. Apply a prime coat on the finished stone base course at a rate of 0.25 gallon residual asphalt per square yard. Allow prime coat to cure for a minimum of 48 hours prior to placing asphaltic concrete. Apply cutback asphalts when the stone base course is dry. Lightly spray stone base with water immediately prior to application of emulsified asphalts. During prime coat placement, minimum ambient temperature shall be 50 degrees F and rising. Maintain and protect primed surfaces from damage until asphaltic concrete placement.
 - 2. Apply primer in accordance with VDOT Section 311 - Prime Coat.
 - 3. Apply primer to contact surfaces of curbs and gutters.
 - 4. Use clean sand to blot excess primer.
- F. Asphalt Pavement - Tack Coat:
 - 1. Apply tack coat on existing pavement to be overlaid at a rate of 0.10 gallon residual asphalt per square yard. Thoroughly clean surfaces to receive the tack coat immediately prior to application of tack coat. Tack coat shall be tacky at the time of asphaltic concrete placement.
 - 2. Apply tack coat in accordance with VDOT Standards.
 - 3. Apply tack coat to contact surfaces of curbs and gutters.
 - 4. Coat surfaces of manhole and drainage structure frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.
- G. Asphalt Pavement - Seal Coats:
 - 1. Apply asphalt and cover material in accordance with VDOT Section 312 -

Seal Coat.

3.4 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Install Work in accordance with VDOT standards.
- B. Place to compacted thickness identified in details on Drawings.
- C. Install drainage tops/frames in correct position and elevation.
- D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- E. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.5 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Place base/binder course to compacted thickness identified in details on Drawings.
- B. Place surface/wearing course within two (2) hours of placing and compacting binder course.
- C. Place surface/wearing course to compacted thickness identified in details on Drawings.
- D. Install drainage tops/frames in correct position and elevation.
- E. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- F. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.6 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch (6 mm) measured with 10 foot (3 m) straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch (6 mm).
- C. Variation from True Elevation: Within 1/2 inch (12 mm).
- D. Assure that drainage swales over pavement function as designed.

3.7 FIELD QUALITY CONTROL

- A. Field testing methods shall be as determined by the Geotechnical Engineer.

3.8 PROTECTION OF ASPHALT

- A. Immediately after placement, protect pavement from premature drying and excessive hot or cold temperatures. Also, protect pavement from mechanical injury for one (1) day or until surface temperature is less than 140 degrees F (60 degrees C).
- B. Do not permit pedestrian traffic over pavement for 7 days minimum after finishing.

3.9 SCHEDULES

- A. Refer to details on the Drawings.

END OF SECTION

SECTION 321313
PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete sidewalks, stairs, integral curbs, curb &/or gutters, median barriers, parking areas, and roads.
- B. Aggregate base course.

1.2 RELATED SECTIONS (including but not limited to)

- A. Section 013300 - Submittals.
- B. Section 014000 - Quality Requirements: Quality Assurance, Mock-ups
- C. Section 014110 - Inspection and Testing.
- D. Section 015700 - Traffic Regulation.
- E. Section 017000 - Execution Requirements: Protection of Completed Work.
- F. Section 033000 - Cast-in-place Concrete: Reinforcing, Joints, Curing.
- G. Section 055000 - Misc. Metals: Stair safety nosing and handrails.
- H. Section 079200 - Joint Sealers: Sealant for joints.
- I. Section 310900 - Geotechnical Engineering, Inspections, and Testing.
- J. Section 310516 - Aggregate Materials: Aggregate base course.
- K. Section 312213 - Rough Grading: Preparation of site for paving and base.
- L. Section 312323 - Backfilling: Compacted subbase for paving.
- M. Section 321216 - Asphalt Pavement.
- N. Section 321723 - Pavement Markings & Signage: Pavement markings.
- O. Section 329119 - Landscape Grading: Preparation of subsoil at pavement perimeter.

1.3 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings.

- B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- C. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
- D. ASTM C33 - Concrete Aggregates.
- E. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- F. ASTM C698 - Test Methods for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- G. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.

1.4 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures.
- B. Product Data: Provide data on joint filler, admixtures, curing compounds and ADA tactile warning mats.
- C. All products identified in PART 2 of this specification.
- D. Submit certification from Concrete batch plant for proposed mix design of each class of mix for information prior to beginning of work.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with requirements of Reference Standards above. Refer to ACI 304 for any concrete related item not covered in Reference Standard. Maintain one copy of the reference utilized onsite with Contract Documents.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with industry standards, the specified requirements and the methods for proper performance of the work of this section.
- C. Concrete Mixing Plant: VDOT Certified.
- D. Obtain materials from same source throughout.

1.6 REGULATORY REQUIREMENTS

- A. Conform to VDOT review, approval and inspections per VDOT Stds.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Materials, other than concrete, shall be placed or installed per manufacturer's recommendations.

PART 2 PRODUCTS

2.1 AGGREGATE BASE

- A. Aggregate for Base Course: Type A3 per Section 310516 - Aggregate Materials.

2.2 FORM MATERIALS

- A. Steel form material, profiled to suit conditions.
- B. Joint Filler (General Pavement): Asphalt impregnated fiberboard, 1/2 inch thick by full depth of concrete pavement less 1/2 inch allowance for joint sealant.
- C. Joint Filler (Curbing): Asphalt impregnated fiberboard, 1/2 inch thick by full depth of VDOT Std. CG-2 (curb only) or CG-6 (curb & gutter) as indicated less 1/2 inch allowance for joint sealant. See Drawings for delineation.
- D. Joint Filler (Petroleum locations): Refer to Section 033000 Cast In Place Concrete.

2.3 REINFORCEMENT

- A. Reinforcing Steel and Welded Steel Wire Fabric: Type specified in Section 033000 - Cast-in-Place Concrete.
- B. Dowels: ASTM A615; 40 ksi (276 MPa) yield grade, plain steel, galvanized finish. Dowels shall be #4 size minimum.
- C. Fiber Reinforcement: For vehicular pavement noted at the automatic vehicular gate provide fiber reinforced concrete using Sika Fibermesh – 650, Forta-Ferro, Euclid Tuf-Strand SF, or approved equal. Application rate shall be a minimum of 4 lbs/ cubic yard.

2.4 CONCRETE MATERIALS

- A. Concrete shall be VDOT Std. Class A3 for walks and stairs and Class A4 within traffic bearing areas. See Drawings for delineations.
- B. VDOT Specification Modifications:
 - 1. Slump: Admixtures shall be added to adjust slump to 5.5 inches. Further adjustments shall be made to address workability during hot or cold weather conditions. Adhere to VDOT Specifications for slump when slip forms are used.
 - 2. Curing compounds shall dry clear (no pigment).

- C. Fine and Coarse Mix Aggregates: ASTM C33.
- D. Detectable Warning Surface: Per VDOT Std. CG-12.
- E. Water: Potable, not detrimental to concrete.

2.5 ACCESSORIES

- A. Method of Curing: Membrane Curing Compound meeting requirements of Section 033000 - Cast In Place Concrete.
- B. Joint Sealers: Specified in Section 079200.
- C. Safety Nosing and Handrails: In accordance with Section 055000 - Misc. Metals.
- D. ADA Tactile Warning:
 - 1. Cast Iron Plates: ADA Compliant, Gray Cast Iron Detectable Warning Surface Plates
 - a. Color: Brick Red
 - b. Slip resistant textured iron surface, minimum 0.8 coefficient of friction.
 - c. Purchase the number and size of panels required to create a continuous 2' wide tactile warning strip for the full width of the walkway, as indicated on the plans. Panel sizes should be the largest size available that will fit within the walkway width without requiring cutting or modification of panels. Provide pre-tapered plates to match curves as necessary.
 - d. Install using the "wet-set" method in freshly placed concrete and in strict accordance with manufacturer's installation instructions.
 - e. Erect units without damage to shape or finish, install in locations indicated on the plans. Install flush with surrounding concrete and fully supported by substrate. A variance in grade of any more than 1/4" will not be accepted. Apply slight vibration to fully set panels in fresh concrete.
 - f. Hand tool control joints at edges of panels and in locations shown on drawings. Control joints shall not exceed 6' in spacing.

2.6 FINISH

- A. Finish for exterior flatwork shall be per schedule at the end of this Section.
- B. Edges of exterior flatwork shall be quarter round tooled after broom finish and left with steel troweled appearance and slightest depression below the interior surface.
- C. Crack control joints for exterior flatwork shall be quarter round tooled after broom finish and left with steel troweled appearance and slightest depression below the interior surface.

2.7 SOURCE QUALITY CONTROL AND TESTS

- A. Section 014000 - Quality Requirements: Quality assurance testing.
- B. Section 310900 - Geotechnical Engineering, Inspections, and Testing.
- C. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of work.
- D. Tests on cement and aggregates will be performed to ensure conformance with specified requirements.
- E. Test samples in accordance with ACI 301.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate the Work and verify base conditions under provisions of Div. 1. Verify that all pre-requisite work (subsurface utilities, etc.) has been completed and is ready to receive the work of this section. Verify that compacted subgrade is dry and ready to support paving/surfacing and imposed loads. Verify that gradients and elevations of base are correct.

3.2 PLACING AGGREGATE BASE COURSE

- A. For Concrete Pavement: Place base material of sufficient width to support formed work. Compact to 100 percent ASTM D-698 maximum dry density. Maintain the base smooth, compacted, well bonded, and true to the designed cross section until concrete placement.

3.3 PREPARATION

- A. For repair work, cut existing surface back to undisturbed material to provide uniform division lines between existing and new work.
- B. Butt new work to existing surfaces to result in smooth transitions and uniform sections.
- C. Before placing surface, inspect the subgrade and base for conformity with the specified section. If necessary, remove or add material to bring all portions of the subgrade and base to proper section and correct elevation. Thoroughly compact and inspect the adjusted section after correcting.
- D. Moisten base to minimize absorption of water from fresh concrete.
- E. Coat surfaces of manhole and drainage structure frames with oil to prevent bond with concrete pavement.
- F. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.4 FORMING

- A. Steel forms are preferred. Wood forms with appropriate bracing may be allowed with prior approval of form installations by the Architect. Slip forms shall be used for all curb and gutter applications (with noted adjustment for slump).
- B. Place and secure forms to correct location, dimension, profile, and gradient.
- C. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- D. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.5 REINFORCEMENT

- A. Place reinforcement as indicated in details on Drawings.
- B. Interrupt reinforcement at expansion joints.
- C. Place dowels to achieve pavement and curb alignment as necessary to prevent differential settlement of adjacent work. One end of dowel shall be set in capped sleeve to allow longitudinal movement (typical of all installations).
- D. Provide dowels at expansion joints. Place dowels at 12 feet (3.66 m) OC maximum with two (2) per connection min.
- E. At automatic gate concrete pavement place dowels at 12" O.C. at all construction and expansion joints.
- F. Provide keyed and doweled, longitudinal construction joints at maximum of 12 feet (3.66 m) OC where slabs exceed 500 SF and are not otherwise segmented by expansion joints.

3.6 PLACING CONCRETE

- A. Measure, mix, transport, and place concrete in accordance with ACI 304 unless superseded by VDOT Section 217.10. Curing (clear, no pigment) shall adhere to product manufacturer's recommended instructions. Use of admixtures shall be approved in advance by the Architect.
- B. Do not produce or place concrete when the weather is rainy or foggy, when the subgrade is frozen or has excess moisture, or when the ambient temperature is less than 40 degrees F in the shade away from artificial heat.
- C. Place concrete for curbs and gutters using the slip form technique.
- D. Ensure reinforcement, inserts, embedded parts, formed joints, etc. are not disturbed during concrete placement.

- E. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- F. Place concrete to pattern indicated. Default to VDOT Spec. if none indicated.

3.7 JOINTS

- A. Place joint filler in pavement pattern placement sequence as indicated on the Drawings. Place joint filler between paving components and building or other appurtenances. Place joint filler where new concrete work meets existing concrete.
- B. For linear work place expansion joints at 30 foot (9 m) intervals unless otherwise indicated. Align curb, gutter, and sidewalk joints where adjacent.
- C. For the automatic gate pavement place sealed control joints at 15 feet O.C. and expansion joints at 30 feet O.C. All joints at automatic gate pavement shall be sealed.
- D. Set top to required elevations. Secure to resist movement by wet concrete.
- E. Recess top of filler ½ inch (13 mm) for joint sealant placement.
- F. Use joint sealant for caulking all joints in concrete pavements and walks.
- G. Provide tooled control joints per VDOT specs to pattern indicated (with 6' OC as default value). Verify pattern with Architect prior to concrete placement.
- H. Provide keyed joints as indicated.

3.8 EXPOSED AGGREGATE

- A. Wash exposed aggregate surface with clean water and scrub with stiff bristle brush exposing aggregate to match sample panel.

3.9 FINISHING & CURING

- A. Finish per schedule at the end of this section. Avoid over-finishing!
- B. Direction of Texturing: Transverse to pavement direction, unless otherwise indicated in schedule.
- C. Tactile Warning: Provide ADA required finish where indicated on Drawings. Finished product shall match sample panel.
- D. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with Manufacturer's instructions.

3.10 JOINT SEALING

- A. Separate pavement from vertical surfaces with ½ inch (13 mm) thick joint filler.
- B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- C. Extend joint filler from bottom of pavement to within ½ inch (13 mm) of finished surface. Conform to Section 079200 for finish joint sealer requirements.

3.11 CURBS

- A. Install VDOT Std. CG-2 (curb only) and/or VDOT Std. CG-6 (curb & gutter) as delineated on the Drawings. Typically upslope curbing may be curb only. Provide also for dry-pan or reverse gutters at locations required to prevent ponded water. This shall be verified and coordinated in advance with the Architect.
- B. Wiped down or submerged curbs (see details) shall have machined finish matching typical CG-2 finish.

3.12 CONCRETE STAIRS

- A. Place stairs at locations indicated on the Drawings.
- B. Construct per details on the Drawings.

3.13 TOLERANCES

- A. Section 014000 - Quality Requirements: Quality Assurance. Tolerances.
- B. Maximum Variation of Surface Flatness: ¼ inch (6 mm) in 10 ft. (3 m).
- C. Maximum Variation From True Position: ¼ inch (6 mm).

3.14 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection and testing.
- B. Section 310900 – Geotechnical Engineering, Inspections, and Testing.
- C. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.
- D. Three concrete test cylinders will be taken for every 75 or less cu. yds. (57 or less cu m) of each class of concrete placed each day.
- E. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.
- F. One slump test will be taken for each set of test cylinders taken.

- G. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.15 PROTECTION

- A. Section 017000 – Execution Requirements: Protection of Completed Work.
- B. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- C. Do not permit pedestrian or vehicular traffic over pavement for 7 days minimum after finishing.

3.16 SCHEDULE

- A. Area Paving: As detailed on Drawings with Light broom finish as default. Verify with Architect prior to placement of concrete.
- B. Sidewalk Paving: Light broom, radius to ¼ inch (6 mm) radius, and trowel joint edges.
- C. Curbs and Gutters: Light broom.
- D. Inclined Vehicular Ramps: Broomed perpendicular to slope.

END OF SECTION

SECTION 321723
PAVEMENT MARKING AND SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pavement Marking & Related Signage.

1.2 RELATED SECTIONS

- A. Section 013300 - Submittal Procedures.
- B. Section 016000 - Product Requirements: Product delivery and Product Storage and Handling.
- C. Section 017000 - Execution Requirements: Spare Parts and Maintenance Products. Final Cleaning.

1.3 DEFINITIONS

- A. Local Governing Authority (LGA) - The state agency, municipal department, or other entity, which legally has jurisdiction over the referenced work or activity. This usually means the field official who makes or controls onsite inspections of the work.

1.4 REFERENCE STANDARD

- A. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.
- B. Manual of Uniform Traffic Control Devices (MUTCD, including Virginia supplement), latest edition.
- C. Americans With Disabilities Act (ADA): 28 CFR Part 36, Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities; Final Rule dated July 26, 1991.
- D. Local Governing Authority Regulations pertaining to work of this section (i.e. handicapped parking marking and signage requirements, fire lane marking and signage requirements, etc.).

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with requirements of Reference Standards above. Refer to ACI 304 for any concrete related item not covered in Reference Standard. Maintain one copy of the reference utilized onsite with Contract Documents.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and

experienced in the necessary crafts and who are completely familiar with industry standards, the specified requirements and the methods for proper performance of the work of this section.

- C. Obtain materials from same source throughout.

1.6 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures.
- B. Product Data: Provide data on paint materials.
- C. Submit certification from sign supplier for all signage provided that they meet applicable standards above.
- D. All products identified in PART 2 of this specification.

1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Section 016000 – Product Requirements: Product delivery and Product storage and handling.
- B. Deliver products to site in Manufacturer's sealed and labeled containers; inspect to verify acceptability.
- C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- D. Paint Materials: Store all paint materials in a single location at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by Manufacturer's instructions. Protect from danger of combustion.

1.8 REGULATORY REQUIREMENTS

- A. VDOT review, approval and inspections per VDOT Stds.

1.9 QUALIFICATIONS

- A. Applicator: Company specializing in performing work of this section with minimum three years documented experience.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

1.11 WARRANTY

- A. Section 017000 - Execution Requirements: Requirements for warranties.
- B. Furnish one-year manufacturer's warranty for traffic paints.

1.12 EXTRA MATERIALS

- A. Section 017000 – Execution Requirements: Spare Parts and Maintenance Products.
- B. Supply Owner with 1-gallon (4 L) of each color, type, and surface texture of paint material used in the work; store where directed.
- C. Label each container with color, type, texture, and locations where used, in addition to the manufacturer's label.

PART 2 PRODUCTS

2.1 EXISTING SIGNAGE

- A. Existing traffic signage may be reused if not damaged and meeting current specifications.
- B. Existing specialty signage shall be salvaged and relocated to new positions as directed by the Owner.

2.2 PAVEMENT MARKING AND SIGNAGE

- A. Provide all identification, fire lane, traffic control and ADA signage indicated on Drawings and per schedule this section. Signs shall meet minimum standards of local fire department/marshal, ADA and Manual of Uniform Traffic Control Devices (MUTCD, including Virginia supplement) for all components. Sign posts shall meet VDOT Stds. & Specs.
- B. Plans have been reviewed and approved by the local governing authority (LGA). If, upon construction compliance inspection by LGA building inspector, any signage is lacking per requirements of VDOT, ADA or local code, the Contractor shall provide and place such signs as necessary for compliance at no additional cost to the Owner.
- C. For work within public right-of-way, provide pavement marking in accordance with VDOT requirements.
- D. Provide pavement markings in accordance with VDOT Section 704. For travel lane marking on-site use same with omission of glass beads. For parking lot striping use "Ultra Hide" water reducible acrylic latex traffic paint as manufactured by Glidden, Benjamin Moore, Devoe, PPG or Sherwin-Williams or approved equal. Use white for pavement markings, and direction arrows on asphalt (OSHA yellow on concrete) unless otherwise required by reference standards.

- E. Provide temporary markings within the VDOT right-of-way in accordance with VDOT requirements.
- F. Reference ADA requirements and local regulations for handicapped space marking configuration and colors.
- G. Recommended Pavement Marking Manufacturer: Pavement Stencil Company, Roanoke, VA or equal.
- H. Do not hand-finish bollard tops. Where bollards are installed use bollard caps manufactured by Top Gard Construction Products, Noblesville, IN or equal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate the Work and verify pavement conditions. Verify that all pre-requisite work (subsurface utilities, etc.) has been completed and is ready to receive the work of this section. Verify that pavement is ready to support paving/surfacing and imposed loads. Verify that finish grade of lawn areas are correct.
- B. Verify that surfaces or substrate conditions, as applicable, are ready to receive Work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Do not apply paint to concrete surfaces until concrete has cured for 28 days
- E. Verify locations, requirements, and extent of work.

3.2 PREPARATION

- A. Surface Appurtenances: Remove or mask any adjacent or attached items which are not to receive applied material prior to preparing surfaces or finishing.
- B. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

3.3 APPLICATION

- A. Protection: Protect work of other trades, whether being painted or not, against damage by painting. Provide "Wet Paint" signs to protect newly painted surfaces.
- B. Procedure: Apply products in accordance with manufacturer's instructions.
- C. Dry Receiving Surface: Do not apply finishes to surfaces that are not dry. Allow applied coats to dry thoroughly before next coat is applied.

- D. Minimum Coating Thickness: Apply no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Appearance: Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- I. Prime concealed surfaces of woodwork with primer paint.
- J. Acceptance: Owner's representative shall determine quality and consistency of coverage, color and finishes. Remove, refinish or repaint work not complying with requirements.

3.4 PAVEMENT MARKINGS

- A. Unless indicated otherwise, provide lane and edge lines four inches (4") in width. Apply paint after asphaltic concrete has cured for a minimum of seven (7) days, and minimum ambient temperature is 40 degrees F. Apply lane and edge markings per manufacturer's recommendation. Apply paint and markings to clean, dry surfaces, protect adjacent surfaces from damage and protect surfaces from traffic until dry. Provide uniform paint film of sufficient thickness to completely conceal base material.
- B. On-site travel lanes and, excluding within parking lots, shall be marked in accordance with VDOT Spec. Section 704 - Pavement Markings & Markers. Requirements for markers and glass beads will not be required on-site. On-site shall mean not within public right-of-way. Note that the public right-of-way includes the bus loop and access thereto. See Schedule this section.
- C. Roadway improvements within public right-of-way shall be marked in accordance with VDOT Spec. Section 704 - Pavement Markings & Markers. Replace any markings damaged by construction. Pavement markings within public right-of-way shall be Type B.
- D. Place required pavement marking and signage in accordance with ADA or Manual of Uniform Traffic Control Devices (MUTCD including Virginia Supplement), as applicable. See Schedule this section. Provide 36 inch deep by 12" square VDOT Std. Class A3 concrete base for signs. See pavement marking and Exterior Handicap Sign detail on the Drawings.
- E. Travel lane stop bars shall be painted, white lines, twenty-four (24) inches in width and across the entire indicated lane width.

- F. Cross-walks, painted traffic islands, and no parking areas (as shown on plan) shall consist of a six (6) inch wide painted yellow line border, entirely on the asphalt (not spilling over onto concrete gutter, etc.), of the width indicated on the plans, with four (4) inch wide yellow lines painted eighteen (18) inches apart and at forty-five (45) degrees to the border throughout the enclosed area. Verify orientation with Architect prior to painting.

3.5 FIELD QUALITY CONTROL

- A. The Owner reserves the right to engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the project may be taken, identified, sealed and certified in the presence of the contractor. The testing agency will perform appropriate tests as required by the Owner. If tests show material being used does not comply with specified requirements, the contractor shall remove non-complying paint from the site, pay for the testing, and repaint surfaces previously coated with the rejected paint. If necessary, the contractor may be required to remove rejected paint from those surfaces if, on repainting with specified paint, the two coatings are incompatible.
- C. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.
- D. Repair lines and markings, which after application and curing do not meet following criteria:
 - 1. Incorrect Location: Remove and replace incorrectly placed patterns.
 - 2. Insufficient Thickness, Line Width, Paint Coverage, Glass Bead Coverage or Retention: Prepare defective material by acceptably grinding or blast cleaning to remove substantial amount of beads and to roughen marking surface. Remove loose particles and debris. Apply new markings on cleaned surface in accordance with this Section.
 - 3. Uncured or Discolored Material, Insufficient Bonding: Remove defective markings in accordance with this Section and clean pavement surface one foot (300 mm) beyond affected area. Apply new markings on cleaned surface in accordance with this Section.
- E. Replace defective pavement markings as specified throughout warranted period. Replace markings damaged by anti-skid materials, studded tires, tire chains, chemical deicers, snow plowing or other loss of marking material regardless of cause. When markings are damaged by pavement failure or by Owner's painting, crack sealing, or pavement repair operations, Contractor is released from warranty requirements for damaged work.
- F. Prepare list of defective areas and areas requiring additional inspection and evaluation to decide where material may need to be replaced.
- G. Replace failed or defective markings in entire section of defective markings within 30 days after notification when any of the following exists during warranty period:
 - 1. Marking exhibits obvious discoloration or pigment loss.
 - 2. More than 15 percent of area of continuous line within any line segment is missing.

3.6 CLEANING

- A. At the end of each workday, collect empty cans, rags, rubbish, and other discarded paint materials, place in closed metal containers, and remove daily from the site.
- B. After completing painting, clean all paint-splattered surfaces being careful not to cause harm to adjacent finished surfaces. Correct damage caused by painting to the satisfaction of the Owner's representative.
- C. At the completion of construction activities of all other trades, touch up and restore damaged or defaced painted surfaces.

3.7 SCHEDULES

- A. Pavement Marking:
 - 1. Stop Bar where indicated on Drawings measuring 24" deep by full width of asphalt in lane.
 - 2. "ONE WAY" as noted on the Drawings.
 - 3. "DO NOT ENTER" as noted on the Drawings.
 - 4. "STOP" at each stop bar where indicated (each lane as applicable).
 - 5. Traffic directional arrows where indicated on Drawings.
 - 6. LGA's Standard handicapped parking space and isle pavement marking in each handicapped space indicated by symbol on Drawings.
 - 7. Fire lane designation to LGA's Standards as indicated on the Drawings and as required by Fire Marshall.
 - 8. Pedestrian Crosswalk to MUTCD standards at location indicated on Drawings.
- B. Signage (locations as noted on the Drawings):
 - 1. "STOP" at each Stop Bar.
 - 2. "ONE WAY" with appropriate directional arrow
 - 3. "NO PARKING – FIRE LANE",
 - 4. "DO NOT ENTER",
 - 5. Right Turn Sign,
 - 6. LGA's Standard handicapped parking space signage at the head of each space and handicapped access signs,
 - 7. Fire lane designation to LGA's Standards as required by Fire Marshall,

END OF SECTION

SECTION 323113
CHAIN-LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Chain-Link Fences: Commercial.
 - 2. Swing, Sliding, and Automatic Gates.
- B. Related Section s include the following:
 - 1. Division 31 Section "Earthwork" for site excavation, fill, and backfill where chain-link fences and gates are located.
 - 2. Division 03 Section "Cast-in-Place Concrete" for concrete.

1.3 SUBMITTALS FOR REVIEW

- A. All products identified in PART 2 of this specification.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Height shall be 8'-0". Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with ASTM A 392 Class 1 zinc coated steel wire, CLFMI CLF 2445, and requirements indicated below:
 - a. Steel Wire Fabric: 2" No. 9 gauge vinyl coated, color black.

2. Selvage: Twisted top and knuckled bottom.
- B. Refer to Details on the Drawings.

2.2 COMMERCIAL FENCE AND GATE FRAMING

- A. Posts and Rails: Round cold-formed, electric-resistance-welded, steel pipe or tubing, with minimum yield strength of 45,000 psi and with outside dimension, minimum wall thickness, and weight complying with ASTM F 761 or ASTM F 654 for the following fence height and strength and stiffness requirements:
1. Duty Rating: Medium.
 2. Tube or Pipe Diameter and Thickness: According to ASTM F 761.
 3. Tube Size and Thickness: According to ASTM F 654.
 4. Metallic-Coated Steel: Posts, rails, and frames protected with an external coating of not less than 0.6 oz. of zinc/sq. ft., a chromate conversion coating, and a clear, verifiable polymer film; with an internal protective coating of not less than 0.6 oz. of zinc/sq. ft. or 81 percent, not less than 0.3-mil- thick, zinc pigmented coating. Posts, rails, and frames shall be vinyl coated or powder coated black as noted on the Drawings.
 5. Post, rail, and frame diameters noted on the Drawings are intended as minimum sizes.

2.3 TENSION WIRE

- A. General: Provide horizontal tension wire at the following locations:
1. Location: Extended along top and bottom of fence fabric.
- B. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire complying with ASTM A 817, ASTM A 824, and the following:
1. Metallic Coating: Type II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:
 - a. Class 1: Not less than 0.8 oz./sq. ft. of uncoated wire surface.
 - b. Class 2: Not less than 1.2 oz./sq. ft. of uncoated wire surface.
 - c. Class 3: Not less than 2 oz./sq. ft. of uncoated wire surface.
 - d. Matching chain-link fabric coating weight.

2.4 FITTINGS & HARDWARE

- A. General: Comply with ASTM F 626.
- B. Gates: Center stop drop bar shall interlock with locking device or latch. Locking mechanism shall not require the use of a chain. Locks are not in contract. Provide gate keepers for double swing vehicular gates.
- C. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:

- a. Hot-Dip Galvanized Steel: 0.106-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

D. Finish:

- 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

2.5 SECURITY FEATURES

- A. Barb Wire: ASTM A121 Coating Type Z, galvanized steel; 12.5 gage thick wire, 3-strand or double 3-strand where noted on the Drawings.
- B. Barbed Tape (Razor Wire): Galvanized steel, 0.98" gage, 1" pre-formed width, available in 18" and 24" loop diameter.

2.6 MANUAL SLIDING AND SWING GATES:

- A. Install gates level.
- B. Install center stop and locking mechanism to align gate leaves without binding or interference.
- C. Lock(s) not-in-contract.
- D. Gates shall match the screening and fabric requirements for adjacent fencing unless noted otherwise.
- E. Conform to details on the Drawings for security measures for gates (barbed wire, razor wire, etc.). At a minimum, security measures shall match the requirements for adjacent fencing except no measures shall be installed at the base of gates. Coordinate installation to avoid security measures conflicting with posts and fence structures.

2.7 AUTOMATIC SLIDING GATES:

- A. Basis of Design for gate shall be TyMetal Model GS931 R2. See Details on the Drawings.
- B. Verify operator electrical requirements with conduits/circuits proposed prior to submission of Shop Drawings.
- C. Coordinate exit loop installation with paving operations. Field verify location for exit loop with Owner in the field.
- D. Install electrical grounding for operator and controls. Coordinate with electrical subcontractor.
- E. Ensure continuity with operational signals (open/close) from inside the Main Public Works Building via BAS controls. Coordinate underground path and routing.
- F. Gate Fabric shall be black vinyl coated, no slats.

2.8 AUTOMATIC GATE OPERATOR:

- A. Basis of Design for the gate operator shall be Lift Master Model SL3000101UL, 1.0 HP.
- B. Operation: Gear Driven.

- C. Meet UL 325, UI 991, ASTM F2200, and CAD C22.2 No. 247.
- D. Motor: 120 VAC, Continuous duty type.
- E. Traveling Speed: 12 inches per second (minimum).
- F. Warranty: 5 years warranty for material and manufacturer's defects.
- G. Provide concrete housekeeping pad for operator and components.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.
 - 1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.
 - 1. Install fencing on established boundary lines inside property line.

3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment as indicated on Drawings.

- D. Line Posts: Space line posts uniformly at 10 feet o.c.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.
 - 1. Locate horizontal braces at midheight of fabric 6 feet or higher, on fences with top rail and at 2/3 fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric.
 - 1. Bottom Tension Wire: Install tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- H. Chain-Link Fabric: Apply fabric to side facing the public. Leave 1 inch between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.
- J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at 1 end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

END OF SECTION

SECTION 329000
EXTERIOR PLANTING

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The extent of landscaping is shown on the drawings and shall include, but not be limited to:
 - 1. Supplying and installing trees, shrubs, groundcovers and other plant material.
 - 3. Finished grading of all planting areas.
 - 4. Staking and guying of plant materials.
 - 5. Fertilizing, spraying, pruning and mulching of all plant material.
 - 6. **Plant Guarantee and Maintenance Period.**

1.2 RELATED DOCUMENTS

- A. Section 329119: Landscape Grading.
- D. Section 310513: Soil Materials.

1.3 QUALITY ASSURANCE

- A. All plants shall meet or exceed the specifications as to quality and size as set forth by the plans or in the current edition of ANSI/Z60.1, "American Standard for Nursery Stock" for number one grade nursery stock as adopted by the American Association of Nurserymen, whichever is more stringent. No "park quality" materials will be acceptable. Any change in size shall first be approved by the A/E and Roanoke County. Substitutions will not be allowed unless adequate proof can be demonstrated that a specified plant cannot be found.
- B. Maintenance Instruction: Typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work. Meet with Owner, describe maintenance instruction at site prior to substantial completion.
- C. Chemical Application License: Application of herbicide, insecticides and other chemicals, shall be applied under the direction of a person licensed by the Commonwealth of Virginia to apply such chemicals. The License of the Applicator shall include certification for all plants indicated and be current.

1.4 PRODUCT HANDLING

- A. Deliver all materials to the Site in their original containers with all labels intact and legible at time of installation.
- B. Insofar as is practicable, plant materials shall be planted on the day of delivery. In the event this is not possible, the Contractor shall protect that stock not planted. Protect plants from sun or drying winds. Plants that cannot be planted immediately on delivery shall be kept in the shade, well watered and protected. Plants shall not remain unplanted for longer than three days after delivery. ALL

plants shall be lifted and handled from the bottom of the ball only. Plants moved with a ball will not be accepted if the ball is cracked or broken before or during plant operations. All foliage-bearing plants stored during summer months or winter months shall be treated with anti-dessiccants.

- C. In the event of damage or rejection, immediately make all replacements necessary to the approval of A/E and at no additional cost to the Owner.

1.5 UTILITIES

- A. The exact location of all existing and proposed underground and overhead utilities shall be verified by the Contractor and he shall conduct his work so as to prevent interruption of service and damage to any system. The Contractor shall protect existing structures and utility services and be responsible for their replacement if damaged by him or to make necessary adjustment in their location if required in order to complete the work of this contract.
- B. Should the Contractor damage any utility during his work, he shall replace and/or repair the utility as it existed prior to the damage at his own expense.

1.6 SEQUENCING AND SCHEDULING

- A. Planting time: Proceed with, and complete landscape work as rapidly as portions of site become available. Work within seasonal limitations for each kind of landscape work required.
- B. No planting shall be done in frozen ground, when snow covers the ground or when the site is muddy.
- C. If planting is done during the summer months special precautions will need to be taken to ensure that the plants do not dry out. If it is deemed necessary to plant during these months, plants will be treated with anti-desiccants, and be watered daily.

PART 2 PRODUCTS

2.1 FERTILIZER

- A. All Fertilizer shall be a commercial balanced formula with at least 25% organic material, and shall conform to applicable state fertilizer laws. Fertilizer will be "Briquettes" as manufactured by Wood Ace, or approved equal for trees. It shall be a slow release formula, and used as specified by manufacturer. Fertilizer shall be delivered mixed as specified, in standard size, unopened containers, showing weight, analysis, and name of manufacturer. If stored at the site, it shall be kept in a weatherproof place where its effectiveness will be unimpaired.
- B. Fertilizer for plant installations which occur in the Fall shall be a 5-10-10 analysis. Spring installations shall be 10-10-10 analysis.

2.2 TREE STAKING

- A. Tree Stakes: 2" x 2" wood posts, 8'-0" long.
- B. Rubber Hose: Two-ply, fabric-bearing hose having an inside diameter of not less than one-half inch, black in color.
- C. Guy Wire: Galvanized malleable iron wire No. 14 gauge.
- D. Turn Buckle: 1-5/16" diameter, with 4-1/2" lengthwise opening with threaded ends, and fitted with screw eyes. All parts are to be hot-dipped galvanized.
- E. Ground Anchors: Galv screw-in anchors, minimum 1/2 inch rod, 18 inch length.

2.3 PLANTING SOIL

- A. This shall be a fertile, friable soil typical of the locality. It shall be well drained without mixture of subsoil. It shall be clean and free of clay lumps, stones, roots, and deleterious substances two inches or more in diameter. It shall be a mixture of the following materials in quantities specified:
- B. For tree planting pits use Planting Soil "A". Planting Soil "A" shall be a mixture of the following materials in quantities specified: one part topsoil, and one part soil from the hole. Soil pH shall be maintained between 5.5 and 7.0. In holes which were in rock, replace rock with topsoil.
- C. Pit planted shrubs shall receive the same soil mix as trees. Use Planting Soil "A". In holes which were in rock, replace rock with topsoil.
- D. For shrub beds and flower beds, use Planting Soil "B". This soil shall be mixture of: one part humus, five parts topsoil. Soil pH shall be maintained between 6.0 and 7.0.

2.4 MULCH

- A. This shall be double shredded hardwood barkmulch used locally within the nursery trade for trees and shrubs or an approved equal. Color shall be selected by Architect.

2.5 PLANT MATERIALS

- A. This shall mean all trees and other plants required to be furnished for the project in accordance with plans and specifications.
- B. Refer to drawings for varieties and spacing of plant materials. Quantities shown on drawings shall take precedence over quantities shown on plant list.
- C. Substitutions will not be permitted unless adequate proof is submitted that the materials are not available. Substitutions must be approved by A/E prior to their installation.

PART 3 EXECUTION

- A. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify all such work is complete to the point where this installation may properly commence. If other work is not complete, do not begin work until it has been completed so as to allow for installation.
- B. Verify that planting may be completed in accordance with the original design and the referenced standards.

3.1 SOIL CONDITIONS

- A. Contractor shall inspect soil conditions and take notice of all soil or drainage conditions that may be detrimental to any plant material growth. Notify A/E in writing of all such conditions.

3.2 PREPARATION OF PLANTING SOIL

- A. Before planting, clean topsoil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.
- B. Place planting soil as follows:

Area	Volume of Planting Soil Mix
Shrubbery Plant Beds	12" Deep for entire bed.
Tree Pits and Shrub Pits	Equal to root ball in depth by 2.5 times ball diameter in width.

3.3 PLANTING AND SURFACE PREPARATION

- A. Tree Planting:
 - 1. Stake locations of all trees 5' and over in height and outlines of all tree masses.
 - 2. Rake surface clear of stones, debris, rubbish, and trash before pit excavation. Dispose of such material off site.
 - 3. Excavate pits as indicated on Drawings. Tree pits shall be excavated three times wider than the diameter of the root ball and only as deep as the root ball to be placed in the hole. If initially dug too deep, the soil added to bring it up to the correct level should be thoroughly tamped.
 - 4. The pit shall be cone-shaped, barely larger than the ball at the bottom and three times the ball diameter at the top as shown on drawing detail.
 - 5. Plants shall be set at the same relationship to finished grade as they were to the ground from which they were dug. Plants must be set plumb and braced in position until prepared topsoil has been placed around the ball and roots. Plants shall be set so that they will be the same depth one year later.
 - 6. The trunk of the tree is not to be used as a lever in positioning or moving the tree in the planting hole.
 - 7. Because some nurseries practice tilling around trees the root flare may be buried several inches deep. In some cases the top of the root ball may

be at ground level but the root flare actually is too deep. Proper planting depth requires the root flare to be at or slightly above the finished grade. It is important to determine how deeply the root flare is buried in the ball before it is placed in the planting hole. Sometimes the top of the ball may need to be removed until the root flare is at the proper planting depth. Remove the excess soil on the top of the root ball.

8. Ropes, strings, and wrapping from the top half of the root ball are to be removed after the plant has been set. All waterproof or water repellant wrappings shall be removed from the ball. Remove at least the top half of the wire basket before backfilling.
9. Mulch trees as shown on drawings. Remove any mulch from 1" of base of tree.

3.4 STAKING AND GUYING

- A. Trees shall be supported immediately after planting as shown on Drawings. The wire shall be encased in hose to prevent direct contact with bark of the tree and shall be placed around the trunk in a single loop. Wires shall be tightened and kept taut with turnbuckles.

3.5 PRUNING

- A. Each tree shall be pruned in accordance with standard horticultural practice to preserve natural character of plant. Prune only dead or excess material unless otherwise advised by A/E. Cuts over 3/4" in diameter shall be painted with an approved tree paint. Paint shall cover all exposed cambium as well as other exposed living tissue. Paint shall be waterproof, adhesive and elastic, antiseptic, free from kerosene, coal tar creosote or any other material injurious to the tree and shall be approved before it is used. Use "Woodtar" or an approved equal.
- B. All deciduous plants and trees shall be pruned immediately after planting, to the satisfaction of the A/E. Main leaders of trees shall not be cut back. Thin branches out and do not merely cut back. Long side branches, however, may be shortened.
- C. If the natural form of the plant is destroyed by careless pruning or thinning, the plant will be rejected.

3.6 SHRUB PLANTING AREAS

- A. Rake surface clear of stones, debris, rubbish and trash before pit excavation. Dispose of such material away from the Site. Rake and compact as above. Excavate holes as indicated and backfill with indicated soil mixture to depth shown.
- B. Place plants in holes as shown on Drawings. Plants placed in holes shall be placed in their pits so that after final settlement, they will stand at approximately the same depth as in the nursery or field. As the planting soil is backfilled around the ball, it shall be placed in layers around the roots or ball. Each layer shall be carefully tamped in place in a manner to avoid injury to the roots or ball or

disturbing the position of the plant. B&B plants shall have the burlap cut away or folded back from the top of the ball before applying water.

- C. After placing backfill and before final watering, apply fertilizer at a rate of 1/4 pound/foot of height for shrubs, or 1/8 pound/foot of height or spread for evergreens.

3.7 CLEAN-UP

- A. The Contractor shall, periodically or as directed during the progress of the work, remove and properly dispose of debris, rubbish, trash, clippings, prunings, and defective or unacceptable material. Keep clear of hazardous obstructions. Trash burning on the site will not be permitted.
- B. Except for the designated storage area, paved areas shall be kept clean of soil, fertilizer, mulch, trash and debris, and shall be maintained in a broom clean condition at all times.

3.8 PLANT GUARANTEE AND MAINTENANCE PERIOD

A. **Contractor's Maintenance:**

1. Contractor's responsibility to plant maintenance under this section shall commence when work is begun and continue until Substantial Completion Acceptance of the construction project. Maintenance shall include all necessary watering, cultivating, fertilizing, weeding, pruning, wound dressing, disease and insect control, protective spraying, replacement of unacceptable material, straightening plants which lean or sag, adjustment of any plants which settle or are planted too low, and other procedures consistent with good horticultural practices which are necessary to insure normal, vigorous and healthy growth of all work under this contract.
2. In the event that treatment or replacement is made necessary as a result of damage caused by circumstances which are beyond the Contractor's control, and not wholly or partially as a result of an act or omission of the Contractor, such treatment or replacement will be authorized by the Owner by Change Order in accordance with the General Conditions.
3. Contractor shall supply to Architect a comprehensive maintenance program for all plant materials on the site for the Owner's use. It should indicate such areas as, fertilizing, pruning, wound dressing, insect control, watering and general care necessary to insure survival of the material and good healthy plants.

3.9 CONTRACTOR'S GUARANTEE PERIOD

- A. **Planting work shall be guaranteed for one (1) year from date of Substantial Completion.** Replacement plants are guaranteed one year from their planting date.
- B. After Substantial Completion Acceptance of the construction project, if the Contractor is not responsible for maintenance because the Owner has taken-over this task, he is responsible to see that a proper maintenance program is being undertaken. The Contractor should make periodic site visits to insure

that the Owner is supplying proper care for plant materials. Notify Architect in writing of observations within seven days of site visit.

- C. Should the Contractor not follow through on his inspection visits, and plant material dies due to lack of maintenance by the Owner, the Contractor could be held responsible and replacements made at his expense. It is his responsibility to advise the Architect of conditions that may affect his plant materials, and the guarantee. This will be in effect for the full one year plant guarantee.

3.10 FINAL INSPECTION

- A. Contractor shall notify the Owner and Architect upon completion of guarantee. Contractor shall request final inspection prior to end of guarantee period.
- B. Should any plant material be dead, or in an unhealthy state of growth as determined by the Architect at the end of the one year period, Contractor shall make all work acceptable and request a reinspection by the Owner and Architect. Any replaced plant material is guaranteed one year from the replacement plants' planting date.

END OF SECTION

SECTION 329013
TREE PROTECTION AND TRIMMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the protection and trimming of existing trees that interfere with, or are affected by, execution of the Work, whether temporary or permanent construction.
- B. Related Sections include the following:
 - 1. Section 011000 - "Summary" for limits placed on Contractor's use of the site.
 - 2. Section 015600 - "Temporary Facilities and Controls" for temporary tree protection.
 - 3. Section 311000 - "Site Clearing" for removal limits of trees, shrubs, and other plantings affected by new construction.
 - 4. Section 329000 - "Exterior Plants" for tree and shrub planting, tree support systems, and soil materials.

1.3 DEFINITIONS

- A. Tree Protection Zone: Area surrounding individual trees or groups of trees to remain during construction and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 QUALITY ASSURANCE

- A. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning)."
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
 - 1. Before tree protection and trimming operations begin, meet with representatives of authorities having jurisdiction, Owner, Architect, consultants, and other concerned entities to review tree protection and trimming procedures and responsibilities.
 - 2. Existing dogwood within interior courtyard near administration area may require minor pruning. Discuss with Architect prior to work within this area. This tree must be saved.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and toxic and other nonsoil materials.
 - 1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.
- B. Chain-Link Fence: Metallic-coated steel chain-link fence fabric of 0.120-inch- diameter wire; a minimum of 48 inches high; with 1.9-inch- diameter line posts; 2-3/8-inch- diameter terminal and corner posts; 1-5/8-inch- diameter top rail; and 0.177-inch- diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Temporary Fencing: Install temporary fencing around tree protection zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence and remove when construction is complete.
 - 1. Install chain-link fence according to ASTM F 567 and manufacturer's written instructions.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Do not store construction materials, debris, or excavated material inside tree protection zones. Do not permit vehicles or foot traffic within tree protection zones; prevent soil compaction over root systems.
- D. Maintain tree protection zones free of weeds and trash.
- E. Do not allow fires within tree protection zones.

3.2 EXCAVATION

- A. Install shoring or other protective support systems to minimize sloping or benching of excavations.
- B. Do not excavate within tree protection zones, unless otherwise indicated.

- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.
 - 1. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
- D. Where utility trenches are required within tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.
 - 1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

3.3 REGRADING

- A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond tree protection zones. Maintain existing grades within tree protection zones.
 - 1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.
- B. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.4 TREE PRUNING

- A. Prune trees to remain that are affected by temporary and permanent construction.
- B. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
- C. Pruning Standards: Prune trees according to ANSI A300 (Part 1):
 - 1. Type of Pruning: Cleaning, Thinning, Raising, Reduction.
 - 2. Specialty Pruning: Restoration, Utility.
- D. Cut branches with sharp pruning instruments; do not break or chop.
- E. Chip removed tree branches and dispose of off-site.

3.5 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.

- B. Remove and replace trees indicated to remain that die or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 - 1. Provide new trees of 6-inch caliper size and of a species selected by Architect when damaged trees more than 6 inches in caliper size, measured 12 inches above grade, are required to be replaced. Plant and maintain new trees as specified in Section 329300.
- C. Aerate surface soil, compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.6 DISPOSAL OF WASTE MATERIALS

- A. Burning is not permitted.
- B. Disposal: Remove excess excavated material and displaced trees from Owner's property.

END OF SECTION

SECTION 329119
LANDSCAPE GRADING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Providing, placing on previously prepared subgrade, and grading topsoil to finish grade.

1.2 RELATED SECTIONS

- A. Division 01 - GENERAL CONDITIONS: Including but not limited to:
 - 1. Coordination of the Work,
 - 2. Submittals; Procedure for submittals, and
 - 3. Protection of the finished Work.
- B. Section 310900 - Geotechnical Engineering, Inspection, and Testing: Geotechnical Engineer.
- C. Section 310513 - Soil Materials: Topsoil materials.
- D. Section 311000 - Site Preparation and Clearing: Preparation for land disturbance, protection of the Work, and stripping and stockpiling topsoil.
- E. Section 312213 - Rough Grading: Site subgrade contouring; general cutting, grading, filling and rough contouring the site. Dewatering excavations and water control.
- F. Section 312317 - Utility Trenching & Backfilling: Utility excavation, backfill and compaction. Excludes bedding and setting utilities. References this section for provision and placement of topsoil.
- G. Section 312513 - Erosion & Sediment Control: Topsoil stockpile protection.
- H. Section 329219 - Seeding: Temporary and permanent seeding. Topsoil testing.

1.3 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures.
- B. Topsoil source.
- C. Bioretention Filter Materials.
- D. All products identified in PART 2 of this specification.

PART 2 PRODUCTS

2.1 MATERIAL

- A. Topsoil: Fill Type T1 or T2 as specified in Section 310513 – Soil Materials.

- B. Aggregate: As required in Section 310516 – Aggregate.
- C. Bioretention Soil Mix: As required in Section 310513 – Soil Materials.
- D. Non-woven Geotextile Fabric: As required in Section 312513 – ESC.
- E. Underdrain: As required in Section 334600 – Subdrainage.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that building, utility and miscellaneous backfilling have been inspected.
- B. Verify that subgrade has been contoured and compacted and that uneven areas, low spots, and stockpiles have been eliminated.
- C. Do not place topsoil within areas yet to be disturbed by other trades. This may include utility, sidewalk, paving, trellis, sprinkler system or fencing operations.

3.2 SUBGRADE PREPARATION

- A. Establish limits, providing for smooth transition to undisturbed area or other finishes.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch (13 mm) in size. Remove subsoil contaminated with petroleum products, cleaners, paint products, or waste concrete or asphalt.
- C. Scarify subgrade to depth of 3 inches (75 mm) where topsoil is scheduled. Re-scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.3 PLACING TOPSOIL

- A. Use all acceptable, on-site, stockpiled topsoil before importing topsoil. It shall be the Contractor's responsibility to determine the need to import topsoil to complete the project. Latent requests for additional costs due to importing topsoil will not be considered.
- B. Do not deliver or place topsoil in frozen, wet or muddy condition.
- C. Place topsoil in areas where seeding to thickness as scheduled. Manually spread topsoil close to trees, plants, site improvements, and buildings to prevent damage. Place topsoil during dry weather.
- D. Fine grade topsoil eliminating rough or low areas. Maintain profiles and contour of subgrade.
- E. Remove roots, weeds, rocks and foreign material while spreading.
- F. Lightly compact placed topsoil.

- G. Unless otherwise noted or indicated, compacted surface of placed topsoil shall be 1/2" below top of header boards, walks, pavements, and utility structures. Where upslope and against curb, flush with top of curb to allow positive drainage.
- H. All required topsoil (per schedule) shall be in place prior to any landscaping activities within the area to immediately receive landscaping.
- I. Leave stockpile area and site clean and raked, matching existing grade before placement of stockpile or proposed grade, as applicable, and ready to receive landscaping. Grade site surface to prevent free-standing surface water.

3.4 BIORETENTION FILTER

- A. Install bioretention filters in accordance with ~~Minimum Standard 3.11~~ the standards and specifications provided in P-FIL-05 Bioretention of the Virginia Stormwater Management Handbook.
- B. Bioretention soils are very sensitive to sediment laden stormwater; filter shall not be installed until all upstream areas have been completely stabilized and A/E has approved installation.
- C. Prior to final completion, Contractor will be responsible for protecting bioretention filter from sediment laden stormwater. Any damage caused to the bioretention filters due to upstream erosion shall be repaired or replaced at the Contractor's expense.
- D. Excavate bioretention filter to a depth as required to contain all layers of the filter and maintain a 0.5% minimum slope on the underdrain pipe. Mechanically compact to 95% a layer of clay soil at the base of the filter to serve as a liner. The clay liner shall be a minimum of 12" in thickness. Onsite soils meeting the ASTM D2487 CL or CH group classification shall be acceptable for use in the liner.
- E. All areas within the limits of bio-retention filters shall receive 30" of suitable bioretention soil mix over perforated piping and a gravel base as shown on plan details. Drainage Stone shall be Aggregate Type A2 - VDOT Std #57, double washed, Pea Gravel Filter shall be Aggregate Type A7 - VDOT Std #8, double washed. Bioretention Mix shall be installed in 12-18" layers. Lightly tamp, but do not compact. Mechanized compaction of the Bioretention Mix is not permitted.
- F. Coordinate the installation of soil and insure that finished grades are as shown on the grading plans. The finished bed shall be level and lower (see plan detail) than the surrounding ground after the amendments have been "tilled in" and mulch added.
- G. Test the planting soil to verify the ph is between 6.0 and 7.0. These tests shall be made available to the Owner upon request. Add lime or sulfur as necessary to adjust the soil to the proper ph.

- H. Add fertilizer at the rate of 2 pounds of 10-10-10 per 100 square feet. Till the entire area to a minimum depth of 6" until all ingredients are thoroughly mixed. Rake the entire area to a smooth even surface.
- I. Place plants in holes in the locations shown on Drawings. Plants placed in holes shall be placed in their pits so that after final settlement, they will stand at approximately the same depth as in the nursery or field. As the planting soil is backfilled around the ball, it shall be placed in layers around the roots or ball. Each layer shall be carefully hand tamped in place in a manner to avoid injury to the roots or ball or disturbing the position of the plant. B&B plants shall have the burlap cut away or folded back from the top of the ball before applying water. See Section 329000 for additional planting requirements.

3.5 TOLERANCES

- A. Top of Topsoil (Top of Mulch in Bioretention Filter): Plus or minus 1/2 inch (13 mm) adjacent to improvements; 1 inch (25 mm) within 100 feet of buildings or athletic or play fields; and 2 inches (50 mm) on surrounding fields and slopes.

3.6 PROTECTION

- A. Section 017000 – Execution Requirements: Protection of Completed Work.
- B. Comply with Section 311000 – Site Preparation and Clearing: Protection.
- C. Protect landscaping and other features remaining as final work.
- D. Protect any/all existing site improvements including structures, fences, sidewalks, utilities, paving and curbs.

3.7 SCHEDULES

- A. Compacted topsoil thickness at the following areas:
 - 1. Seeded Grass: 4 inches (100 mm).
 - 2. Ground Cover Areas: 8 inches (200 mm).
 - 3. Perennial Bulb Beds: 12 inches (300 mm).
 - 4. Planter Boxes: 12 inches (300 mm) and to within 3 inches (75 mm) of box rim.
 - 5. Landscape Berms: 12 inches (300 mm).
 - 6. Steep slopes where hard fescue or crown vetch re proposed as stabilization: no topsoil required.

END OF SECTION

SECTION 329219
SEEDING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. All labor, materials, equipment and incidentals necessary to provide a complete installation of all tillage, pH balancing, fertilizing, seeding, and mulching of all disturbed areas within the Contract limits not occupied by structures, pavement or plantings, as indicated on the Drawings and specified herein.
- B. Topsoil testing.
- C. Erosion Control/Temporary Seeding.
- D. Permanent Seeding/complete stabilization with natural materials.
- E. Maintenance.
- F. Lawn guarantee.

1.2 RELATED SECTIONS

- A. Division 01 - GENERAL CONDITIONS: Including but not limited to:
 - 1. Coordination of the Work,
 - 2. Submittal Procedures,
 - 3. Closeout Procedures,
 - 4. Protection of Completed Work.
- B. Section 310513 - Soil Materials: Topsoil.
- C. Section 312317 - Utility Trenching & Backfilling: Backfilling to subgrade over utilities.
- D. Section 312513 - Erosion & Sediment Control: References EC / Temporary Seeding.
- E. Section 329119 - Landscape Grading: Preparation of subgrade and provision and placement of topsoil in preparation for the work of this section.

1.3 REFERENCE STANDARDS AND QUALITY ASSURANCE

- A. All materials, preparations and workmanship shall be performed by experienced workmen regularly engaged in the work of this section. Seeding work shall be performed by a single firm specializing and experienced in landscape work.
- B. All products shall be applied or installed in strict conformance with the manufacturer's written instructions and acceptable trade practices.

- C. All products shall be labeled in accordance with the U.S. Department of Agriculture Rules & Regulations.
- D. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- E. Have topsoil classified and analyzed to determine nutritional requirements of soil for establishment of lawns.
- F. FS O-F-241D - Fertilizers, Mixed, Commercial.

1.4 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer composition.

1.5 DEFINITIONS

- A. Noxious Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.
- B. Satisfactory stand of grass: A dense, vigorous and well established cover of living grass of the specified mixture where no individual lawn area has unacceptable portions in excess of one percent of its area or gaps larger than a circle 4 inches in diameter.
- C. Establishment period: The establishment period for lawn areas shall be the time from installation until final acceptance, as determined by the Architect.

1.6 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedure.
- B. Soil analysis report: Testing will be at the Contractor's expense.
- C. Certification that imported topsoil is free from weeds.
- D. Certificates of inspection as required by governing authorities.
- E. Other data substantiating that materials comply with specified requirements.
- F. Manufacturer's or vendor's certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species.
- G. All products identified in PART 2 of this specification.

1.7 SUBMITTALS AT PROJECT CLOSEOUT

- A. Section 017000 - Execution Requirements: Contractor's Closeout Submittals to Architect.
- B. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.
- C. Guarantee and warranties.

1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Section 016000 – Product Requirements.
- B. Fertilizer, soil amendments, and seed shall be delivered to the site in the original, unopened, undamaged containers bearing the manufacturer's guaranteed analysis, name, trade name, trademark, and statement of conformance to state and federal laws. Labels shall be intact and legible. In lieu of containers, fertilizer and soil amendments may be furnished in bulk with a certificate indicating the above information accompanying each delivery. All such certificates shall be submitted to the Architect to confirm quantities of materials used on project.
- C. During delivery and storage, seed, fertilizer, soil amendments, straw and matting shall be kept in dry storage free from the effects of weather and away from contaminants. Should any material become wet or damaged, reject immediately and replace at no cost to the Owner.
- D. Precautions shall be taken to protect containers from rupture prior to use.

1.9 MAINTENANCE SERVICE

- A. Provide service and maintenance of seeded areas through establishment period (see definitions above).

1.10 INITIAL ACCEPTANCE

- A. Establishment of new lawn: Contractor shall be responsible for providing a finished lawn of a satisfactory stand of grass (see definitions above). Any areas which fail to show a satisfactory stand of grass shall be reworked and reseeded at the Contractor's expense with the same seed as originally used thereon until all required areas are satisfactorily covered.

1.11 GUARANTEE AND WARRANTIES

- A. Contractor shall guarantee all seeding work for a period of one (1) year. Guarantee period shall begin on the date of acceptance of the established lawn for the entire project, as determined by the Architect.
- B. Provide written warranties within thirty (30) days of final acceptance.

PART 2 PRODUCTS

2.1 SEED MIXTURE

- A. State-certified seed of the latest season's crop, labeled in conformance with U.S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable State seed laws.
- B. All seed shall be Blue Tag Certified Seed with varieties strictly conforming to those listed on the Virginia Turfgrass Variety Recommendations, latest edition, published by Virginia Polytechnic Institute and State University.
- C. Permanent Seeding: Lawn areas shall be seeded with a mixture of 80 percent by weight (typ) improved or turf-type Fescue, 10 percent Bluegrass and 10 percent Ryegrass. The improved Fescue component shall be composed of three subspecies, each composing between 20 and 40 percent of the Fescue component. The Bluegrass shall be composed of equal parts of three subspecies. The Ryegrass component shall be of a single species of perennial ryegrass. Seed at 5-8 #/1000 square feet. Seeding shall be between April 1 and May 31, or August 15 and October 15.
- D. Seed that has become wet, moldy, or otherwise damaged will not be acceptable.
- E. Erosion Control/Temporary Seeding: ~~Apply at 100#/acre.~~

~~2/15 to 4/30~~ Annual rye grass (*Lolium multiflorum*) Apply at 60-100#/acre.

~~5/1 to 8/15~~ ~~Weeping Lovegrass (*Eragrostis curvula*)~~ German Millet (*Setaria italica*) Apply at 50#/acre.

~~8/16 to 10/31~~ ~~Annual rye grass (*Lolium multiflorum*)~~

~~11/1 to 2/15~~ 50/50 Mix of annual ryegrass (*Lolium multiflorum*) & cereal (Winter) rye (*Secale cereale*) Apply at 50-100#/acre

2.2 SOIL MATERIALS

- A. Topsoil: As specified in Section 310513 – Soil Materials: Topsoil Materials.

2.3 ACCESSORIES

- A. Straw Mulch Material:
 - 1. Straw shall be stalks from oats, wheat, rye, barley or rice that are free from noxious weeds, chemicals, mold, decay or foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
 - 2. Straw shall be in an air-dry condition suitable for placing. Straw supplied for mechanical application shall be chopped.
- B. Wood Cellulose Mulch Material:
 - 1. Mulch supplied for use with hydraulic application of grass seed and fertilizer

- shall consist of specially prepared wood cellulose fiber. Wood cellulose fiber shall not be utilized however from 6/1 to 9/1 or 12/1 to 3/1. During this time, straw mulch shall be utilized.
2. Processing of wood cellulose fiber shall be in such a manner that it will not contain germination or growth inhibiting elements.
 3. Wood cellulose fiber shall be dyed an appropriate color to allow visual metering of its application.
 4. Wood cellulose fiber shall have the property of becoming evenly dispersed and suspended when agitated in water.
 5. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like ground cover which readily absorbs water and allows infiltration to the underlying soil.
 6. Weight specifications from suppliers and for applications shall refer to air dry weight of the fiber, a standard equivalent to 10 percent moisture.
- C. Binder for Mulch: Emulsified asphalt, ASTM D977-86, Grade SS-1.
- D. Fertilizer: Commercial fertilizer shall conform to all applicable state and federal regulations and be certified by the Virginia Department of Agriculture and Consumer services to be in accordance with the type and quantity of material indicated on the bag labels. For EC / temporary seeding, it shall have a minimum guaranteed analysis of 5 percent nitrogen, 10 percent phosphorus, and 10 percent soluble potash or approved equal. For permanent seeding, it shall have a minimum guaranteed analysis of 14 percent nitrogen, 20 percent phosphorus, and 14 percent soluble potash or approved equal.
- E. Soil Amendments:
1. Lime: To pH balance soil, ground, natural, dolomitic limestone containing not less than 85% of total carbonates with a minimum of 30% magnesium carbonates, ground so that not less than 90% passes a 10-mesh sieve and not less than 50% passes a 20-mesh sieve.
 2. Aluminum Sulfate: To pH balance soil, commercial grade in dry power form.
 3. Superphosphate: Soluble mixture of treated minerals; 20% available phosphoric acid.
- F. Water: Potable.
- G. Mulch Stabilization Netting: Plastic or natural fiber netting used to prevent displacement of straw mulch, manufactured by:
1. American Excelsior Co. - Erosion Control Netting
 2. Belton Industries - Soil Anti-wash/Geojute
 3. CONWED Fibers - Erosion Control Netting
- H. Re-vegetation Mats/Erosion Control Mats:
1. Mats manufactured specifically to hold moisture without the additional use of mulch, and retard erosion, manufactured by:
 2. Re-vegetation Mats:
 - a. North American Green, Inc. - SC150 Blanket
 - b. American Excelsior Co. - Curlex Blanket
 - c. Gulf States Paper Corp. - Hold/Gro

- d. CONWED Fibers - Futerra Revegetation Blanket
 - e. CONTECH Constr. Prod., Inc. - Excelsior Erosion Control Blankets
- 3. Erosion Control Mats:
 - a. North American Green, Inc. - P350
 - b. Landlok - TRM 450
- I. Staples: Plain iron wire, No. 8 gauge or heavier, with a minimum in-ground length of 6 inches.
- J. Stakes: Softwood lumber, chisel pointed.
- K. String: Inorganic fiber.
- L. Landscape Fabric: 3.0 oz. Or better non-woven polyester, commercial weed restrictor fabric. UV stabilized
- M. Other Materials: All other materials, not specifically described but required for a complete and proper seeding operation, shall be selected by the Contractor and subject to the approval of the Architect.

2.4 TESTS

- A. Provide and pay for the services of a testing agency certified by the state to:
 - 1. Classify the topsoil in accordance with the Uniform Soil Classification System and provide percentages of sand, silt and clay.
 - 2. Perform an analysis of topsoil to be used, and make a determination of pH and nutritional requirements of the soil for establishment of lawns.
 - 3. Analyze fertilizer to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- B. Submit sample of fertilizer and topsoil proposed (one per source) to approved testing laboratory in sealed containers to prevent contamination. Sample size shall be as required by laboratory.

PART 3 EXECUTION

3.1 EXAMINATION / COORDINATION

- A. Series 01300 – Administrative Requirements: Coordination.
- B. Verify that prepared subsoil base and utility installation work is complete.
- C. Verify that Landscape Grading (topsoil material and depth) is complete, correct and ready to receive the work of this section.

3.2 EROSION CONTROL/TEMPORARY SEEDING

- A. Temporary seeding shall be applied to denuded areas within 7 days after final grade has been established, if season is improper for permanent seeding, and within 7 days to portions of the site which may not be at final grade but which will remain inactive for more than 30 days and less than one year. Lawn areas,

athletic fields and slopes may be topsoiled and permanently seeded only if this can be accomplished during the correct time of year for the permanent seed mixture specified. Permanent Seeding is required for areas which will remain dormant for more than one year.

- B. Where the area is compacted, crusted or hardened, the soil surface shall be loosened by disking, raking, harrowing or other means.
- C. Apply lime at a rate of 50 pounds per 1000 sq. ft. and commercial fertilizer at 10 pounds per 1000 sq. ft. Thoroughly mix into loosened soil.
- D. Seed shall be evenly applied at a rate of 2 lbs. per 1000 sq. ft. to the prepared ground and mulched.
- E. Slopes greater than 3:1 shall be hydroseeded. Other areas may be hydroseeded or dry seeded at the Contractor's option.
- F. Hydroseeding operations shall include seed, fertilizer, mulch and binder in one operation. Areas which are hydroseeded from 6/1 to 9/1 or 12/1 to 3/1 shall be mulched with straw. Wood fiber mulch shall not be used during these times.
- G. After mulching of dry seeded areas, mulch shall be stabilized using a liquid binder. Portions which continue to lose mulch due to wind or runoff shall be further stabilized with mulch stabilization netting. Install netting as specified herein.
- H. Areas which fail to establish vegetative cover adequate in checking erosion shall be re-seeded as soon as such areas are recognized.

3.3 PERMANENT SEEDING - GENERAL

- A. Seeding shall not be done when the ground is frozen, snow covered, saturated, or in any other condition which would make establishment and survival of lawns unlikely.
- B. At the time of beginning seed bed preparation, topsoil shall be in a loose, friable condition, free from stones over 1" in any dimension, sticks, roots and other extraneous matter. If topsoil has become crusty, hardened or eroded since being spread, it shall be a part of this work to restore the soil to the loose condition described above.
- C. Prior to preparation of undisturbed areas, remove vegetation and debris and dispose of such material off-site; do not turn under into soil being prepared for seed bed. Loosen existing grade to a depth of 4", remove all debris which surfaces.
- D. Contractor shall hydroseed all slopes 3 to 1 or steeper. All other areas shall be dry-seeded or hydroseeded at the Contractor's option unless noted otherwise on the Drawings.

3.4 SEED BED PREPARATION:

- A. Work areas of 3 to 1 slope and less to a smooth even surface free from

irregularities, ridges or depressions. Prepared areas shall meet required finish grade elevations and shall drain adequately.

- B. Areas greater than 3 to 1 slopes shall be left in a roughened state but meeting required finish grade elevations. Repair all washed and eroded portions.
- C. Spread fertilizer at the rate of 25 lbs. per 1000 sq. ft. or as recommended otherwise by the soil test report. Add pH balancing agents at rate recommended by soil test reports to achieve a pH of 6.0 to 7.0 for turf grass seeding. For vegetative cover other than turf grass, achieve the pH level best suited for that material as suggested by the testing agency. Under circumstances where it is not possible to obtain soil tests, apply lime at a rate of 100 lbs./1000 sq. ft. Blend additives thoroughly into upper 4" of topsoil.
- D. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- E. Blend additives thoroughly into upper 4" of topsoil. Remove any rock or other debris which may surface. Till areas until soil is loose and friable and all soil amendments are uniformly distributed.
- F. Moisten prepared areas if soil is dry. Water thoroughly, then allow surface moisture to evaporate. Do not create muddy soil conditions.

3.5 DRY SEEDING NEW LAWNS:

- A. Within 3 days of finish grading and seed bed preparation, sow seed using a spreader or seeding machine at the rate of 5 lbs. per 1000 sq. ft. Do not seed when wind velocity exceeds 5 mi. per hour. Distribute seed evenly over entire area by sowing equal quantity in 2 directions at right angles to each other.
- B. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- C. Rake seed lightly into top 1/4" of soil, firm entire area with a roller not exceeding 90 lbs. per foot of roller width, and water with a fine spray.
- D. Unless indicated otherwise on the Drawings, protect newly seeded areas by spreading mulch to a uniform and continuous depth of 1/2" loose measurement (70-90 lbs./1000 sq. ft.). Anchor mulch by one of the following methods:
 - 1. Liquid mulch binder, applied at the rate of 10 gal. per 1000 sq. ft. Mask adjacent areas to prevent over-spray damage.
 - 2. Tractor-drawn mulch anchoring equipment, limit use to slopes 3:1 and less. Machinery shall be operated along the contour.
 - 3. Mulch stabilization netting.
- E. Install erosion control/re-vegetation mat in areas designated on the Drawings.
- F. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches (100 mm) of soil.

3.6 HYDROSEEDING NEW LAWNS (Required for 3:1 and greater slopes)

- A. The slurry shall be prepared and applied to yield the following rates:
 - 1. Seed: 5 lbs. per 1000 sq. ft.
 - 2. Fertilizer: 25 lbs. per 1000 sq. ft.
 - 3. Mulch: 35 lbs. per 1000 sq. ft.
- B. Hydroseed mulch is to be an integral part of the slurry mix; it shall be added after the seed and fertilizer have been thoroughly mixed and shall be applied uniformly to all seeded areas.
- C. Areas which are hydroseeded from 6/1 to 9/1 or 12/1 to 3/1 shall be mulched with straw. Wood fiber mulch shall not be used during these times.

3.7 SEED PROTECTION

- A. Identify seeded areas with stakes and string around area periphery. Set string height to 12 inches (300 mm). Space stakes at 10 feet max. (3 m).
- B. Cover seeded slopes where grade is 3H:1V or greater with re-vegetation mats.
- C. Place re-vegetation mats or erosion control mats in ditches where indicated on the Drawings.

3.8 NETTING/MAT PLACEMENT:

- A. Laying the Net/Mat:
 - 1. Start laying net/mat from top of swale/slope and unroll downgrade. Mat shall be placed minimum 12" beyond edges of swale and 18" beyond top and bottom of slopes.
 - 2. Allow to lay loosely on soil - do not stretch or pull.
 - 3. To secure: Upslope ends of net/mat should be buried in a slot or trench no less than 6 inches deep. Tamp earth firmly over net/mat. Staple every 12 inches across the top end.
 - 4. Edges shall be stapled every 3 feet. Where 2 strips are laid side by side, the adjacent edges shall be overlapped 3 inches and stapled together.
 - 5. Staples shall be placed down the center of net/mat strips at 3-foot intervals. DO NOT STRETCH when applying staples.
- B. Joining Strips: Insert new roll of net/mat in trench, as with upslope ends. Overlap the end of the previous roll 18 inches, turn under 6 inches, and staple across end of roll just below anchor slot and at the end of the turned-under portion every 12 inches.
- C. At Bottom of Slopes: Lead net/mat out onto a level area before anchoring. Turn ends under 6 inches, and staple across end every 12 inches.
- D. Provide 12 inch (300 mm) overlap of adjacent rolls. At sides of ditches, lay fabric laps in direction of water flow.
- E. Check Slots: On highly erodible soils and on slopes steeper than 4:1, erosion

check slots should be made every 15 feet. Insert a fold into a 6-inch trench and tamp firmly. Staple at 12-inch intervals across the downstream portion.

- F. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- G. Rolling: After installation, net/mat should be rolled to ensure firm contact with soil.

3.9 MAINTENANCE DURING ESTABLISHMENT PERIOD:

- A. The Contractor shall be responsible for all maintenance during the establishment period. This period may extend beyond the Date of Substantial Completion if lawns are not deemed acceptable at that time. Maintenance shall include watering, fertilizing, removal of straw mulch, weed eradication, mowing, trimming, clipping removal, the reconstruction of all areas failing to yield vital stands, and the reconstruction of all area damaged by erosion or other occurrence.
- B. Stands in lawn areas shall be mowed at regular intervals to maintain at a maximum height of 2-1/2 inches (65 mm). Do not cut more than 1/3 of height at any one mowing. Soil stability areas shall not be mowed.
- C. Neatly trim edges and hand clip where necessary.
- D. Immediately remove clippings after mowing and trimming.
- E. Water to prevent grass and soil from drying out with hoses and portable sprinklers in areas that do not receive water from irrigation. Contractor to regularly rotate location of portable sprinklers to ensure that no single area becomes saturated.
- F. Roll surface to remove minor depressions or irregularities.
- G. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- H. After the third cutting of the establishment period but prior to inspection by the Architect, lawn areas within the scope of this Contract shall be fertilized with a mixture having 50% or more of the total nitrogen in a water insoluble form:

<u>Time of Application</u>	<u>lbs. Total Nitrogen per 1000 sq. ft.</u>
August 15 - Nov. 15	1-1/2 to 2
April 15 - June 15	1 to 1-1/2

3.10 LANDSCAPE FABRIC PLACEMENT: Place between soil and mulch in all mulched planted areas for weed control.

3.11 CLEAN-UP AND PROTECTION

- A. Keep pavements clean and work area in an orderly condition.
- B. Remove from the site, all equipment, surplus materials, debris, etc. resulting from the seeding work as herein specified.

- C. Protect seeded areas and materials from damage due to operations by other contractors, trades and trespassers. Maintain protection during installation and until final acceptance. Treat, repair or replace damaged seeded areas as herein before specified.

3.12 INSPECTION AND ACCEPTANCE:

- A. When establishment period is completed, Architect will, upon written request, make an inspection to determine acceptability.
- B. Work may be inspected for acceptance in sections agreeable to the Architect, provided all work for that section is complete.
- C. When inspected work is not acceptable, replace or remedy rejected work. Continue all applicable requirements of Contract until re-inspection and acceptance by the Architect.

3.13 GUARANTEE

- A. The Contractor shall be responsible for providing a finished lawn by Substantial Completion if possible. The Contractor shall produce dense, vigorous, well established lawns and shall maintain lawn areas until final acceptance of the work by the Owner. Any areas which fail to show a uniform stand of grass shall be reworked, and reseeded at the Contractor's expense with the same seed as originally used thereon, and such reseeded shall be replaced until all required areas are covered with a satisfactory stand of grass.
- B. Re-seeding of bare areas must be accomplished through mechanical means using a slit-seeder or a core aerator.
- C. Contractor's responsibility to maintain shall begin when work is begun and continue until maintenance program is accepted by Owner.
- D. In the event that treatment or replacement is made necessary as a result of damage caused by circumstances which are beyond the Contractor's control, and not due wholly or partially as a result of any act or omission by the Contractor, such treatment or replacement will be authorized by the Owner by Change Order in accordance with the General Conditions.

END OF SECTION

SECTION 331116
WATER MAINS AND SERVICES

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not limited to)

- A. Pipe and fittings for exterior water system including distribution main, domestic service and fire service, as applicable.
- B. Valves, fire hydrants, fire department connection, and domestic water hydrants.
- C. Bedding and compaction.
- D. Adjustment of existing utility structures to meet proposed work.
- E. Provide an approved, operational underground exterior water service and fire service piping system from five (5) feet outside the building through connection to existing system.

1.2 RELATED SECTIONS

- A. Applicable sections of Division 1 - GENERAL CONDITIONS: Including but not limited to:
 - 1. Section 013100 – Coordination of the Work.
 - 2. Section 013300 – Submittal Procedures: Procedures for submittals.
 - 3. Section 014000 – Quality Requirements: Aggregate and concrete testing.
 - 4. Section 015600 – Temporary Facilities and Controls: Dewatering excavations and water control.
 - 5. Section 106000 – Products Requirements: Product delivery, handling, storage, and protection.
 - 6. Section 017000 – Execution Requirements: Contract Closeout, Project Record Documents.
- B. Section 310513 – Soil Materials: Soil and aggregate materials.
- C. Section 310516 – Aggregate Materials.
- D. Section 311000 - Site Preparation and Clearing: Preparation for land disturbance, protection of the Work.
- E. Section 312213 – Rough Grading.
- F. Section 312317 - Utility Trenching & Backfilling: Excavation, backfill, compaction, testing, Trace Wire & ID Tape.
- G. Section 331300 - Disinfection of Water Distribution System: Disinfection of site service utility water piping.

1.3 REFERENCES

- A. AMERICAN SOCIETY OF TESTING & MATERIALS (ASTM)
- B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
- C. AMERICAN WATER WORKS ASSOCIATION (AWWA)
- D. AMERICAN WELDING SOCIETY (AWS)
- E. FACTORY MUTUAL RESEARCH CORP. (FM)
- F. MANUFACTURERS' STANDARDS SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
- G. NATIONAL FIRE PREVENTION ASSOCIATION (NFPA)
- H. UNDERWRITERS LABORATORIES (UL)
- I. UNI-BELL PLASTIC PIPE ASSOCIATION (UNI)
- J. VIRGINIA DEPARTMENT OF HEALTH (VDH)
 - 1. Virginia Department of Health (VDH) "Waterworks Regulations," latest edition, hereinafter Waterworks Regulations.
- K. SOILS
 - 1. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
 - 2. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
 - 3. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 4. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- L. COPPER
 - 1. ANSI/ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 - 2. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - 3. ASTM B32 - Solder, Metal.
 - 4. ASTM B88 - Seamless Copper Water Tube.
 - 5. AWS A5.8 - Brazing Filler Metal.
- M. PVC
 - 1. ASTM D1785 - Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, 120.
 - 2. ASTM D2241 - Polyvinyl Chloride (PVC) Plastic Pipe, (SDR-PR).
 - 3. ASTM D2672 - Bell-End Polyvinyl Chloride (PVC) Plastic Pipe.
 - 4. ASTM D2466 - Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
 - 5. ASTM D2467 - Socket-Type Polyvinyl Chloride (PVC) Plastic Pipe Fittings,

Schedule 80.

6. ASTM D2564 - Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings.
7. ASTM D2774 - Underground Installation of Thermoplastic Pressure Piping.
8. ASTM D3139 - Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
9. ASTM D2855 - Making Solvent-Cemented Joints With Poly Vinyl Chloride (PVC) Pipe and Fittings
10. ASTM F402 - Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings
11. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
12. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.
13. UNI B3 - Installation of Polyvinyl Chloride (PVC) Pressure Pipe Complying With AWWA C900.

N. DUCTILE IRON

1. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other liquids.
3. ANSI/AWWA C110 - Gray Iron and Ductile Iron Fittings, 3 Inch Through 48 Inches, for Water and Other Liquids.
4. ANSI/AWWA C111- Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.
5. ANSI/AWWA C115- Rubber-Gasket Joints for Ductile Iron and Grey-Iron Flanged Pressure Pipe and Fittings.
6. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
7. ANSI/AWWA C153 - Ductile-Iron Compact Fittings, 3 Inch Through 16 Inch, for Water and Other Liquids.
8. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.
9. ANSI/AWWA C606 - Grooved and Shouldered Type Joints.
10. ASTM A48 - Gray Iron Castings.

O. PE PIPE

1. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, 1/2 inch through 3 inch, for Water
2. ASTM D3035 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.

P. VALVES, ETC

1. ANSI/AWWA C500 - Gate Valves (Double Disc), 3 through 48 in NPS, for Water and Sewage Systems.
2. ANSI/AWWA C502 - Dry Barrel Fire Hydrants.
3. ANSI/AWWA C504 - Rubber Seated Butterfly Valves.
4. ANSI/AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS.
5. ANSI/AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.

6. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.
7. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.
8. MSS SP80 - Bronze Gate, Globe, Angle and Check Valves.
9. MSS SP71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
10. UL 246 - Hydrants for Fire - Protection Service.

Q. FIRE SERVICE

1. NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances."
2. NFPA 13, "Standard for the Installation of Sprinkler Systems."

1.4 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures: Submittals.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. All products identified in PART 2 of this specification.
- C. Manufacturer's Certificate: Certify that above referenced products meet or exceed specified requirements.
- D. Submit NFPA "Contractor's Materials and Test Certificate for Underground Piping." Use NFPA 13 Version with Owner Representative signature block.

1.5 PROJECT RECORD DOCUMENTS

- A. Section 017000 – Execution Requirements: Contract Closeout.
- B. Record actual locations of piping mains, valves, connections per the As-Built Survey requirements of Specifications 31 10 00 – Site Preparation and 31 22 13 – Rough Grading.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- D. Certify in writing to the Owner and to the Architect that the "System" has been approved and is ready for use.
- E. Maintenance Data: Submit maintenance data and parts list for the fire water system materials and products.

1.6 QUALITY ASSURANCE

- A. Code Compliance: Comply with:
 1. VDH Waterworks Regulations,
 2. Local water system standards and specifications,
 3. Local Fire Department/Marshal Regulations or Standards: Comply with governing regulations pertaining to hydrants, including hose coupling threading and matching of connections, and
 4. Owner's Insurance Company requirements.

- B. Install fire water systems in accordance with NFPA 24.
- C. Valves: Manufacturer's name and pressure rating shall be marked on valve body.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 – Product Requirements: Deliver, store, protect and handle products to site: Material & Equipment.
- B. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.1 PIPE & FITTINGS (4" & larger)

- A. Ductile Iron Pipe (buried applications): AWWA C151/ANSI 21.51, minimum thickness Class 51 with a minimum working pressure of 250 psi.
 - 1. Fittings: Ductile or grey iron, AWWA C110/ANSI 21.10 with a pressure rating not less than the pipe or AWWA C153/ANSI A21.53 with a working pressure of not less than that of the pipe.
 - 2. Joints: Mechanical joints per AWWA C111.
 - a. Bituminous Coating & Cement Lining: AWWA C104, Standard thickness for pipe and fittings.
 - b. Examples Meeting the Criteria or 1-3 above include, but are not necessarily limited to:
 - 1. Clow Super Bell-Tite Push-on Joint Ductile Iron Pipe.
 - 2. Pipe Tyton (Push-on) Joint Ductile Iron Pipe.
 - 3. Griffin Super Bell-Tite Push-on Joint Ductile Iron Pipe.
- B. Ductile Iron Pipe (non-buried applications): AWWA C-151/ANSI 21.51, minimum thickness Class 53.
 - 1. Cement Lining: AWWA C104, Standard thickness, for pipe and fittings.
 - 2. Joints: AWWA C115 flanges or AWWA C606 grooved and shouldered joints. Provide flange joints with AWWA C111 full faced rubber gaskets for each flange in piping. Provide flanges, connection pieces, transition gaskets, transition sleeves and other adapters as required to complete the piping installation.
 - 3. Fittings:
 - a. AWWA C110/ANSI 21.10 (flanged), or AWWA C606 (grooved & shouldered) and pressure rating not less than the pipe.
 - 4. Grooved and shouldered joints shall be as manufactured by Victaulic Company of America of Easton, Pennsylvania or approved equal. The supplier of the grooved and shouldered joints shall be a factory certified representative of this piping system.
- C. PVC Pipe (4" - 12"): ANSI/AWWA C900 pressure Class 150 (DR18) with ductile iron pipe equivalent OD.
 - 1. Joints: ASTM D3139 push-on or ASTM D3139 and AWWA C111 compression type mechanical joints, as applicable. ASTM F477 gaskets for push-on joints for pipe and AWWA C111 gaskets for push-on joints and mechanical joints for joint connections between pipe and metal fittings,

valves, and accessories.

- D. Examples Meeting the above Criteria include, but are not necessarily limited to:
 - 1. Johns-Manville Blue Brute PVC Water Pipe, DR18, Class 150
 - 2. Johns-Manville PVC Class Water Pipe, DR18, Class 150
 - 3. Clow Super Main 900 Water Main, DR18, Class 150
 - 4. CertainTeed Vinyliron Pipe, DR18, Class 150
 - 5. National C900 Pipe, DR18, Class 150
 - 6. Extrusion Technologies Inc. (ETI) C900, DR18, Class 150
- E. Fittings: ANSI/AWWA C110, ductile iron, with a pressure rating not less than the pipe and AWWA C104 standard thickness cement lining.

2.2 PIPE & FITTINGS (smaller than 4-inch diameter)

- A. Copper Tubing (for water piping only): ASTM B88, Type K:
 - 1. Fittings:
 - a. ANSI/ASME B16.18, cast copper and brass, solder joint fittings, or
 - b. ANSI/ASME B16.22, wrought copper, solder joint fittings.
 - 2. Joints:
 - a. ASTM B32, 95-5 tin antimony solder, or
 - b. Plumbing Code approved lead free solder, or
 - c. Compression connection, as applicable.
- B. Polyvinyl Chloride (PVC) Pipe: ASTM D2241, SDR-21 (200 psig rated).
 - 1. Joints: ASTM F477 rubber gaskets for push-on pipe.
 - 2. Pipe and fittings shall bear the seal of approval of the National Sanitation Foundation for potable water service.
 - 3. Pipe and fittings shall be of the same PVC material and shall be one of the following pipe/fitting combinations, as marked on the pipe and fitting, respectively: PVC 2120/PVC II; PVC 2116/PVC II.
 - 4. Examples Meeting the above Criteria include, but are not necessarily limited to:
 - a. Johns-Manville Ring-Tite PVC Pressure Pipe (D2241) Bell & Spigot
 - b. Clow PVC Bell-Tite Pressure Rated Pipe (D2241) Bell & Spigot
- C. Polyethylene Pipe: AWWA C901 ASTM D3035, with outside Dimension Ratio (DR) of 11.
 - 1. Joints: Butt fusion.
 - 2. Fittings: AWWA C901, molded.

2.3 INSULATING JOINTS

- A. Provide between pipes of dissimilar metals a rubber gasket or other approved type of insulating joint or dielectric coupling which shall effectively prevent metal-to-metal contact between adjacent sections of piping.

2.4 BALL VALVES - Up to 2 Inches (50 mm)

- A. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, [AWWA] [IPS] [compression] inlet end, [compression] [IPS] outlet [with electrical ground connector], with control rod, extension box [and valve key].

2.5 GATE VALVES - Up to 3 Inches (75 mm):

- A. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, extension box and valve key.

2.6 GATE VALVES - 3 Inches (75 mm) through 14 Inches (350 mm)

- A. UL/FM Rated, Iron or ductile iron body, bronze trim, non-rising stem with square nut, single wedge, rubber encapsulated resilient seat, mechanical joint ends, control rod, available as post indicator, extension box and valve key. ANSI/AWWA C509 except with wall thicknesses exceeding the min. requirements of AWWA C153.
 - 1. Valves shall have a double O-ring stem seal, a minimum stem diameter of 7/8 inch for valves larger than six (6) inches, and shall open left (counter-clockwise).
 - 2. Valves shall be designed for a working pressure not less than that specified for the connecting pipe.
 - 3. Valves shall be coated inside and out with a fusion bonded epoxy coating meeting AWWA C550.
 - 4. Valves for above ground mounting or installed in vaults shall have flanged ends.
 - 5. Valves for buried installation shall have mechanical joints conforming to AWWA Std. C111 unless otherwise specified.
 - 6. Gate valves shall be supplied from a single manufacturer.
 - 7. Supply post indicator where indicated on the Drawings or as required by NFPA 24.
 - 8. Examples meeting the above criteria include, but are not necessarily limited to:
 - a) American Flow Control Model AFC-2500, by American Darling Valve (Ductile Iron)

2.7 SWING CHECK VALVES (smaller than four inches)

- A. MSS SP80, Class 125, except sizes 2.5 inches and larger shall conform to MSS SP71, Class 125.

2.8 SWING CHECK VALVES (4 inches to 24 inches (100 mm to 600 mm))

- A. Check valves shall conform with the specifications in ANSI/AWWA Standard C508. Valves shall be iron body, bronze trim, [45] [22] degree swing disc, renewable disc and seat, flanged ends. Valves shall be equipped with an outside weighted arm. Provide piston type anti-slam device on all check valves where indicated.

2.9 FIRE DEPARTMENT CONNECTIONS (FDC)

- A. Provide 90-degree cast brass siamese connections and sleeve assembly, with two 2-1/2 inch fire department inlet female hose connections, thread per local fire dept. requirements, and self closing brass double clapper valves. Provide rough brass covers with chains. Acceptable FDC manufacturers include but are not limited to:
 - 1. Allen Manufacturing Div.
 - 2. Moon, Inc.
 - 3. Croker-Standard Div.
 - 4. Fire-End & Croker Corp.
 - 5. Elkhart Brass Mfg. Co., Inc.

2.10 FIRE HYDRANTS

- A. Hydrant: Type as required by utility company.
- B. Examples meeting the above criteria include, but are not necessarily limited to:
 - 1. American Flow Control Model B-84-B, AMERICAN-DARLING VALVE
 - 2. Mueller Centurion A423, by Mueller Co.
 - 3. Kennedy K81D
 - 4. AVK Model 2780
- C. Hydrant Extensions: Fabricate in multiples of 6 inches (150 mm) with rod and coupling to increase barrel length.
- D. Hose and Pumper/Steamer Connections: Two (2) 2-1/2 inch hose connections and one (1) 4-1/2 inch pumper connection per utility company requirements. Nozzle threads shall be National Standard.
- E. Operating nut shall be National Standard, pentagon shape (1.5" point to flat) and turn counter-clockwise to open unless otherwise required by local utility company.
- F. Finish: Primer and two coats of enamel to color required by utility company. All barrels shall be painted silver and the bonnet shall be painted with red reflective paint as required by utility company.
- G. Tools: Provide two (2) complete sets of tools required for maintenance and/or repair.

2.11 WATER VAULT

- A. Vault detailed is manufactured by Clearflow Co., and is available pre-assembled. Allow for proper delivery time.
- B. Backflow Prevention: Provided within vault as detailed on the Drawings.
- C. Meter Assembly: Provided within vault as detailed on the Drawings.

2.12 FROSTPROOF YARD HYDRANT

- A. Provide a self-draining, non-freezing, low lead, Sanitary yard hydrant.

- B. A lockable feature is required.
- C. Riser shall be steel pipe with a cast iron casing guard.
- D. Principal interior operating parts shall be brass and removable from yard hydrant for servicing without excavation.
- E. Yard hydrant shall be set in four cubic yards (4 CY) of crushed stone to allow for proper drainage.
- F. Yard hydrant shall be Woodford Sanitary Yard Hydrant, Model S4H meeting ADA requirements for height and a 5 lbs. maximum operating force to operate.

2.13 ACCESSORIES

- A. General: Provide flanges, connecting pieces, transition glands, transition sleeves, and other adapters as required for a complete and operational system.
- B. Structure top adjustments: Provide grade rings, brick and mortar, or extensions as required for adjusting structure top elevations to meet proposed finish grades.
- C. Thrust Block/Anchorages: Provide at all tees, wyes, crosses, plugs, caps, bends, valves and hydrants.
- D. Valve Box: Each valve on buried piping shall be provided with an adjustable cast-iron valve box of a size suitable for the valve. Provide each cast-iron box with a heavy coat of bituminous paint. The head shall be round and the lid shall have the word "WATER" cast on it. The least diameter of the box shaft shall be 5.25 inches.
- E. Trace Wire for Non-Metallic Piping: Comply with Section 312317 - Utility Trenching & Backfilling.
- F. Buried Utility Warning and Identification Tape: Comply with Section 312317 - Utility Trenching & Backfilling.
- G. Identification Tags and Plates: Provide valves with tags or plates numbered and stamped for their usage. Plates and tags shall be of brass or non-ferrous metal and shall be mounted or attached to the valve.
- H. Rim Adjustments: Provide pre-cast grade rings or install brick and mortar as necessary to level, raise or lower existing or new manhole frames and covers to meet finish grade. Adjustments of 8 inches or less in height shall not be considered for additional compensation.

2.14 BEDDING MATERIALS

- A. Bedding & Haunching: Coarse Aggregate Type A1 (Utility Bedding, Select Backfill) as specified in Section 310516 - Aggregate Materials.
- B. Cover Bedding/Initial Backfill: Soil Type S1 or S2 as specified in Section 310513 - Soil Materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate with the WVWA for all required meetings, inspections, and approvals.
- B. Verify that building service connection, point of water service connection and municipal utility water main size, location and invert are as indicated.
- C. Verify that grades are within six (6) inches of finished subgrade prior to the commencement of this work. Minimum clear cover over all water pipe shall be three (3) feet.
- D. Inspect all new water piping material upon receipt and immediately prior to installation to verify that it is in acceptable condition and proper working order. Mark all damaged material, remove it from the site at the first opportunity and replace it promptly so the work will not be delayed.
- E. For new and existing water utilities affected by new work, verify that structure top elevations have been adjusted to meet proposed finished grades.

3.2 PREPARATION

- A. Provide adequate means and methods for lowering sections of pipe and associated items into trenches. Do not drop or dump pipe, fittings, valves, or any other water piping material.
- B. Have all necessary arrangements made to complete the work and place it in operation without delays.
- C. Prepare pipe connections to equipment with flanges or unions.

3.3 SEPARATION

- A. Water Piping Installation Parallel to Sewer Piping
 - 1. Normal Conditions: Water piping shall be laid at least ten (10) feet horizontally from a sewer or sewer manhole wherever possible, measured edge to edge.
 - 2. Unusual Conditions: When local conditions prevent ten (10) feet horizontal separation, the water piping may be laid closer to a sewer or sewer manhole provided that:
 - a. The bottom (invert) of the water piping shall be at least 18 inches above the top (crown) of the sewer piping.
 - b. Where this vertical separation cannot be obtained, the sewer piping shall be constructed of AWWA-approved water pipe and pressure tested in place without leakage prior to backfilling.
 - c. The sewer manhole shall be of water-tight construction and tested in place.
- B. Water Piping Installation Crossing Sewer Piping
 - 1. Normal Conditions: Water piping crossing above sewer piping shall be laid

to provide a separation of at least 18 inches above the top (crown) of the sewer piping.

2. Unusual Conditions: When local conditions prevent the vertical separation described above, the following construction shall be used:
 - a. Sewer piping passing over or under water piping shall be constructed of AWWA-approved water pipe and pressure tested in place without leakage prior to backfilling.
 - b. Water piping passing under sewer piping shall, in addition, be protected by providing the 18 inch vertical separation described above, adequate structural support for the sewer piping to prevent excessive deflection of the joints and the settling on and breaking of the water piping, and that the length (min. 18 feet) of the water piping be centered at the point of crossing so that joints shall be equidistant and as far as possible from the sewer piping.

C. Sewer Manholes

1. No water piping shall pass through or come in contact with any part of a sewer manhole.

3.4 BEDDING

- A. Excavate pipe trench in accordance with Section 312317 - Utility Trenching & Backfilling for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated. See Drawings for trench detail.
- B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches (150 mm) compacted depth, compact to 95 percent. Continue until pipe springline elevation is reached and hand excavate an accurate pipe shape to invert required. After setting pipe, where hand excavation is irregular against pipe, hand fill and tamp for an even fit tight to pipe at springline.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.5 INSTALLATION - PIPE

- A. Connection to Existing Water Systems: Connection to existing system will be made by the Contractor and coordinated with the Western Virginia Water Authority. Use tapping and drilling machine valve and mechanical joint type sleeves for connections to be made under pressure. Bolt sleeves around mains; bolt valve conforming to AWWA C500 to the sleeve. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, all without interruption of service. Notify the Owner in writing at least fifteen (15) days prior to the date the connections are required; receive approval before any service is interrupted. Furnish all materials and labor required to make connections into the existing water supply systems.
- B. The Contractor shall be responsible for all public notification of service interruptions of the water main. Comply with all WVWA requirements regarding safety, temporary services and installation procedures.

- C. The Contractor shall comply with the Waterworks Regulations pertaining to separation of water and sanitary sewer.
- D. Establish elevations of buried piping to ensure not less than 3 ft (900 mm) of cover.

3.6 UTILITY ADJUSTMENT

- A. Adjust the tops of all affected water utility structures whether new or existing to meet finished grades. Provide grade rings, brick and mortar, or extensions for existing or new structures such that tops meet proposed finish grades. Adjustments of 8 inches or less in height shall be made at no additional cost to the Owner.
- B. Coordinate timing of adjustment work to be prior to stone base applications for paved areas and prior to topsoil applications in lawn spaces.

3.7 DUCTILE IRON

- A. Install ductile iron piping and fittings in accordance with ANSI/AWWA C600.

3.8 POLY-VINYL CHLORIDE (PVC)

- A. Install PVC piping and fittings to ASTM D2774.
- B. Inspect pipe, fittings, valves, and accessories before and after installation; those found defective shall be replaced with new materials. Ream pipe and tube ends and remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, removing scale and dirt, on inside and outside, before assembly and maintain in a clean condition.
- C. Route pipe in a straight line, unless otherwise indicated on the Drawings. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.
- D. Cut pipe accurately to measurements established at the site and work into place without springing or forcing and making proper provision for expansion and contraction of piping without stressing pipe or joints. Replace pipe or fitting that does not allow sufficient space for proper installation of joint material with new pipe or fittings of proper dimensions. Blocking or wedging between bells and spigots will not be permitted.
- E. Install pipe to indicated elevations and grade to within tolerance of 5/8 inch (20 mm). Ensure firm and uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Keep trenches free of water. At the end of each days work, close open ends of pipe temporarily with wood blocks or bulkheads.
- F. Install access fittings to permit disinfection of water system performed under Section 331300 - Disinfection of Water Distribution System. Position drains at low points.

- G. Conduct testing.
- H. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main, vertical and horizontal, and behind fire hydrant as recommended by manufacturer. See detail on the Drawings.
- I. Install trace wire continuous over top of non-metallic pipe. Coordinate with Section 312317 - Utility Trenching & Backfilling.
- J. Place cover bedding/initial backfill to depth indicated in trench section on the Drawings, compacted to 95%.
- K. Backfill pipe trench in accordance with Section 312317 - Utility Trenching & Backfilling for work of this Section.

3.9 SPECIAL REQUIREMENTS FOR INSTALLATION OF DISTRIBUTION PIPING

- A. Ductile Iron Pipe and Fittings:
 - 1. AWWA C600 for pipe installation, joint assembly, valve and fitting installation, and thrust restraint, except as otherwise specified hereunder. Provide AWWA C600 joint assembly for push-on joints. Provide AWWA C600 joint assembly for mechanical joints and with the recommendations of Appendix A to AWWA C111. Make flanged joints up tight; avoid undue strain on flanges, fitting, valves, and other accessories. Use full-sized bolts for the bolt holes; use of the undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overtraining the flange. When any flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified for flanged joints, except that bolts with insulating sleeves shall be full size for the bolt holes. Assure that there is no metal-to-metal contact between dissimilar metals after joint has been assembled.
- B. Polyvinyl Chloride (PVC) Pipe and Fittings:
 - 1. UNI B3 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings, except as specified hereunder. Make push-on joints with elastomeric gaskets using either elastomeric gasket bell-end pipe or elastomeric gasket couplings. Use push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
 - 2. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of UNI B3 for laying the pipe. Assemble push-on joints for connection to fittings, valves, and other accessories with the requirements of AWWA C600 for joint assembly. Assemble compression-type joints and mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners in accordance with the requirements of UNI B3 and AWWA C600, and Appendix A to AWWA C111. Cut off spigot end of pipe for compression-type joint and mechanical-joint connections and

do not re-bevel.

C. Pipe Anchorage:

1. Provide anchorage of buried piping shall be installed at all 22.5 degrees and sharper bends, and tees. Dead ends of piping shall be securely blocked in the direction of flow.
2. Provide reaction anchors of concrete blocking, metal harness, retainer gland type, or restrained joint type pipe at all changes in direction of pressure pipelines and as shown on the Drawings.
3. Use of metal harness restraints shall be approved by the Engineer.
4. Concrete thrust blocks (reaction backing) shall have a minimum compressive strength of 3000 psi. Dead ends restrained with concrete shall have the concrete bearing solidly against the piping and affording a minimum of 3 square feet of bearing area against a vertical trench face (undisturbed earth) for 3- and 4-inch piping, and in accordance with the drawing details for piping 6-inch diameter and larger.

3.10 SETTING OF VALVES AND VALVE BOXES

A. Valve, Air Release, Meter and Blow-Off Chambers (as applicable):

1. Drain to surface where not subject to flooding by surface water or to absorption pit located above seasonal water table elevation per Waterworks Regulations Section 3.53 C, otherwise to manufacturer's recommendation.
2. Install valves with operator stems in the vertical plane through the pipe axis and perpendicular to the pipe axis. Locate valves where shown on the Drawings. Thoroughly clean before installation. Check valves for satisfactory operation.
3. Equip all underground valves without gearing or operators with valve boxes. Set box in alignment with valve stem centered on valve nut. Set the valve box to prevent transmitting shock or stress to the valve. Set the box cover flush with the finished ground or pavement surface.
4. Valve, Air Release, Meter and Blow-Off Chambers
 - a. Drain to surface where not subject to flooding by surface water or to absorption pit located above seasonal water table elevation per Waterworks Regulations Section 3.53 C, otherwise to manufacturer's recommendation.
 - b. Provide chambers/boxes in accordance with manufacturer's recommendations and of adequate size to permit ease of access and maintenance.

3.11 SPECIAL REQUIREMENTS FOR INSTALLATION OF WATER SERVICE PIPING

A. Metallic Piping:

1. Install pipe and fittings in accordance with the general requirements for installation of piping and with the applicable requirements of AWWA C600 for pipe installation, except as otherwise specified in the following paragraphs.

B. Joints for Copper Tubing:

1. Cut copper tubing with square ends; remove fins and burrs. Replace

dented, gouged, or otherwise damaged tubing with new tubing. Before making joint, clean ends of tubing and interior of fitting or coupling with wire brush or abrasive. Apply a rosin flux to the tubing end and on recess inside of fitting or coupling. Insert tubing end into fitting or coupling for the full depth of the recess and solder. For compression joints on flared tubing, insert tubing through the coupling nut and then flare tubing with flaring tool.

C. Flanged Joints:

1. Make flanged joints up tight; avoid undue strain on flanges, valves, fittings, and accessories.

D. PVC Piping

1. Install pipe and fittings in accordance with the general requirements for installation of piping and with the applicable requirements of ASTM D2774 and ASTM D2855, except as modified herein. ASTM F402 for safe handling of solvent cements.
2. Jointing
 - a. Make solvent-cemented joints and assemble in accordance with ASTM D2855. Make pipe joints to other pipe materials in accordance with the recommendation of the PVC pipe manufacturer, as approved.

E. Installation of Valves and Valve Boxes:

1. Valves and valve boxes shall be set plumb, with valve boxes centered directly over the valves. Valve boxes shall be located outside the area of the roads and streets whenever possible. Earth fill shall be tamped around the valve box to a distance of 4 feet on all sides of the box, or to the undisturbed trench face if less than 4 feet. Clean foreign matter from interior of valves before installation. Stuffing boxes shall be tightened and the valve shall be inspected in open and closed positions to ensure that all parts are in proper working order.
2. Install a full-ported shut-off valve below each Air Release or Combination Air Valve in the event servicing is required.

3.12 INSTALLATION - FIRE HYDRANT ASSEMBLIES

- A. Set valves on solid bearing.
- B. Center and plumb valve box over valve. Set box cover flush with finished grade. The Contractor shall locate and uncover all valve boxes after pavement/surface treatment of roads and adjust the tops to final road grades, if necessary.
- C. Set Fire Department Connection (FDC) plumb and locate centerline of nozzles perpendicular to roadway.
- D. Set hydrants plumb and locate pumper nozzle perpendicular to roadway.
- E. Set hydrants to grade in accordance with manufacturer's recommendations, with nozzle centers at least 20 inches (500 mm) above ground.
- F. Locate control valve 4 inches (100 mm) minimum away from hydrant.

- G. Provide a drainage pit 36 inches (900 mm) square by 24 inches (600 mm) deep filled with 2 inch (50 mm) diameter washed gravel. Encase elbow of hydrant in gravel to 6 inches (150 mm) above drain opening. Do not connect drain opening to sewer.
- H. Paint hydrants in accordance with requirements of local fire department.

3.13 FIELD TESTS AND INSPECTIONS OF WATER MAINS

- A. Perform all field tests, and provide all labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with contract requirements. Allow concrete to cure a minimum of 5 days before testing any section of piping where concrete thrust blocks have been provided.
- B. Field Testing of System:
 - 1. The Contractor may backfill over the pipe as laid, except as noted below. The bell holes shall either be left open or reopened for a visual inspection of the joints during the test period. The bell holes of all dry joints may be backfilled following this test. All leaking joints shall be reconnected (or tightened as necessary) and retested and all pipe, valves and fittings and other materials found defective under this test shall be removed and replaced at the Contractor's expense.
 - 2. Exception: When the open trench or open bell holes necessary for a visual inspection and test of the joints present a hazard to safety and welfare, or in an emergency, and/or special case, the operation incident to trenching, pipe laying, backfilling and testing shall be so coordinated as to minimize the lineal footage of open trench and that portion of the system tested in accordance with this section.
 - 3. This portion or portions of the system shall be tested between valves or temporary plugs in sections of not more than 2,500 lineal feet.
- C. Pressure and Leakage Test:
 - 1. Test Restrictions and Certification:
 - a. Per "Contractor's Material and Test Certificate for Underground Piping" following this section.
 - b. Test pressure shall not vary by more than +/-5 psi for the duration of the test.
 - c. Valves shall not be operated in either direction at differential pressure exceeding the rated valve working pressure. Use of a test pressure greater than the rated valve pressure can result in trapped test pressure between the gates of a double-disc gate valve. For tests at these pressures, the test setup should include provision, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or fully opened if desired.
 - d. Test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

- D. Pressurization:
1. After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to the required hydrostatic pressure at the point of testing to provide the minimum required pressure at the high point in the test section. Each valved section of pipe shall be slowly filled with water, and the specified test pressure, based on the evaluation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Owner. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test.
- E. Air Removal:
1. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied.
- F. Examination:
1. All fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until it is satisfactory to the Owner.
- G. Flushing: Per Test Certificate unless test section is a fire service line, then flushing shall be in accordance with NFPA 24.
- H. Leakage Defined
1. See Test Certificate.
- I. Allowable Leakage
1. See Test Certificate.
- J. When hydrants are in the test section, the test shall be made against closed hydrant valves.
- K. Acceptance of Installation:
1. Acceptance shall be determined on the basis of allowable leakage. If any test of laid pipe disclosed leakage greater than that specified in Paragraph "H" above, the contractor shall, at his own expense, locate and make approved repairs as necessary until the leakage is within the specified allowance.
 - a. All visible leaks are to be repaired, regardless of the amount of leakage.

3.14 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 331300 -Disinfection of Water Distribution System.

3.15 SERVICE CONNECTIONS

- A. Provide all sleeves, caulk or other materials required to provide a watertight connection at buildings or though walls or foundations.

3.16 FIELD QUALITY CONTROL

- A. Field trench inspection and compaction testing shall be performed under provisions of Section 312317 - Utility Trenching & Backfilling.
- B. Compaction testing will be performed in accordance with ANSI/ASTM D698 Standard Proctor. Field testing methods shall be as deemed appropriate by the Geotechnical Engineer.
- C. Installation and testing shall be inspected in accordance with Section 310900 – Geotechnical Engineering, Inspections & Testing
- D. Disinfection testing shall be performed in accordance with Section 331300 - Disinfection of Water Distribution System.
- E. All equipment shall be tested in operation to demonstrate compliance with the contract requirements.
- F. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

Contractor's Material and Test Certificate for Underground Piping

PROCEDURE

Upon completion of work, inspection, and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

PROPERTY NAME

DATE

PROPERTY ADDRESS

PLANS

ACCEPTED BY APPROVING AUTHORITIES (NAMES)

ADDRESS

INSTALLATION CONFORMS TO ACCEPTED PLANS

☐ YES ☐ NO

EQUIPMENT USED IS APPROVED

☐ YES ☐ NO

IF NO, STATE DEVIATIONS

INSTRUCTIONS

HAS PERSON IN CHARGE OF FIRE EQUIPMENT BEEN INSTRUCTED AS TO LOCATION OF CONTROL VALVES AND CARE AND MAINTENANCE OF THIS NEW EQUIPMENT?

IF NO, EXPLAIN

☐ YES ☐ NO

HAVE COPIES OF APPROPRIATE INSTRUCTION AND CARE AND MAINTENANCE CHARTS BEEN LEFT ON PREMISES?

IF NO, EXPLAIN

☐ YES ☐ NO

LOCATION

SUPPLIES BUILDINGS

UNDERGROUND
PIPES AND
JOINTS

PIPE TYPES AND CLASS

TYPE JOINT

PIPE CONFORMS TO _____ STANDARD

☐ YES ☐ NO

FITTINGS CONFORM TO _____ STANDARD

☐ YES ☐ NO

IF NO, EXPLAIN

JOINTS NEEDING ANCHORAGE CLAMPED, STRAPPED, OR BLOCKED IN ACCORDANCE WITH _____ STANDARD

☐ YES ☐ NO

IF NO, EXPLAIN

TEST
DESCRIPTION

FLUSHING: Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags and outlets such as hydrants and blow-offs. Flush at flows not less than 390 GPM (1476 L/min) for 4-inch pipe, 880 GPM (3331 L/min) for 6-inch pipe, 1560 GPM (5905 L/min) for 8-inch pipe, 2440 GPM (9235 L/min) for 10-inch pipe, 3520 GPM (13323 L/min) for 12-inch pipe. When supply cannot produce stipulated flow rates, obtain maximum available.

HYDROSTATIC: Hydrostatic tests shall be made at not less than 200 psi (13.8 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.3 bars) for two hours.

LEAKAGE: New pipe laid with rubber gasketed joints shall, if the workmanship is satisfactory, have little or no leakage at the joints. The amount of leakage at the joints shall not exceed 2 qts. per hr (1.89 L/h) per 100 joints irrespective of pipe diameter. The leakage shall be distributed over all joints. If such leakage occurs at a few joints the installation shall be considered unsatisfactory and necessary repairs made. The amount of allowable leakage specified above may be increased by 1 fl oz per in. valve diameter per hr. (30 mL/25 mm/h) for each metal sealed valve isolating the test section. If dry barrel hydrants are tested with the main valve open, so the hydrants are under pressure, an additional 5 oz. per minute (150 mL/min) leakage is permitted for each hydrant.

Figure 8-1 (b) Part 1.

FLUSHING TEST	NEW UNDERGROUND PIPING FLUSHED ACCORDING TO _____ STANDARDS BY (COMPANY) <input type="checkbox"/> YES <input type="checkbox"/> NO IF NO, EXPLAIN _____		
	HOW FLUSHING FLOW WAS OBTAINED <input type="checkbox"/> PUBLIC WATER <input type="checkbox"/> TANK OR RESERVOIR <input type="checkbox"/> FIRE PUMP		THROUGH WHAT TYPE OPENING <input type="checkbox"/> HYDRANT BUTT <input type="checkbox"/> OPEN PIPE
	LEAD-INS FLUSHED ACCORDING TO _____ STANDARD BY (COMPANY) IF NO, EXPLAIN _____ <input type="checkbox"/> YES <input type="checkbox"/> NO		
	HOW FLUSHING FLOW WAS OBTAINED <input type="checkbox"/> PUBLIC WATER <input type="checkbox"/> TANK OR RESERVOIR <input type="checkbox"/> FIRE PUMP		THROUGH WHAT TYPE OPENING <input type="checkbox"/> Y.CONN TO FLANGE & SPIGOT <input type="checkbox"/> OPEN PIPE
HYDROSTATIC TEST	ALL NEW UNDERGROUND PIPING HYDROSTATICALLY TESTED AT _____ PSI FOR _____ HOURS		JOINTS COVERED <input type="checkbox"/> YES <input type="checkbox"/> NO
LEAKAGE TEST	TOTAL AMOUNT OF LEAKAGE MEASURED _____ GALS _____ HOURS		
	ALLOWABLE LEAKAGE _____ GALS _____ HOURS		
HYDRANTS	NUMBER INSTALLED	TYPE AND MAKE	ALL OPERATE SATISFACTORILY <input type="checkbox"/> YES <input type="checkbox"/> NO
	WATER CONTROL VALVE LEFT WIDE OPEN IF NO, STATE REASON _____ <input type="checkbox"/> YES <input type="checkbox"/> NO		
	HOSE THREADS OF FIRE DEPARTMENT CONNECTIONS AND HYDRANTS <input type="checkbox"/> YES <input type="checkbox"/> NO INTERCHANGEABLE WITH THOSE OF THE FIRE DEPARTMENT ANSWERING ALARM		
REMARKS	DATE LEFT IN SERVICE _____		

SIGNATURES	NAME OF INSTALLING CONTRACTOR _____		
	TESTS WITNESSED BY		
	FOR PROPERTY OWNER (SIGNED)	TITLE	DATE
	FOR INSTALLING CONTRACTOR (SIGNED)	TITLE	DATE
ADDITIONAL EXPLANATION AND NOTES			

Figure 8-1 (b) Part 2.

END OF SECTION

SECTION 331300
DISINFECTION OF WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not necessarily limited to)

- A. Disinfection of all equipment, pipe lines, and all structures in the water project with which water comes in contact and/or which have been contaminated by the Contractor's operations shall be accomplished after completion of construction and immediately before the system or unit is placed in operation.
- B. Testing and reporting results.

1.2 RELATED SECTIONS

- A. Applicable sections of Division 01 – GENERAL CONDITIONS: Including but not limited to:
 - 1. Coordination of the Work,
 - 2. Submittals: Procedures for submittals,
 - 3. Quality Control or Testing Laboratory Services: Testing water samples. Field inspection and testing,
 - 4. Material & Equipment: Delivery, storage and handling, and
 - 5. Contract Closeout: Project Record Documents, Requirements.
- B. Section 331116 – Water Mains and Services

1.3 REFERENCES

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

VIRGINIA DEPARTMENT OF HEALTH (VDH)

- A. VDH "Waterworks Regulations," latest edition, hereinafter Waterworks Regulations.
- B. ANSI/AWWA B300 – Standard for Hypochlorites.
- C. ANSI/AWWA B301 – Standard for Liquid Chlorine.
- D. ANSI/AWWA B302 – Standard for Ammonium Sulfate.
- E. ANSI/AWWA B303 – Standard for Sodium Chlorite.
- F. AWWA C651 – Standards for Disinfecting Water Mains.
- G. ANSI/AWWA C652 – Standards for Disinfecting Water Storage Facilities.

1.4 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of applicable of Division 01: Contract Closeout: Project Record Documents, Requirements.
- B. Disinfection report; record:
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and time of completion.
 - 3. Test locations.
 - 4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - 5. Date and time of flushing start and completion.
 - 6. Disinfectant residual after flushing in ppm for each outlet tested.
- C. Bacteriological report; record:
 - 1. Date issued, project name, and testing laboratory name, address, and telephone number.
 - 2. Time and date of water sample collection.
 - 3. Name of person collecting samples.
 - 4. Test locations.
 - 5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
 - 6. Coliform bacteria test results for each outlet tested.
 - 7. Certification that water conforms, or fails to conform, to bacterial standards of VDH Waterworks Regulations.
 - 8. Bacteriologist's signature and authority.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA C651.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS & DILUTION MEDIUM

- A. Disinfecting Agent: The disinfection agent shall be liquid chlorine ANSI/AWWA B301, or sodium hypochlorite solution ANSI/AWWA B303. Dry hypochlorite ANSI/AWWA B300, similar and equal to "HTH" may also be used as the disinfecting agent.
- B. Potable water.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Piping shall be cleaned immediately after placing and all open ends shall be adequately sealed to prevent entry of debris.

- B. Unless the Contractor adheres to AWWA C651 concerning pipe cleanliness and prevents contamination of pipe, fittings and valves during construction, disinfection will be difficult.
- C. All sediment and foreign matter including debris resulting from cutting, welding or fabrication shall be removed from entire water distribution system including water lines and hydrants, followed by thorough flushing with potable water at a minimum velocity of 2.5 ft/sec to remove any sediment which may have collected during operation with raw water. In cases where this velocity is not attainable or is ineffective, cleaning devices such as foam swabs or "pigs" will be considered.
- D. Perform scheduling and disinfection activity with start-up, testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

- A. Provide and attach required equipment to perform the work of this Section.
- B. Pressure Testing: After the valves and piping have been installed, they shall be subjected for one hour to a hydrostatic pressure test of 150 pounds per square inch at the points of reading when the system is put into operation. Any defective material shall be replaced by the Contractor with sound material.
- C. Disinfection: All water lines shall be disinfected prior to being placed in operation. Potable water shall be introduced into the pipe line at a constant flow rate. This water shall receive a chlorine dosage which will result in a chlorine concentration of 100 mg/L in a "slug" of the water. An approved hypochlorite solution injected by a metering pump or liquid chlorine injected by a solution-feed chlorinator and booster pump may be used. The chlorine shall be added long enough to ensure that all portions of the pipe are exposed to the 100 mg/L chlorine solution for at least 3 hours. The Chlorine residual shall be checked at regular intervals not to exceed 2000 feet to ensure that adequate residual is maintained. As the chlorinated water passes valves and other appurtenances, they shall be operated to ensure disinfection of these appurtenances.

After the required retention period, the heavily chlorinated water shall be flushed from the pipe line using potable water until chlorine measurements show a concentration no greater than that generally prevailing in the source system. Comply with AWWA C651 requirements for disposal of disinfecting water with high chlorine concentrations.

After flushing the waterlines, two series of bacteriological samples shall be taken 24 hours apart. Collect one set of samples at intervals of 1,200 ft. of waterline, plus one set at each end of the new line and at the end of each branch (minimum of three sets total). Sets of two consecutive biological samples, taken at least 24 hours apart, which show no contamination, will indicate acceptable disinfection and the water lines may be placed in service.
- D. Disinfect permanent system devices removed for system disinfection by exposing to a chlorine solution for a similar time period (method shall be approved in the

field). Replace same devices, being sure not to contaminate in the process.

3.3 QUALITY CONTROL

- A. Submit under provisions of applicable section of Division 01: Quality Control or Testing Laboratory Services: Testing water samples. Field inspection and testing.
- B. Test samples in accordance with AWWA C651.
- C. Approval of Disinfection: The complete disinfection program and methods followed, especially if materially different from those specified, shall be in accordance with directives of VDH and all methods employed shall have the approval of VDH. Definite instructions as to the collection and shipment of samples shall be requested from VDH and shall be followed in all respects. Final approval of the bacterial samples shall be received from VDH prior to the time that water mains are placed in service and allowed to be used for distribution of potable water. The Contractor shall deliver copies of the approved test data for the Owner and the Engineer.
- D. All references made above to VDH shall also apply to the local utility purveyor, as applicable.

END OF SECTION

SECTION 333100
SITE SANITARY GRAVITY SEWER SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not limited to)

- A. Sanitary gravity sewerage piping, fittings and accessories, and bedding.
- B. Connection of building sanitary drainage system to municipal sewer.
- C. Cleanout access and manholes.
- D. Utility top elevation adjustment.
- E. Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein from approximately five (5) feet outside building walls.

1.2 RELATED SECTIONS

- A. Applicable sections of Division 01 - GENERAL CONDITIONS: Including but not limited to:
 - 1. Coordination of the Work,
 - 2. Soil and aggregate testing, compaction testing, and inspection of bearing surfaces,
 - 3. Material delivery, storage and handling,
 - 4. Project Record Document Requirements, and
 - 5. Procedures for Submittals.
- B. Appendix – Geotechnical Engineering, Inspection, & Testing: Underground Utility Quality Assurance.
- C. Section 312213 – Rough Grading: Site subgrade contouring. General cutting, grading, filling and rough contouring the site. Geotechnical Engineer. Subsoil and aggregate materials. Classifications of Excavation. Unauthorized excavation defined. Excavation. Dewatering.
- D. Section 312317 - Utility Trenching & Backfilling: Excavating for sewer system piping and structures. Inspection of bearing surfaces. Bedding & haunching. Trace Wire for Non-Metallic Piping. Initial backfill. Backfill over piping up to subgrade elevation. Warning & ID Tape. Protection of utility from disturbance and damage during backfill operation.

1.3 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Latest revision shall be assumed.

AMERICAN SOCIETY OF TESTING & MATERIALS (ASTM)

- B. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
- C. ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
- D. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- E. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- F. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe

UNI-BELL PLASTIC PIPE ASSOCIATION (UNI)

- G. UNI B5 - Installation of Polyvinyl Chloride (PVC) Sewer Pipe
- H. UNI B6 - Low Pressure Air Testing of Installed Sewer Pipe

VIRGINIA DEPARTMENT OF TRANSPORTATION (VDOT)

- I. VDOT - Virginia Department of Transportation "Road & Bridge Standards & Specifications"

VIRGINIA DEPARTMENT OF HEALTH (VDH)

- J. VDH - Virginia Department of Health "Sewage Conveyance and Treatment (SCAT) Regulations."
- K. VDH - Virginia Department of Health "Sewage Handling and Disposal (SH&D) Regulations."
- L. VDH – Virginia Department of Health "Waterworks Regulations."

1.4 QUALITY ASSURANCE

- A. Qualifications of Installers: Use skilled and experienced workmen to ensure proper installation of the products specified herein. Workmen shall be thoroughly familiar with codes covering work of their trade and work to be performed under this contract. In the acceptance or rejection of installed Work, no allowance shall be made for the lack of experience on the part of the workmen.
- B. Comply with all standards specified in this Section.

1.5 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures: Submittals.
- B. Manufacturer's Product Data:
 - 1. Provide manufacturer's standard drawings or catalog cuts for pipe, pipe accessories, and fittings.
 - 2. Provide manufacturer's drawings for metal work.
 - 3. All products identified in PART 2 of this specification.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise. Production control tests shall have been performed at the intervals or frequency specified in the referenced publication. Other tests shall have been performed within three years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project. Include:
 - 1. Pipe and fittings, including factory applied linings,
 - 2. Pipe joint materials,
 - 3. Cast iron frames and covers,
 - 4. Precast concrete manhole sections.

1.6 DELIVERY, STORAGE, HANDLING, AND PROTECTION

- A. Delivery and Storage
 - 1. Piping: Inspect materials delivered to the site for damage; store with minimum of handling, on site in enclosures or under protective covering and not directly on the ground. Store plastic piping, jointing materials and rubber gaskets out of direct sunlight. Keep inside of pipes and fittings free of dirt and debris.
 - 2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
- B. Handling: Handle pipe, fittings, and other accessories in such a manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs or replace. Carry, do not drag, pipe to the trench.
- C. Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of other trades.
- D. Damage: in the event of damage, immediately make all repairs and replacements necessary to the approval of and at no additional cost to the Owner or Engineer.

1.7 PROJECT RECORD DOCUMENTS

- A. Record location of pipe runs, connections, manholes, cleanouts, structure top elevations and all pipe invert elevations.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities (active or abandoned).

1.8 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this section. Conform to materials' manufacturer's installation recommendations. Code shall take precedence.
- B. The Contractor shall comply with the VDH Waterworks Regulations Section pertaining to separation of water and sanitary sewer. Comply also with VDOT Std. UB-1 where separation requirements cannot be maintained.

1.9 COORDINATION

- A. Verify that field measurements and elevations are as indicated.
- B. Coordinate the Work with earthwork, trenching, point of connection to building sanitary plumbing, and connection to municipal sanitary sewer.
- C. Assure that structure tops will be at proposed finish grade and slope and that pipe cover is as specified.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

- A. Plastic Gravity Sewer Pipe & Fittings (12" and less in diameter with 10' max. bury): Conform to ASTM D3034, Type PSM, Poly-Vinyl Chloride (PVC) material, SDR-35; inside nominal diameter as indicated on Drawings. Examples meeting design criteria:
 - 1. National Pipe Company, PVC Sewer Pipe (SDR 35),
 - 2. Robintech, King's Joint PVC Sewer Main (SDR-35),
 - 3. Clow, Deflec-Tite PVC Sewer Pipe (SDR-35), or
 - 4. Approved equal.
- B. Refer to Section 226600 for Acid Neutralization Waste Piping Materials.
- C. Joints: Bell and spigot type suitable for elastomeric gasket joints conforming to ASTM D3212.
- D. Gaskets: Conform to ASTM F477.

2.2 PIPE ACCESSORIES

- A. Joints of Dissimilar Pipe: Provide standard manufactured fitting specifically for the proposed connection by same manufacturer of either type pipe or provide

mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required and with gaskets conforming to ASTM F477.

2.3 MANHOLES

- A. Manholes indicated on Drawings shall be precast VDOT Std. MH-2 with nominal shaft diameter of 4 feet unless otherwise indicated. Taper shape shall be as indicated on Drawings by symbol or description. No parging will be permitted on interior manhole walls.
- B. Manhole frames and covers shall conform to VDOT Std. MH-1 except as herein modified. The frame shall be drilled to permit using 3/4 inch diameter bolts to secure it to the structure. Three such bolts shall be used per frame at 120 degrees. The words "SANITARY SEWER" shall be cast into the cover so as to be plainly visible. Covers shall be solid with two (2) "pick holes" at opposing edges.
- C. Steps shall be per VDOT Std. ST-1 placed in line with vertical wall of eccentric tapers or as creates most desirable access in other situations. All structures in excess of 3'-6" depth shall be provided with steps.
- D. Shaping shall be per VDOT Std. IS-1. All structures shall be provided with shaping.
- E. Base Pad (Precast): VDOT Standard B-1.
- F. Base Pad (Cast-in-place): VDOT Std. B-2 footing.
- G. Resilient Pipe Sleeve: For pipes from 4" to 22" diameter, provide resilient connectors in the wall of the reinforced concrete base/riser made of rubber with stainless steel sleeves and clamps, all conforming to ASTM C-923 equal.
- H. Riser Joint Sealant: Provide flexible rubber gasket conforming to ASTM C443 to create permanently flexible watertight joints.
- I. Waterproofing: Provide a 2 component, low-modulus, chemically cured coal tar epoxy polyimide waterproofing vapor barrier to manhole exteriors. It shall be spray applicable cure to a durable, flexible consistency.
- J. Rim Adjustments: Provide pre-cast grade rings or install brick and mortar as necessary to level, raise or lower existing or new manhole frames and covers to meet finish grade. Adjustments of 8 inches or less in height shall not be considered for additional compensation.

2.4 CLEANOUTS

- A. Per detail(s) on Drawings.

2.5 BEDDING & BACKFILL MATERIALS

- A. See Section 312317 - Utility Trenching & Backfilling for:
 - 1. Bedding & Haunching,
 - 2. Cover Bedding/Initial Backfill, and
 - 3. Backfill Materials.

2.6 UTILITY ADJUSTMENT

- A. Provide grade rings, brick and mortar, or extensions for existing or new structures such that tops meet proposed finish grades. Adjustments of 8 inches or less in height shall be made at no additional cost to the Owner.

2.7 CONCRETE MATERIALS

- A. Concrete Materials not otherwise described herein shall be as specified in Section 033000 - Cast-In-Place Concrete.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that all prerequisite work has been completed. Verify location and elevation of points of connection. Notify Engineer of any discrepancies.
- B. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 GENERAL

- A. See Section 312317 - Utility Trenching & Backfilling: Excavating for sewer system piping and structures. Inspection of bearing surfaces. Bedding & haunching. Trace Wire for Non-Metallic Piping. Initial backfill. Backfill over piping up to subgrade elevation. Warning & ID Tape. Protection of utility from disturbance and damage during backfill operation.

3.3 INSTALLATION - PIPE

- A. These General Requirements for installation of pipelines apply except where specific exception is made in the following paragraph entitled, "Special Requirements." "Also" shall mean in addition to the general requirements.
- B. Obtain required approvals before making connection to existing line. Conduct work so that there is minimum impact from any interruption of service on existing line.
- C. Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Ream pipe and tube ends and remove fins and burrs from pipe and fittings. Provide adequate means and methods for lowering sections of pipe and associated items into trenches. Do not drop or dump pipe, fittings, or any other sewer piping material. Before placing in position, clean pipe, fittings and accessories, removing scale and dirt, on inside and outside, before assembly and maintain in a clean condition.
- D. Install pipe, fittings, and accessories in accordance with ASTM D2321 (PVC) and manufacturer's instructions. Seal joints watertight.
- E. Route pipe in straight line. Lay non-pressure pipe with bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around unless a curved section is indicated on Drawings.
- F. Cut pipe accurately to measurements established at the site and work into place without springing or forcing and making proper provision for expansion and contraction of piping without stressing pipe or joints. Replace pipe or fitting that does not allow sufficient space for proper installation of joint material with new pipe or fittings of proper dimensions. Blocking or wedging between bells and spigots will not be permitted.
- G. Tolerance: Lay pipe to slope gradients indicated on Drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m). Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose.
- H. Ensure firm and uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Keep trenches free of water. At the end of each days work, close open ends of pipe temporarily with plugs, wood blocks or bulkheads.
- I. Install haunching to springline of pipe (compacted thickness) per Section 312317 - Utility Trenching & Backfilling.
- J. Conduct required testing of piping system.

- K. Install trace wire continuous over top of non-metallic pipe and place cover bedding/initial backfill above springline of pipe per Section 312317 - Utility Trenching & Backfilling.
- L. Connect to building sanitary plumbing outlet and municipal sewer system, septic tank & drainfield, or on-site treatment, as applicable.

3.4 SPECIAL REQUIREMENTS

- A. PVC Plastic Piping: Also conform to the requirements of UNI B5 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of UNI B5 for joint assembly. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.5 INSTALLATION - CLEANOUTS

- A. Location/spacing: As indicated on Drawings, at all angular changes of direction and at 60 feet O.C. maximum in gravity lines not between manholes.
- B. Establish location, top elevation and pipe inverts and install wye as indicated in pipe installation above.
- C. Set vertical piping (adjusted to make ferrule or cover at proper finish grade), backfill per Section 312317 - Utility Trenching & Backfilling, then set cleanout ferrule.
- D. Level top surface of backfill, form for the concrete collar pad (coordinating with adjacent work as necessary), and cast-in-place.
- E. Traffic Bearing Only: Set adapter so that in the completed work the cleanout plug has 2 inches minimum to 6 inches maximum clearance beneath the cover but no deeper than flush with the concrete anchor pad. Fill from cleanout invert with VDOT Std. #26 coarse aggregate to beneath the concrete anchor pad. Wrap cleanout adapter with welder's cloth followed by aluminum flashing prior to placing concrete. See detail on Drawings for other dimensions. Mount cover frame on grout to slope and elevation of finished traffic surface. Anchor frame with 5/8" bolts to anchor pad.

3.6 MANHOLE CONSTRUCTION

- A. Construct base slab of cast-in-place concrete or use precast concrete base sections as indicated. Make inverts conforming with VDOT Std. IS-1 Shaping. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as the manhole size will permit. For cast-in-place concrete construction, key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. Make joints between precast manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints for precast concrete manholes. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is

constructed on an existing line, applicable local utilities standards shall take precedence over the above.

- B. Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and rises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.
- C. Apply waterproofing to exterior of structures, which have fully cured, to a minimum dry film thickness of 35 mils.

3.7 UTILITY ADJUSTMENTS

- A. Adjust new and existing structure tops affected by new work to meet proposed finish grades.
- B. Coordinate timing of adjustments to be prior to stone base applications for paved areas and prior to topsoil applications for lawn spaces.

3.8 FIELD QUALITY CONTROL

- A. The Engineer or other assigned Owner's representative will conduct field investigations and witness field tests specified in this section. The Contractor shall provide sufficient notice of tests for Owner's representative to be present (24 hours minimum). The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished as set forth in applicable section of Division 1; Temporary Utilities. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the Drawings and Specifications.
- B. Trench, Bedding and Compaction Tests: Per Section 312317 - Utility Trenching & Backfilling.
- C. Tests for Non-Pressure Lines: Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the other end of the segment/run of pipe. When pressure piping is used in a non-pressure line for non-pressure use, test as specified for non-pressure line.
- D. Leakage Test: Test lines for leakage by low-pressure air tests. Prior to testing for leakage, place and compact haunching. When necessary to prevent pipeline movement during testing, place cover bedding/initial backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

- E. Low-Pressure Air Test for PVC Piping: Test in accordance with UNI B6, including the allowable pressure drop. Make calculations in accordance with the Appendix to UNI B6.
- F. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.9 SCHEDULE

- A. Sanitary Gravity Line: Indicated on the Drawings as "SS". Size: as indicated on Drawings and Profiles.
- B. Cleanout: As indicated on Drawings by "SSCO".

END OF SECTION

SECTION 334100
SITE STORM DRAINAGE SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not limited to)

- A. Site storm drainage piping, fittings and accessories, and bedding.
- B. Drainage system from origin at inlets and/or connection to building rain leaders or downspouts to connection to municipal sewers or outfall, as applicable.
- C. Manholes, drop inlets (yard, sump or curb), detention basin structure(s).

1.2 RELATED SECTIONS

- A. Applicable sections of Division 01 - GENERAL CONDITIONS: Including but not limited to:
 - 1. Frequency of Tests,
 - 2. Coordination of the Work,
 - 3. Soil and aggregate testing, compaction testing, and inspection of bearing surfaces,
 - 4. Material delivery, storage and handling,
 - 5. Project Record Document Requirements, and
 - 6. Procedures for Submittals.
- B. Section 310900 - Geotechnical Engineering, Inspection, & Testing: Underground Utility Quality Assurance.
- C. Section 310513 - Soil Materials: Sub-soil materials.
- D. Section 310516 - Aggregate Materials.
- E. Section 312213 - Rough Grading: General cutting, grading, filling and rough contouring the site. Classification of Excavation. Unauthorized excavation defined.
- F. Section 312513 - Erosion & Sediment Control.
- G. Section 312323 - Backfilling.
- H. Section 312317 - Utility Trenching & Backfilling: Excavating for sewer system piping and structures. Inspection of bearing surfaces. Backfilling over piping up to subgrade elevation.
- I. Section 334600 - Subdrainage: Foundation, retaining wall and or slab-on-grade weep drainage system.

1.3 REFERENCES

VIRGINIA DEPARTMENT OF TRANSPORTATION (VDOT)

- A. VDOT "Road & Bridge Standards & Specifications", latest edition (hereinafter VDOT Std. ...).
- B. VDOT Memorandum LD-94(D)121.11 dated May 12, 1994 "Drainage Structure Criteria" - Polyethylene, Corrugated exterior, smooth interior (type S)

AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS (AASHTO)

- C. AASHTO M-198B - (flexible butyl resin sealant (ConSeal))

AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

- D. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- E. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- F. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets. (for use in structure risers)
- G. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
- H. ASTM D698 (Standard Proctor) - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- I. ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- J. ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- K. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- L. ASTM D3033 - Type PSP Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- M. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- N. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- O. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- P. ASTM F405 - Polyethylene perforated drain pipe.

1.4 DEFINITIONS

- A. Bedding: Fill placed under pipe to provide support.
- B. Haunching: Fill placed from bedding to springline of the pipe, also considered bedding, which further supports pipe in both the horizontal and vertical.
- C. Cover Bedding/Initial Backfill: Fill placed above haunching to protect pipe prior to further backfill.

1.5 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures: Submittals.
- B. All products identified in PART 2 of this specification. Include joint sealer for concrete pipe.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of pipe runs, connections, drainage structures, structure top elevations and invert elevations for each pipe.
- B. Identify and describe unexpected variations in subsoil conditions or discovery of uncharted utilities.

1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for materials and installation of the Work of this section.

1.8 COORDINATION

- A. Coordinate the Work with termination of rain water leaders outside building, trenching, connection to foundation drainage system (as applicable), grading and erosion & sediment control/stabilization, and local governing authorities for work off-site.

1.9 QUALITY ASSURANCE

- A. For concrete pipe and structures, all work shall be performed in accordance with the VDOT Road & Bridge Standards; however, the Contractor shall note that the City requires that the bell/spigot or tongue/groove connection be 100% complete with no missing sections. This requirement takes precedence over the VDOT RBS, any ASTM specifications, or any concrete trade association literature, etc.

PART 2 PRODUCTS

2.1 DRAINAGE PIPE MATERIALS

- A. Pipe materials have been indicated on the plans, profiles and Schedule at the end of this section. If no material is specifically required, the Contractor shall have the option of choosing the following.
- B. Cast Iron Pipe (CIP) (max. 12" diameter): VDOT Spec. Section 232, Service type, inside nominal diameter as indicated on Drawings, bell and spigot end.
- C. Concrete Pipe (CP) (max. 12" diameter): VDOT Spec. Section 232.02 (a) 1. a. Plain concrete culvert pipe, non-reinforced; inside nominal diameter as indicated on Drawings, standard or modified tongue-and-groove joints.
- D. Reinforced Concrete Pipe (RCP): VDOT Spec. Section 232.02 (a) 1. b. Reinforced concrete culvert pipe, circular, Class III (for 14' max. cover and H-20 live load); mesh reinforcement; inside nominal diameter as indicated on Drawings. Utilize bell and spigot joint connections with mastic joint compound, pre-formed mastic or butyl joint sealer. Note that tongue-and-groove joints shall not be allowed.
- E. Plastic Pipe (Poly-vinyl Chloride - PVC) (max. 12" diameter): VDOT Spec. Section 232.02 (g) 2. PVC Storm Drains; inside nominal diameter as indicated on Drawings.
- F. Plastic Pipe (HDPE) (12" to 36" diameter): HDPE (high density poly-ethylene) corrugated storm drain and culvert pipe, type S (smooth interior wall); inside nominal diameter as indicated on Drawings. Pipe shall conform to AASHTO M-294. Corrugated interior pipe will not be allowed.
- G. Plastic Pipe (HDPE) (42" to 48" diameter): HDPE (high density poly-ethylene) corrugated storm drain and culvert pipe, type S (smooth interior wall); inside diameter as indicated on the Drawings. Pipe shall have a minimum pipe stiffness of 20 psi for 42" pipe and 17 psi for 48" pipe at 5% deflection; Pipe shall conform to AASHTO M-294. Corrugated interior pipe will not be allowed.
- H. Plastic Pipe (PE) (only use in locations specifically indicated on the drawings): Perforated, corrugated, poly-ethylene (PE) pipe; inside nominal diameter as indicated on Drawings.

2.2 ACCESSORIES

- A. Joints of Dissimilar Pipe: Provide standard manufactured fitting specifically for the proposed connection by same manufacturer of either type pipe or stainless steel mechanical clamp contracting ring type, neoprene ribbed gasket for positive seal (Fernco type).
- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required flared end sections, tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

- C. Filter Fabric: Per Section 312513 - Erosion & Sediment Control, Silt Fence/Filter Fabric.
- D. Filter Cloth: (Encourages drainage) Woven geotextile fabric Manufactured by LINQ, Model #GTF 200 S.
- E. Geotextile Fabric: (Structural support) Non-woven geotextile fabric, Manufactured by LINQ Model #GTF 180 EX.
- F. Trace Wire for Non-Metallic Piping: Comply with Section 312317 - Utility Trenching & Backfilling.
- G. Buried Utility Warning and Identification Tape: Comply with Section 312317 - Utility Trenching & Backfilling.
- H. Hydraulic Cement Mortar: Mortar for concrete pipe to concrete structure connections shall conform to ASTM C270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar but in no case shall exceed 6 gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with proper covering until satisfactorily cured.
 - 1. Grout shall not be allowed in lieu of mortar.

2.3 DRAINAGE STRUCTURES

- A. VDOT Standard or Modified VDOT Standard structures where indicated on the Drawings. Modified VDOT Standard structures shall conform to VDOT Standards for all work except structure shape or configuration modified per detail on Drawings. No parging will be permitted on interior walls.
- B. Manhole style access covers shall be labeled as "STORM SEWER".
- C. Gratings: Unless noted otherwise, all grates shall be cast iron material. Gratings within sidewalks, plazas, or areas that receive pedestrian traffic shall be ADA compliant.
- D. Nominal shaft diameter as required for proposed piping or as otherwise indicated on Drawings (48 inches (1200 mm) minimum for round or square, unless otherwise noted).
- E. Throat inlet lengths shall be as indicated on Drawings.
- F. Concrete manhole taper shape and orientation shall be as indicated by symbol on Drawings.
- G. Steps shall be per VDOT Std. ST-1 placed in line with vertical wall of eccentric tapers or as creates most desirable access in other situations. All structures over

3.5 feet deep, from top to invert out, shall be provided with steps.

- H. Flow channel shaping shall be per VDOT Std. IS-1. All structures shall be provided with shaping.
- I. Base Pad (Precast): As detailed in VDOT Standard B-1 for VDOT Std. structures, otherwise per detail on drawings.
- J. Base Pad (Cast-in-place): VDOT Std. B2 footing.
- K. Riser Joint Sealant: Provide flexible rubber compression gaskets to create permanently flexible watertight joints.

2.4 WATER QUALITY STRUCTURES

- A. Water Quality Structures manufactured by CONTECH "Jellyfish Filter" where indicated on the drawings. Contractor to coordinate size, location, and configuration of each Water Quality Structure with Manufacturer and with surrounding grades, piping utilities, and pavements.
 - 1. Install in accordance with all manufacturer's technical details and requirements. See plans for additional requirements.

2.5 AREA DRAINS

- A. Refer to schedule and details on the Drawings for in-line drains and drain basins.

2.6 EXTERIOR MECHANICAL AREA FLOOR DRAINS

- A. Floor Drain: Coated cast iron construction, deep two-piece body with double drainage flange, non-puncturing flashing clamp collar, weepholes, bottom outlet, 12.625" dia. round bronze top-grate with 43.5 sq. in. free area minimum, removable deep sediment bucket which supports a medium-duty loose-set anti-silting grate with perimeter slots, size to match shaft construction below. JOSAM 32330 Series, SUPER-FLO 12-5/8" Top w/ Bucket (2" to 8" pipe outlet).
- B. Shaft Construction: Pipe type and size shall match horizontal run of pipe indicated on Drawings (minimum 4" to maximum 8" shaft). Bell end at top of shaft shall be adjusted to set finished grade of final product.

2.7 CLEANOUTS

- A. In Lawn Areas: (See detail on Drawings)
 - 1. Cleanout Ferrule: Cast iron construction, bronze countersunk threaded cleanout plug with recessed socket, size to match shaft construction below. JOSAM 58190-22 Series (2" to 8" pipe size).
 - 2. Shaft Construction: Pipe type and size shall match horizontal run of pipe indicated on Drawings (minimum 4" to maximum 8" shaft). Bell end at top of shaft shall be adjusted to set finished grade of final product.
 - 3. Base/Collar Pad: Cast-in-place VDOT Class A3 concrete.

- B. In Concrete Paved Areas (non-traffic bearing): (See detail on Drawings)
 - 1. Cleanout Ferrule: Cast iron construction, bronze countersunk threaded cleanout plug with recessed socket, 58190-22 Series as manufactured by Josam, size to match shaft construction below.
 - 2. Shaft Construction: Pipe type and size shall match horizontal run of pipe indicated on Drawings (minimum 4" to maximum 8" shaft). Bell end at top of shaft shall be adjusted to set finished grade of final product.
 - 3. Base/Collar Pad: Concrete pavement (sidewalk, etc.) shall act as collar. Scoring and finishing shall be that specified for the sidewalk. Do not strike or score dimensions of collar around cleanout unless the sidewalk scoring or jointing fall within that area. If so obtain Architects input on orientation of collar.
- C. In Paved Areas (traffic bearing): (See detail on Drawings)
 - 1. Cleanout Lid and Frame: Cast iron construction, hinged lid, #R-1976 manufactured by Neenah:
 - a. Lid Design: Checkerboard grill.
 - b. Nominal Lid and Frame Size: 11-1/4 inch dia. lid, 10 inch clear opening, 20 inch dia. flange, and 8 inch height.
 - 2. Base/Collar Pad: Cast-in-place VDOT Std. Class A3 concrete.

2.8 BEDDING AND BACKFILL MATERIALS

- A. Bedding & Haunching: See Section 312317 - Utility Trenching & Backfilling. [Except dry-mix lean concrete shall be used for bedding (saddle) of pipe through detention basin berm.]
- B. Cover Bedding/Initial Backfill (Select Backfill): See Section 31 23 17 - Utility Trenching & Backfilling.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions.
- B. Verify that sizes, locations and elevations of any/all points of connection to existing or proposed work are as indicated on Drawings.
- C. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Excavate pipe trench and correct over excavation in accordance with Section 312317 - Utility Trenching & Backfilling for work of this section. See Drawings for trench detail.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated. Remove large stones or other hard matter, which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches (150 mm) compacted depth and compact to 95 percent. Continue until pipe springline is reached and hand excavate an accurate pipe shape to invert required. After setting pipe, where hand excavation is irregular against pipe, hand fill and tamp for an even fit tight to pipe at springline.
- B. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with VDOT Standards, applicable ASTM Standard for material and manufacturer's instructions, whichever is most stringent. Seal joints watertight.
- B. Concrete Pipe: Contractor shall use manufacturer's installation recommendations for installing the pipe. The Contractor shall be warned that bell-spigot confined o-ring gasket pipe requires a special installation technique to avoid cracking the bell-spigot connections. Cracks in the bell-spigot connections shall be rejected by the City.
 - 1. When connecting the concrete pipe to a concrete structure, the Contractor shall thoroughly wet, with clean water, the adjoining concrete material before applying the mortar. This will help achieve the bond at the joint and also prevent shrinkage cracking in the mortar. The City shall reject connections that are not bonded or connections that have shrinkage cracking.
- C. Lay pipe to slope gradients noted on Drawings with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m). See Drawings for storm sewer profiles.
- D. Install aggregate at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches (300 mm), compact to 95 percent.
- E. Refer to Section 312317 - Utility Trenching & Backfilling for backfilling requirements. Do not displace or damage pipe when compacting.
- F. Make connection to all storm water collectors and receiving channel or system to include, but are not necessarily limited to building rain leaders, downspouts, foundation drains, existing storm sewer to remain, etc.
- G. Install trace wire continuous over top of non-metallic pipe. Coordinate with Section 312317 - Utility Trenching & Backfilling.
- H. Install Utility Warning and Identification Tape continuous over pipe. Coordinate with Section 312317 - Utility Trenching & Backfilling. See Drawings for trench detail; ID tape location.

3.5 INSTALLATION - CLEANOUTS AND FLOOR DRAINS

- A. Establish elevations and pipe inverts as indicated in pipe installation above.
- B. Form bottom of excavation clean and smooth to correct elevation.
- C. Install wye per pipe installation above.
- D. Set vertical piping (adjusted to make ferrule or grate at proper finished grade), backfill per Section 312317 - Utility Trenching & Backfilling, then set cleanout ferrule.
- E. Level top surface of backfill, form for the concrete collar pad (coordinating with adjacent work as necessary), and cast-in-place.
- F. Traffic Bearing Cleanout Only: Set adapter so that in the completed work the cleanout plug has 2 inches minimum to 6 inches maximum clearance beneath the lid but no deeper than flush with the concrete anchor pad. Fill from cleanout invert with VDOT Std. #26 coarse aggregate to beneath the concrete anchor pad. Wrap cleanout adapter with welder's cloth followed by aluminum flashing prior to placing concrete. See detail on drawings for other dimensions. Mount lid and frame on grout to slope and elevation of finished traffic surface. Anchor frame with 5/8" bolts to anchor pad.

3.6 INSTALLATION - DRAINAGE STRUCTURES

- A. Form bottom of excavation clean and smooth to correct subgrade elevation.
- B. Place and level a 4 inch (50 mm) base of Type A3 coarse aggregate.
- C. Set bottom riser section (doghouse or with precast base).
- D. Set pipe in and out of structure to line and grade.
- E. If not precast, form and place cast-in-place concrete base pad to pipe inverts per Drawings, providing for shaping.
- F. If precast, level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.
- G. Pipes shall be neatly and tightly mortared in place. Provide for required shaping.
- H. Set remaining risers and top segments to elevation indicated coordinating with adjacent work in line and grade.
- I. Mount manhole lid and frame in grout to elevation and slope of paved surface or level in lawn areas, secure top cone section to orientation (if eccentric) indicated.
- J. Contractor shall mortar all lifting lug locations.

3.7 FIELD QUALITY CONTROL

- A. Trench, Bedding & Backfilling Tests: Field trench inspection and compaction testing will be performed under provisions of Section 312213 – Rough Grading and Section 312317 - Utility Trenching & Backfilling.
- B. The Architect or other assigned Owner's representative will conduct field investigations and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished as set forth in Div. 1; Temporary Utilities. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the Drawings and Specifications.
- C. Request inspection of installed piping prior to placing cover bedding/initial backfill over pipe. Place initial backfill and reinspect.
- D. Tests for Non-Pressure Lines: Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the other end of the segment/run of pipe. When pressure piping is used in a non-pressure line for non-pressure use, test as specified for non-pressure line.
- E. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- F. Once completed, the City of Roanoke Planning and Stormwater Department will conduct a storm drain acceptance review. Part of that process includes the Stormwater Department televising the installed pipe for defective workmanship and substandard joint conditions using a robotic pipe camera. Any defective work discovered during this process shall be corrected by removing the pipe and installing a new section.

3.8 PROTECTION

- A. Protect finished Work under provisions of Section 311000 - Site Preparation & Clearing.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

3.9 SCHEDULE

- A. Refer to Drawings (Profiles) for additional pipe and structure types and sizes.
- B. Storm Sewer Branch Lines: Connect inlets at various site locations with intersection of main sewer line. Size and type as indicated on Drawings (profiles).
- C. Storm Sewer within VDOT Right-of-way and/or Easement: Size as indicated on Drawings (profiles).

- D. Rain Leaders (RL): From 5 feet (1.5 m) beyond building wall, to municipal storm sewer; PVC; size as indicated on Drawings.

END OF SECTION

SECTION 334600 SUBDRAINAGE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Complete system through outfall / terminus connection.
 - 2. Sub-surface weep-type drainage system for building perimeter, retaining walls, and slabs-on-grade as applicable.
 - 3. Filter aggregate and fabric.
 - 4. Bedding.
- B. Related Sections:
 - 1. Section 310516 - Aggregate Materials.
 - 2. Section 312316 - Excavating: Excavating for site subdrainage system piping and surrounding filter aggregate.
 - 3. Section 312323 - Backfilling: Backfilling over filter aggregate, up to subgrade elevation.
 - 4. Section 334100 - Storm Drainage: Connection to weep drainage system, sump, etc.

1.2 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM D3034 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 2. ASTM D3212 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe Bell and Spigot Type Joints.
 - 3. ASTM F477 – Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe Bell and Spigot Type Joint Gaskets.
 - 4. ASTM F758 – Standard Specification for Subdrainage Perforations.
- B. UNI-BELL
 - 1. UNI-B-1 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe Bell and Spigot Type Joints.
 - 2. UNI-B-4 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- C. American Association of State Highway & Transportation Officials (AASHTO):
 - 1. AASHTO M252 – Standard Specification for Corrugated Polyethylene Drainage Tubing.
 - 2. AASHTO M288 – Standard Specification for Geotextiles, latest edition.

1.3 SUBMITTALS FOR REVIEW

- A. Section 013300 - Submittal Procedures.

- B. Product Data for Information: Submit data on pipe drainage products, pipe accessories, and appurtenances. All products identified in PART 2 of this specification.

1.4 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution Requirements: Requirements for submittals.
- B. Section 017810 - Project Record Documents: Record location of pipe runs, connections, cleanouts and principal invert elevations (highs, bends, penetrations, and connections).

PART 2 PRODUCTS

2.1 PIPE MATERIALS

- A. Polyvinyl Chloride (PVC) Pipe: ASTM D3034 and/or UNI-BELL UNI-B-4, SDR 35 with bell and spigot joints per ASTM D3212 and/or UNI-BELL UNI-B-1 and ASTM F477 gaskets; size as indicated on Drawings (4 inch (100 mm) minimum inside diameter); with required fittings. Solid or perforated as required. Perforation pattern shall conform to ASTM F758. Perforations shall be circular, 3/16 to 1/2 inch diameter, on 3 to 3.5 inch centers, and arranged in four rows along the barrel where rows are 45 and 80 degrees either side from bottom centerline of the pipe.
- B. Corrugated Plastic Tubing: AASHTO M252; Single-wall flexible type corrugated HDPE pipe with soil-tight joints with required fittings; size as indicated on Drawings (4 inch (100 mm) minimum inside diameter). If connection to storm sewer system is indicated, supply appropriate connector for differing materials as recommended by manufacturers.
- C. Use perforated pipe at subdrainage system; unperforated through sleeved walls.

2.2 AGGREGATE AND BEDDING

- A. Filter Aggregate and Bedding Materials: Fill Type A2 as specified in Section 310516 – Aggregate Materials.

2.3 ACCESSORIES

- A. Filter Fabric: AASHTO M288 for subsurface drainage, Survivability Class 3, non-woven, as manufactured by TC Mirafi, Amoco Fabrics and Fibers Co., Typar Geotextiles (Reemay, Inc.). Products meeting this requirement are Mirafi 180N, Amoco ProPex 4553, or Typar 3401.
- B. Filter Cloth: (Encourages drainage) Woven geotextile fabric Manufactured by LINQ, Model #GTF 200 S.
- C. Geotextile Fabric: (Structural support) Non-woven geotextile fabric, Manufactured by LINQ Model #GTF 180 EX.

- D. Pipe Sleeve: Steel type for foundation wall penetrations, as applicable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 013100 – Administrative Requirements: Coordination: Verification of existing conditions before starting work.
- B. Verify trench cut or excavated base is ready to receive work and excavations, dimensions, and elevations are as indicated on shop drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation per excavation or trenching spec as applicable.
- B. Remove large stones or other hard matter, which could damage drainage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION

- A. Place filter fabric.
- B. Place drainage pipe on fabric. Use PVC pipe where depth of fill over pipe exceeds 10 feet. Use same pipe throughout a section or loop. Separate runs may be of other materials.
- C. Lay pipe to slope gradients of 1/8 inch per foot; with maximum variation from indicated slope of 1/8 inch (3 mm) in 10 feet (3 m).
- D. Place pipe with perforations facing down. Mechanically join pipe ends.
- E. Install Type A2 aggregate at sides and top of pipe. Install top cover compacted thickness of 12 inches (300 mm).
- F. Close filter fabric over leveled top surface of aggregate cover prior to subsequent backfilling operations.
- G. Place aggregate in maximum 6 inch (150 mm) lifts, consolidating each lift.
- H. Refer to applicable area or trench excavation and backfill section for compaction requirements. Do not displace or damage pipe when compacting.
- I. Connect to storm sewer system or sump pit or rout to surface discharge point per Drawings. Where the need for subdrainage is unnecessary use unperforated pipe (ie. extensions away from structure to sewer outlet or discharge).
- J. Coordinate the Work with connection to indicated outfall, and trenching.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Testing and inspection services.
- B. Request inspection prior to placing aggregate cover over pipe.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 017000 - Execution Requirements: Protecting installed construction.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION

SECTION 031000
CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Form-facing material for cast-in-place concrete.
 - 2. Shoring, bracing, and anchoring.

1.3 DEFINITIONS

- A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction, movement, contraction, and isolation joints
 - c. Forms and form-removal limitations.
 - d. Shoring and reshoring procedures.
 - e. Anchor rod and anchorage device installation tolerances.

1.5 ACTION SUBMITTALS

- A. Product Data: For each of the following:
 - 1. Exposed surface form-facing material.
 - 2. Form-release agent.

1.6 INFORMATIONAL SUBMITTALS

- A. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Mockups: Formed surfaces to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
 - 1. Build panel approximately 32 sq. ft. in the location indicated or, if not indicated, as directed by Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle forms in a manner to prevent damage to form surface.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 - 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 - 2. Limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).

2.2 FORM-FACING MATERIALS

- A. As-Cast Surface Form-Facing Material:
 - 1. Provide continuous, true, and smooth concrete surfaces.
 - 2. Furnish in largest practicable sizes to minimize number of joints.
 - 3. Acceptable Materials: As required to comply with Surface Finish designations, and as follows:
 - a. Plywood, metal, or other approved panel materials.
- B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
 - 1. Provide lumber dressed on at least two edges and one side for tight fit.

- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces not exceeding specified formwork surface class.
 - 1. Provide forms with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation, with end forms.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

2.3 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

2.4 RELATED MATERIALS

- A. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- C. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- D. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with ACI 301.

- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified..
- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips
 - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- L. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.

2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 3. Place joints perpendicular to main reinforcement.
 4. Space vertical joints in walls as indicated on Drawings.
- M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
 3. Install dowels for reinforced concrete masonry walls.
 4. Clean embedded items immediately prior to concrete placement.

3.3 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work.

1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
1. Align and secure joints to avoid offsets.
 2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORING AND RESHORING INSTALLATION

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
 2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION

SECTION 032000
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction contraction and isolation joints.
 - c. Steel-reinforcement installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of Architect.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates and Test Reports: For each of the following, signed by manufacturers:

1. Steel Reinforcement

B. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Mockups: Reinforcing for cast-concrete formed surfaces, to demonstrate tolerances and standard of workmanship.

1. Build panel approximately 32 sq. ft. in the location indicated on Drawings or, if not indicated, as directed by Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars to be lapped as indicated.
 - 2. Stagger splices in accordance with ACI 318.
- G. Install welded-wire reinforcement in longest practicable lengths.
 - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
 - a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches.
 - 2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire.
 - 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 - 4. Lace overlaps with wire.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.
- B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Steel-reinforcement placement.

END OF SECTION

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, finishes, and curing.

B. Related Requirements:

1. Section 03 10 00 "Concrete Forming and Accessories" for form-facing materials.
2. Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Ready-mix concrete manufacturer.
 - c. Concrete Subcontractor.
 - d. Special Inspector,
2. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction joints, control joints, isolation joints, and joint-filler strips.
 - c. Semirigid joint fillers.
 - d. Vapor-retarder installation.
 - e. Anchor rod and anchorage device installation tolerances.
 - f. Cold and hot weather concreting procedures.
 - g. Concrete finishes and finishing.
 - h. Curing procedures.
 - i. Forms and form-removal limitations.
 - j. Shoring and reshoring procedures.

- k. Methods for achieving specified floor and slab flatness and levelness.
- l. Floor and slab flatness and levelness measurements.
- m. Concrete repair procedures.
- n. Concrete protection.
- o. Initial curing of field test cylinders (ASTM C31/C31M.)

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

- 1. Portland cement.
- 2. Fly ash.
- 3. Blended hydraulic cement.
- 4. Aggregates.
- 5. Admixtures:
 - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
- 6. Vapor retarders.
- 7. Curing and sealing compounds.
- 8. Joint fillers.
- 9. Repair materials.
- 10. Floor sealers.

B. Design Mixtures: For each concrete mixture, include the following:

- 1. Mixture identification.
- 2. Minimum 28-day compressive strength.
- 3. Durability exposure class.
- 4. Maximum w/cm.
- 5. Slump limit.
- 6. Air content.
- 7. Nominal maximum aggregate size.
- 8. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
- 9. Intended placement method.
- 10. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

- 1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Bonding agents.
5. Adhesives.
6. Vapor retarders.
7. Semirigid joint filler.
8. Joint-filler strips.
9. Repair materials.

C. Preconstruction Test Reports: For each mix design.

D. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor to be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Mockups: Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.

1. Formed Surfaces: Build panel approximately 32 sq. ft. Insert area in the location indicated or, if not indicated, as directed by Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I, gray.
2. Fly Ash: ASTM C618, Class C or F.
3. Blended Hydraulic Cement: ASTM C595/C595M, Type IL, portland-limestone cement.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
 - c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
2. Maximum Coarse-Aggregate Size: 1 inch nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.4 CURING AND SEALING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Water: Potable or complying with ASTM C1602/C1602M.
- C. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.5 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.
- C. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.6 ONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
 - 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent by mass for footings and walls, 15 percent by mass for slabs.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
 - 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, and concrete with a w/cm below 0.50.

2.7 CONCRETE MIXTURES

- A. Class A: Normal-weight concrete used for footings, piers, and walls.
 - 1. Exposure Class: ACI 318 F0, S0, W0, C0.
 - 2. Minimum Compressive Strength: 4000 psi at 28 days.
 - 3. Maximum w/cm: 0.50.
 - 4. Slump Limit: 4 inches , plus or minus 1 inch.
 - 5. Air Content: No air-entraining admixture required.
 - 6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

- B. Class C: Normal-weight concrete used for interior slabs-on-grade and slabs on steel deck.
1. Exposure Class: ACI 318 F0, S0, W0, C0.
 2. Minimum Compressive Strength: 4000 psi at 28 days.
 3. Maximum w/cm: 0.50.
 4. Minimum Cementitious Materials Content: 540 lb/cu. yd.
 5. Slump Limit: 5 inches plus or minus 1 inch, 8 inches plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
 6. Air Content:
 - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
 7. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.
- C. Class D: Normal-weight concrete used for exterior concrete walls, piers and slabs-on-grade.
1. Exposure Class: ACI 318 F2, S0, W1, C1.
 2. Minimum Compressive Strength: 4500 psi at 28 days.
 3. Maximum w/cm: 0.45.
 4. Slump Limit: 5 inches , plus or minus 1 inch.
 5. Air Content:
 - a. 6 percent, plus or minus 1.5 percent at point of delivery for concrete.
 6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
 2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
 - 1. Daily access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
 - 4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.4 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
 - 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
 - 2. Face laps away from exposed direction of concrete pour.
 - 3. Lap joints 6 inches and seal with manufacturer's recommended tape.
 - 4. Terminate vapor retarder at the top of floor slabs, sealing entire perimeter to existing floor slabs and foundation walls.
 - 5. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
 - 6. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.5 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
 - 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
 - 2. Place joints perpendicular to main reinforcement.

- a. Continue reinforcement across construction joints unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Space vertical joints in walls as indicated on Drawings.
- C. Control Joints in Slabs-on-Grade: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
 1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
 1. Install dowel bars and support assemblies at joints where indicated on Drawings.
 2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
 1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
1. If a section cannot be placed continuously, provide construction joints as indicated.
 2. Deposit concrete to avoid segregation.
 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Do not place concrete floors and slabs in a checkerboard sequence.
 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 3. Maintain reinforcement in position on chairs during concrete placement.
 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 5. Level concrete, cut high areas, and fill low areas.
 6. Slope surfaces uniformly to drains where required.
 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-3.0:
 - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
 - b. Remove projections larger than 1/8 inch.
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 Class A.
 - e. Locations: Apply to exposed concrete surfaces.

- B. Rubbed Finish: Apply the one of the following to exposed wall, beam, and column surfaces. Finish shall be consistent throughout the Project.

1. Smooth-Rubbed Finish:
 - a. Perform no later than one day after form removal.
 - b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
 - c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
 - d. Maintain required patterns or variances to match approved mockups.
2. Grout-Cleaned Rubbed Finish:
 - a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
 - b. Do not clean concrete surfaces as Work progresses.
 - c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
 - d. Wet concrete surfaces.
 - e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.
 - f. Maintain required patterns or variances to match approved mockups.

C. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish:
1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
 2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
 3. Apply float finish to surfaces to receive trowel finish.
- C. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighthen until surface is free of trowel marks and uniform in texture and appearance.
3. Do not add water to concrete surface.
4. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
5. Apply a trowel finish to surfaces to vault base slab, slabs-on-grade, and vault suspended slab.
6. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
 - a. Slabs-on-Ground:
 - 1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and also no more than 1/16 inch in 2 feet.
 - b. Suspended Slabs:
 - 1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and also no more than 1/16 inch in 2 feet.

D. Broom Finish: Apply a broom finish to exterior concrete flat work.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.
4. Curing: Comply with ACI 308.1.

B. Curing Slab-on-Grade Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Apply two coats of curing and sealing compound in accordance with manufacturer's written instructions.

3.11 TOLERANCES

A. Conform to ACI 117.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged the minimum time period specified by the joint filler manufacturer or at least one month, whichever is greater.
2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.
 - a. Limit cut depth to 3/4 inch.
 - b. Make edges of cuts perpendicular to concrete surface.
 - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.

- d. Fill and compact with patching mortar before bonding agent has dried.
 - e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
 - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
 - b. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
 - a. Correct low and high areas.
 - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.
 - b. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - c. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with repair topping.
 - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
 - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
 - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
 - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
 - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
 - d. Place, compact, and finish to blend with adjacent finished concrete.
 - e. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

- a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
 - b. Dampen cleaned concrete surfaces and apply bonding agent.
 - c. Place patching mortar before bonding agent has dried.
 - d. Compact patching mortar and finish to match adjacent concrete.
 - e. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- C. Inspections:
 - 1. Headed bolts and studs.
 - 2. Verification of use of required design mixture.
 - 3. Concrete placement, including conveying and depositing.
 - 4. Curing procedures and maintenance of curing temperature.
 - 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 - 6. Batch Plant Inspections: On a random basis, as determined by Architect.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C143/C143M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure five 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one laboratory-cured specimens at seven days.
 - b. Test three laboratory-cured specimens at 28 days.
 - c. Hold one laboratory-cured specimen to test at 56 days if required.
 - d. A compressive-strength test to be the average compressive strength from a set of three specimens obtained from same composite sample and tested at 28 days.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
9. Additional Tests:
 - a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.
10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.15 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION

SECTION 077140
GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes pre-finished aluminum gutters and downspouts.

1.2 REFERENCES

- A. AAMA 603.8 (American Architectural Manufacturers Association) - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
- B. AAMA 605.2 (American Architectural Manufacturers Association) - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
- C. ASTM B32 - Specification for Solder Metal.
- D. ASTM B209/B209M - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- E. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.
- F. SMACNA (Sheet Metal and Air Conditioning Contractors National Association) - Architectural Sheet Metal Manual.

1.3 DESIGN REQUIREMENTS

- A. When size is not indicated, conform to SMACNA Manual for sizing components for rainfall intensity determined by a storm occurrence of 1 in 10 years.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.
- B. Product Data: Submit data on manufactured components, materials, and finishes.
- C. Samples: Submit two samples, 4 inch x 4 inch, for each type of metal illustrating finish, color, and configuration.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA Manual.
- B. Maintain one copy of each document on site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Products and Substitutions: Product storage and handling requirements.
- B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope to drain.
- C. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.7 COORDINATION

- A. Coordinate Work with installation of metal flashings and roofing shingles.

1.8 WARRANTY

- A. Special Warranty on Metal Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal gutters and downspouts roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 GUTTERS AND DOWNSPOUTS

- A. Product Description:
 - 1. Gutter: SMACNA "A" Profile, .032" prefinished aluminum, maximum lengths.
 - 2. Downspouts: 4" x 4", .032" prefinished aluminum, maximum lengths.
- B. Gutter Guard: prefinished aluminum mesh strainer, continuous along entire length of top of gutter:
 - 1. Subject to compliance with requirements, provide products by one of the following manufacturers or approval equal:
 - 1) Englert
 - 2) Amerimax
 - 3) Leaf Filter

2.2 COMPONENTS

- A. Pre-Finished Aluminum Sheet: ASTM B209/B209M, manufacturer's standard alloy and temper for specified finish; minimum 0.040 inch thick; mill finish shop Fluoropolymer coating; color as selected by Architect from full range of standard colors.

2.3 ACCESSORIES

- A. Anchors and Supports: Profiled to suit gutters and downspouts.
 - 1. Anchoring Devices: Where not indicated provide in accordance with SMACNA requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Brackets.
- B. Fasteners: Same material and finish as gutters and downspouts.
- C. Protective Backing Paint: FS TT-C-494, bituminous.

2.4 FABRICATION

- A. Form gutters and downspouts of profiles and sizes indicated.
- B. Fabricate with required connection pieces.
- C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- D. Hem exposed edges of metal.
- E. Fabricate gutter and downspout accessories; seal watertight.

2.5 FACTORY FINISHING

- A. PVDF (polyvinylidene fluoride) coating: Multiple coat, thermally cured, fluoropolymer system conforming to AAMA 605.2.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify surfaces are ready to receive gutters and downspouts.

3.2 PREPARATION

- A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil.

3.3 INSTALLATION

- A. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.
- B. Slope gutters 1/8 inch per foot minimum.
- C. Anchor downspouts to walls per SMACNA requirements.
- D. Terminate downspouts in cast iron boots.

END OF SECTION

SECTION 107300
PROTECTIVE COVERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, General Requirements, of these Specifications, apply to work specified in this section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Protective Cover system; including frames, drainage system and roof deck assembly.
 - 2. Pitched roof with roll-formed aluminum roof panels.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 03, "Cast-in-Place Concrete," for concrete for post footings.
 - 2. Division 26, Electrical, for lighting mounted to soffit of protective cover system.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design, engineer, fabricate, and install Protective Cover system to withstand the structural loads required under the State Building Code without exceeding the allowable design working stresses of the materials involved, including anchors and connections.

1.4 SUBMITTALS

- A. Product Data: Submit for each type of protective cover and accessory indicated. Indicate roof panel type, fascia profile, framing components and accessories.
- B. Shop Drawings: Submit shop drawings indicating layout of Protective Cover coordinated with field measurements and including frame heights, roof slopes, overall dimensions, connections and relationship to adjoining work, accessories, types of materials, and finishes. Indicate work by others required for complete installation.
- C. Certification: Submit design calculations prepared and sealed by registered (structural) Professional Engineer licensed in the State of Virginia indicating structure complies with wind criteria of ANSI/ASCE 7-88, stability and loading requirements of building code and all other governing criteria.
- D. Color Samples: Submit printed or coated metal samples of complete color range offered for Architects selection.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer to perform unit of work of this section who has specialized in the installation of types of protective covers similar to that required for this project and who is acceptable to, or certified by, manufacturer of protective covers.

- B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel" and D1.3 "Structural Welding Code - Sheet Steel."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Check actual dimensions of construction affecting protective covers by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work. Provide approved layout drawings and column base inserts or form-outs for installation of concrete foundations.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Peachtree Protective Covers, Inc.
 - 2. Dittmer Architectural Aluminum
 - 3. Avadek Walkway Cover Systems

2.2 MATERIALS

- A. Aluminum Sheet: ASTM B 209
- B. Aluminum Tubing: ASTM B 429, 6063 - T6, schedule 40.
- C. Aluminum Extrusions: ASTM B 429, 6063 - T6.
- D. Cast Aluminum (end caps): 319 alloy.
- E. Fasteners: Vibration-proof, of size and material standard with manufacturer.

2.3 CONSTRUCTION

- A. Smoothly round corners, edges, and exposed fasteners to eliminate snagging and pinching hazards. Form exposed sheet metal with flat, flush surfaces, true to line and level, and without cracking and grain separation. Perform welding by operators and processes complying with AWS requirements.

2.4 PROTECTIVE COVER

- A. General: Provide manufacturer's standard prefinished metal roofing Protective Cover system fabricated to comply with requirements indicated. Provide all roof deck, fascia, and frames ("bents") consisting of beams and columns with integral (internal) rainwater drainage system. Include all accessories, closure and trim pieces, anchors and connection devices required for complete assembly.
- B. Frame Height: Sloped roof deck, heights as indicated on drawings.
- C. Support Structure: All structural fabrication shall be extruded anodized aluminum sections made of 6063-T6 aluminum alloy, and having a minimum wall thickness of 0.125 inches. Provide frames ("bents") fabricated from anodized beams and columns as either all-welded rigid frames or mechanically joined sections as

determined by manufacturer (fabricator) and in accordance with final shop drawings. Provide column sleeves for presetting into concrete foundation structure.

1. Finish: Provide factory applied 2-coat, thermocured coating system ("Kynar") composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70% polyvinylidene fluoride resin by weight; conforming to AAMA 2605 (formerly 605.2). Finish color will be selected from manufacturer's full range of color offerings.
 2. Provide frame configuration indicated for installation, including those required for angled or corner conditions.
 3. Provide extruded aluminum wall angle for wall supported applications as indicated.
- D. Extruded Aluminum Roof Deck: Provide interlocking structural deck system fabricated of anodized 6063-T6 aluminum alloy and having a minimum wall thickness of 0.065 inches. All splices shall occur at supports; splices in other locations will not be permitted.
1. Provide manufacturer's standard 3-1/2" deep flat bottom deck section for flat soffit.
 2. Provide manufacturer's standard 3" deep corrugated deck section for vertical screen wall.
 3. Provide manufacturer's standard anodized extruded aluminum fascia of profile indicated.
 4. Metal Roofing Finish: Provide factory applied 2-coat, thermocured coating system ("Kynar") composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70% polyvinylidene fluoride resin by weight; conforming to AAMA 2605 (formerly 605.2). Finish color will be selected from manufacturer's full range of color offerings.
 5. Hardware: All connections shall be made with standard corrosion resistive fasteners.
 6. Drainage: Internal drainage in column shall connect to site drainage below grade. Provide 3" diameter aluminum pipe extension welded to column.

2.5 FOUNDATIONS FOR PROTECTIVE COVER

- A. Provide concrete foundations complying with criteria specified in Section 03 30 00, "Cast-in-Place Concrete." Footings for the bent frame assembly shall provide sufficient bearing area at the bottom to support all loads of the Protective Cover. Footing design is based on 3,000 PSF allowable soil pressure unless otherwise instructed in the soil data, such as, but not limited to, adverse soil conditions, high water table, underground obstructions and other conditions, to permit bidders reasonable evaluation of the site conditions. Foundation concrete shall attain minimum working strength of 3,000 pounds per square inch at 28 days.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install protective covers to comply with manufacturer's instructions and final shop drawings. Provide accessories indicated and anchors, fasteners, inserts, and other items required for installation of units and permanent attachment of units to adjoining construction.
- B. Adjust frames prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and wall angles to building construction as follows:
 - 1. Anchor posts in concrete by means of column sleeves preset and anchored into concrete. Insert posts into sleeves, and fill annular space between post and sleeve solid with non-shrink nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's directions. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8 inch build-up, sloped away from post. For installations exposed on exterior, or to flow of water, seal anchoring material to comply with grout manufacturer's directions.
 - 2. Anchor wall angles into wall construction with lead expansion shields and bolts or alternate expansion devices sufficient to support loading.

3.2 CLEANING AND PROTECTION

- A. Clean installed protective covers on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensures that protective covers are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Connectors and splices.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Copper building wire.
2. Connectors and splices.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

D. Conductor Insulation:

1. Type THHN and Type THWN-2. Comply with UL 83.
2. Type XHHW-2. Comply with UL 44.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as

defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
2. Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors must be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

1. Copper:
 - a. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
 - b. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

C. ASD Output Circuits Cable: Extra-flexible stranded for all sizes.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway Type XHHW-2, single conductors in raceway.
- B. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION, GENERAL

- A. Complete raceway installation between conductor and cable termination points in accordance with Section 26 05 33.13 "Conduits for Electrical Systems" prior to pulling conductors and cables.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

- E. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least **6 inch** of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of *assembly*.

END OF SECTION

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grounding and bonding conductors.
2. Grounding and bonding clamps.
3. Grounding and bonding connectors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment Grounding Conductor:

1. General Characteristics: 600 V, wire or cable, green color, in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

2.2 GROUNDING AND BONDING CLAMPS

- A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications.

B. Performance Criteria:

1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2.3 GROUNDING AND BONDING CONNECTORS

A. Performance Criteria:

1. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

3.2 INSTALLATION OF GROUNDING AND BONDING

- A. Comply with manufacturer's published instructions.

3.3 PROTECTION

- A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Support, anchorage, and attachment components.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Sockets.
 - e. Eye nuts.
 - f. Fasteners.
 - g. Anchors.
 - h. Brackets.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch diameter holes at a maximum of 8 inch on center in at least one surface.

PART 3 - EXECUTION

3.1 SELECTION

- A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:
1. NECA NEIS 101
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERM as required by NFPA 70.

3.2 INSTALLATION OF SUPPORTS

- A. Comply with NECA NEIS 101

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 05 50 00 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M. Submit welding certificates.
- D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION

SECTION 260533
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 ACTION SUBMITTALS

A. Product Data: For the following:

1. Wireways and auxiliary gutters.
2. Surface metal raceways.
3. Surface nonmetallic raceways.
4. Cabinets, cutout boxes, and miscellaneous enclosures.

PART 2 - PRODUCTS

2.1 TYPE EMT-S RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 797 and UL Category Control Number FJMX.

2.2 TYPE LFMC RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 360 and UL Category Control Number DXHR.

2.3 TYPE LFNC RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 1660 and UL Category Control Number DXOQ.

2.4 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and

marked for intended location and use.

2.5 SURFACE METAL RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 5 and UL Category Control Number RJBT.

2.6 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 514A and UL Category Control Number QCIT.

B. Metallic Outlet Boxes:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Description: Box with provisions for mounting wiring device directly to box.

2.7 CABINETS, CUTOUT BOXES, JUNCTION BOXES, PULL BOXES, AND MISCELLANEOUS ENCLOSURES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics:
 - a. Non-Environmental Characteristics: UL 50.
 - b. Environmental Characteristics: UL 50E.

B. Indoor Sheet Metal Cabinets:

1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.

C. Indoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

D. Indoor Cast-Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2.8 COVER PLATES FOR DEVICES BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

PART 3 - EXECUTION

3.1 SELECTION OF RACEWAYS

3.2 Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements. SELECTION OF BOXES AND ENCLOSURES

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:

1. Outdoors:
 - a. Type 3R unless otherwise indicated.
2. Indoors:
 - a. Type 1 unless otherwise indicated.

3.3 INSTALLATION OF RACEWAYS

A. Installation Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
3. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
4. Comply with NECA NEIS 101 for installation of steel raceways.
5. Comply with NECA NEIS 102 for installation of aluminum raceways.

B. Raceways Penetrating Rooms or Walls with Acoustical Requirements:

1. Seal raceway openings on both sides of rooms or walls with acoustically rated putty.

3.4 INSTALLATION OF SURFACE RACEWAYS

- A. Install surface raceways only where indicated on Drawings.

3.5 INSTALLATION OF BOXES AND ENCLOSURES

- A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
- B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements.
- C. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- D. Locate boxes so that cover or plate will not span different building finishes.
- E. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
- F. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
- G. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
- H. Set metal floor boxes level and flush with finished floor surface.
- I. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- J. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
 1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
 2. Provide gaskets for wallplates and covers.

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating

recommended by manufacturer.

3.8 CLEANING

- A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION

SECTION 260533.13
CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type ERM-C-S duct raceways, elbows, couplings, and nipples.
2. Type FMC-S and Type FMC-A duct raceways.
3. Type LFMC duct raceways.
4. Type PVC duct raceways and fittings.
5. Fittings for conduit, tubing, and cable.
6. Electrically conductive corrosion-resistant compounds for threaded conduit.
7. Solvent cements.

1.2 DEFINITIONS

- A. Conduit: A structure containing one or more duct raceways.
- B. Duct Raceway: A single enclosed raceway for conductors or cable.
- C. Duct Bank: An arrangement of conduit providing one or more continuous duct raceways between two points.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Type ERM-C-S duct raceways, elbows, couplings, and nipples.
2. Type FMC-duct raceways.
3. Type PVC duct raceways and fittings.
4. Fittings for conduit, tubing, and cable.
5. Electrically conductive corrosion-resistant compounds for threaded conduit.
6. Solvent cements.

B. Sustainable design submittals.

1. Solvent cements.

PART 2 - PRODUCTS

2.1 TYPE EMT-S DUCT RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN FJMX; including UL 797.

B. Raceway Color Codes:

Red- Fire Alarm

Orange- Telcom

Blue- 208/120V Power

Purple- Security

2.2 TYPE LFMC DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DXHR; including UL 360.

2.3 TYPE PVC DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DZYR; including UL 651.

2.4 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- 2.

2.5 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 2. Listing Criteria: UL CCN DWTT; including UL 514B.
- B. Source Quality Control:
1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
 2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
- C. UL DWTT - Solvent Cements for Type PVC Duct Raceways and Fittings:

PART 3 - EXECUTION

3.1 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.

3.2 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
1. Type ERM-C-S: Article 344 of NFPA 70 and NECA NEIS 101.
 2. Type FMC-S: Article 348 of NFPA 70 and NECA NEIS 101.
 3. Type LFMC: Article 350 of NFPA 70 and NECA NEIS 101.
 4. Type PVC: Article 356 of NFPA 70 and NECA NEIS 111.
 5. Expansion Fittings: NEMA FB 2.40.
 6. Consult Architect for resolution of conflicting requirements.
- C. Interfaces with Other Work:
1. Coordinate installation of new products for with existing conditions.

END OF SECTION

SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Labels.
2. Extruded insulating tubing.
3. Bands.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 LABELS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN PGDQ2 for components; including UL 969.

B. UL PGDQ2 - Self-Adhesive Labels: thermal, transfer-printed.

2.2 BANDS

A. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

2.3 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.4 CABLE TIES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN ZODZ; including UL 1565 or UL 62275.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 SELECTION OF COLORS AND IDENTIFICATION MARKINGS

- A. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded conductors.
1. Colors for 208Y/120 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 2. Colors for 480Y/277 V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 3. Color for Neutral (Grounded Conductor): White.
 4. Color for Equipment Ground: Green.
- B. Color-Coding Instructional Signs: Self-adhesive labels, including color code for grounded and ungrounded conductors.
- C. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage.
- D. Cover Plates: Label individual cover plates with self-adhesive labels. Place label at top of cover plate. Label cover plate with the following information, in the order listed:
1. Panelboard designation.
 2. Colon or dash.
 3. Branch circuit number.
- E. Equipment Identification Labels:

1. Black letters on white field.
2. Indoor Equipment: Self-adhesive label
3. Outdoor Equipment: Laminated acrylic or melamine sign

F. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 SELECTION OF SIGNS AND HAZARD MARKINGS

- A. Comply with 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs.
- B. Electrical Hazard Warnings:
 1. Arc-Flash Hazard Warning: Self-adhesive labels. Comply with NFPA 70E

3.4 INSTALLATION

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
- D. Verify identity of item before installing identification products.
- E. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- F. Apply identification devices to surfaces that require finish after completing finish work.
- G. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- H. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.
- I. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.
- J. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

- K. Laminated Acrylic or Melamine Plastic Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

END OF SECTION

SECTION 262416 PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. New and existing panelboards.
2. Disconnecting and overcurrent protective devices.

1.2 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Disconnecting and overcurrent protective devices.

B. Shop Drawings: For each panelboard and related equipment.

1. Detail bus configuration, current, and voltage ratings.
2. Short-circuit current rating of panelboards and overcurrent protective devices.

1.4 CLOSEOUT SUBMITTALS

A. Warranty documentation.

PART 2 - PRODUCTS

2.1 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with interrupting capacity matching existing breaker type and AIC ratings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering breakers for existing panelboards.

3.2 INSTALLATION

- A. Comply with manufacturer's published instructions.

3.3 IDENTIFICATION

- A. Breaker Labels: Faceplate must list current rating, UL and IEC certification standards, and AIC rating.
- B. Circuit Directory:
 - 1. Provide computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
 - a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.

3.4 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Nonconforming Work:
 - 1. Panelboards will be considered defective if they do not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- C. Collect, assemble, and submit test and inspection reports, including certified report that identifies panelboards included and that describes scanning results, with comparisons of two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 262726
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General-use switches.
2. General-grade duplex straight-blade receptacles.
3. Receptacles with ground-fault protective devices.

1.2 ACTION SUBMITTALS

A. Product Data:

1. General-use switches.
2. General-grade duplex straight-blade receptacles.
3. Receptacles with ground-fault protective devices.

PART 2 - PRODUCTS

2.1 GENERAL-USE SWITCHES, DIMMER SWITCHES, AND FAN-SPEED CONTROLLER SWITCHES

A. Toggle Switch:

1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Options:
 - a. Device Color: As indicated on architectural Drawings.
3. Accessories:
 - a. Cover Plate high-impact thermoplastic (nylon) with smooth finish and color: matching wiring device; from same manufacturer as wiring device.
 - b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.2 GENERAL-GRADE SINGLE STRAIGHT-BLADE RECEPTACLES

A. Single Straight-Blade Receptacle

1. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- 2. General Characteristics:
 - a. NEMA 5-20R.

PART 3 - EXECUTION

3.1 INSTALLATION OF SWITCHES

- A. Comply with manufacturer's instructions.

3.2 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

- A. Comply with manufacturer's instructions.
- B. Identification:
 - 1. Identify cover or cover plate for device with panelboard identification and circuit number

END OF SECTION

SECTION 265119
LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaires.
 - 4. Include emergency lighting units, including batteries and chargers.
 - 5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
- B. Product Schedule: For luminaires and lamps.
- C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 LUMINAIRE SUPPORT

- A. Comply with manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Supports:
 - 1. Sized and rated for luminaire weight.

2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.

END OF SECTION

SECTION 270528
PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings.
 - 2. Nonmetallic conduits and fittings.
 - 3. Optical-fiber-cable pathways and fittings.
 - 4. Metallic surface pathways.
 - 5. Tele-power poles.
 - 6. Hooks.
 - 7. Boxes, enclosures, and cabinets.
 - 8. Polymer-concrete handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid conduit.
- C. IMC: Intermediate metal conduit.
- D. RTRC: Reinforced thermosetting resin conduit.

1.4 ACTION SUBMITTALS

- A. Product data for the following:
 - 1. Surface pathways
 - 2. Wireways and fittings.
 - 3. Tele-power poles.
 - 4. Boxes, enclosures, and cabinets.
 - 5. Underground handholes and boxes.
- B. Shop Drawings: For custom enclosures and cabinets and custom underground handholes and boxes. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of pathway groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
 - 3. Underground ducts, piping, and structures in location of underground enclosures and handholes.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Data: Seismic rating Provide seismic bracing for all pathway racks, enclosures, cabinets, equipment racks, and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
 - 2. Alpha Wire.
 - 3. Southwire Company.
 - 4. Thomas & Betts Corporation; A Member of the ABB Group.
- C. General Requirements for Metal Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
 - 2. Comply with TIA-569-D.
- D. GRC: Comply with ANSI C80.1 and UL 6.

- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: die cast.
 - b. Type: compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- H. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Description: Nonmetallic raceway of circular section with manufacturer-fabricated fittings.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
 - 2. Carlon; a brand of Thomas & Betts Corporation.
 - 3. RACO; Hubbell.
 - 4. Thomas & Betts Corporation; A Member of the ABB Group.
- C. General Requirements for Nonmetallic Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 - 2. Comply with TIA-569-D.
- D. RNC: Type EPC-40-PVC Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material.
- F. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Description: Comply with UL 2024; flexible-type pathway with a circular cross section, approved for plenum riser or general-use installation unless otherwise indicated.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Alpha Wire.
 - 2. Carlson; a brand of Thomas & Betts Corporation.
 - 3. Endot Industries Inc.
 - 4. IPEX USA LLC.
- C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with TIA-569-D.

2.4 SURFACE METAL PATHWAYS

- A. Description: Galvanized steel with snap-on covers, complying with UL 5.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. MonoSystems, Inc.
 - 2. Niedax Inc.
 - 3. Panduit Corp.
 - 4. Wiremold / Legrand.
- C. Finish: Manufacturer's standard enamel finish in color selected by Architect.
- D. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- E. Comply with TIA-569-D.

2.5 TELE-POWER POLES:

- A. Description: Prefabricated, finished metal pole with prewired power and communications outlets.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. MonoSystems, Inc.
 - 2. Panduit Corp.
 - 3. Wiremold / Legrand.
- C. Material: Galvanized steel with ivory baked-enamel finish.

- D. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.
- E. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- F. Comply with TIA-569-D.

2.6 HOOKS

- A. Description: Prefabricated sheet metal cable supports for telecommunications cable.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. MonoSystems, Inc.
 - 2. Panduit Corp.
 - 3. Wiremold / Legrand.
- C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with TIA-569-D.
- E. Galvanized steel.
- F. J shape.

2.7 BOXES, ENCLOSURES, AND CABINETS

- A. Description: Enclosures for communications.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Erickson Electrical Equipment Company.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. RACO; Hubbell.
 - 4. Thomas & Betts Corporation; A Member of the ABB Group.
 - 5. Wiremold / Legrand.
- C. General Requirements for Boxes, Enclosures, and Cabinets:
 - 1. Comply with TIA-569-D.
 - 2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
 - 3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
 - 4. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

5. Gangable boxes are allowed.
- D. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- E. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- F. Metal Floor Boxes:
 1. Material: Cast metal.
 2. Type: Fully adjustable.
 3. Shape: Rectangular.
 4. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum galvanized, cast iron with gasketed cover.
- I. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4, with continuous-hinge cover with flush latch unless otherwise indicated.
 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Nonmetallic Enclosures:
 - a. Material: Plastic.
 - b. Finished inside with radio-frequency-resistant paint.
 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- J. Cabinets:
 1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.
 4. Metal barriers to separate wiring of different systems and voltage.
 5. Accessory feet where required for freestanding equipment.
 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.8 POLYMER-CONCRETE HANDHOLES

- A. Description: Molded of sand and aggregate; bound together with polymer resin; and reinforced with steel, fiberglass, or a combination of the two.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. [Armorcast Products Company.](#)
2. [NewBasis.](#)
3. [Oldcastle Enclosure Solutions.](#)
4. [Quazite: Hubbell Power Systems, Inc.](#)

C. General Requirements for Polymer Concrete Handholes:

1. Boxes and handholes for use in underground systems shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
3. Comply with TIA-569-D and SCTE 77.

D. Configuration: Designed for flush burial with integral closed bottom unless otherwise indicated.

E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.

1. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
2. Cover Legend: Molded lettering, "COMMUNICATIONS" "FIBER" "PHONE" "CABLE".

F. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

G. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.9 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed Conduit: RNC, Type EPC-80-PVC.
2. Concealed Conduit, Aboveground: IMC.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried concrete encased.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums
3. Concealed in Ceilings and Interior Walls and Partitions: EMT or innerduct.
4. Damp or Wet Locations: GRC.
5. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, communications-cable pathway.
6. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: Riser-type, communications-cable pathway.
7. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: EMT.
8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel units in institutional and commercial kitchens and damp or wet locations.

C. Minimum Pathway Size: 3/4-inch trade size for copper and aluminum cables, and 1 inch for optical-fiber cables.

D. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use set-screw or compression, steel fittings. Comply with NEMA FB 2.10.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:
 - 1. NECA 1.
 - 2. NECA/BICSI 568.
 - 3. TIA-569-D.
 - 4. NECA 101
 - 5. NECA 102.
 - 6. NECA 105.
 - 7. NECA 111.
- B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- C. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- D. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems" for hangers and supports.
- E. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling" for sleeves and sleeve seals for communications.
- F. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- G. Complete pathway installation before starting conductor installation.
- H. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- I. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.
- J. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within 12 inches of enclosures to which attached.
- L. Pathways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
 - 3. Arrange pathways to keep a minimum of 2 inches of concrete cover in all directions.

4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 5. Change from nonmetallic conduit and fittings to GRC or IMC and fittings before rising above floor.
- M. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for pathways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- O. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- Q. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.
- R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.
- S. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- T. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.
- U. Surface Pathways:
1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
 2. Install surface pathway with a minimum 2-inch radius control at bend points.
 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- V. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
 2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.

3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- W. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.
- X. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service pathway enters a building or structure.
 3. Where otherwise required by NFPA 70.
- Y. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- Z. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT that is located where environmental temperature change may exceed 100 deg F, and that has straight-run length that exceeds 100 feet.
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

AA. Hooks:

1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.
2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
3. Hook spacing shall allow no more than 6 inches of slack. The lowest point of the cables shall be no less than 6 inches adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
4. Space hooks no more than 5 feet o.c.
5. Provide a hook at each change in direction.

BB. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.

CC. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

DD. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

EE. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

GG. Set metal floor boxes level and flush with finished floor surface.

HH. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe of less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end

of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."

4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete around conduit for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 270553 "Identification for Communications Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line, 24 inches below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- F. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 310513
SOIL MATERIALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Subsoil materials.
- B. Topsoil materials.

1.2 RELATED SECTIONS (include but are not limited to)

- A. Appendix:
 - 1. Subsurface Investigation (Geotechnical) report; bore hole locations and findings of subsurface materials.
- B. Section 013300 – Submittal Procedures.
- C. Section 014000 – Quality Requirements: Testing soil fill materials.
- D. Section 310516 – Aggregate Materials.
- E. Section 312216 – Rough Grading.
- F. Section 312513 – Erosion and Sediment Control: Slope protection and erosion control.
- G. Section 312323 – Backfill.
- H. Section 312317 –Trenching.
- I. Section 329119 – Landscape Grading.

1.3 REFERENCES

VIRGINIA DEPARTMENT OF TRANSPORTATION

- A. VDOT, “Road & Bridge Standards & Specifications,” latest edition.

AMERICAN SOCIETY OF TESTING AND MATERIALS

- B. ASTM D698 – Std. Test Method for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ASTM D2487 – Classification of Soils for Engineering Purposes.

- D. ASTM D2922 – Std. Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- E. ASTM D3017 – Std. Test Method for Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- F. ASTM D4318 – Std. Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits).

1.4 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures.
- B. Materials Source: Submit name of imported materials source, to Geotechnical Engineer.
- C. Samples: Submit, in air-tight containers, 10 lb (4.5 kg) sample of each type of fill to appropriate testing laboratory.

1.5 QUALITY ASSURANCE

- A. Furnish each individual soil material from single source throughout the work.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

- A. Subsoil Type S1:
 - 1. Excavated and re-used material, imported borrow, or select or local borrow.
 - 2. Graded.
 - 3. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris; Less than 1% (by weight) of organic matter or other deleterious material.
 - 4. Conforming to ASTM D2487 Group Symbol CL or better.

2.2 TOPSOIL MATERIALS (See Section 329119 – Landscape Grading for Schedule)

- A. Topsoil Type T1:
 - 1. On-site topsoil, excavated and reused material, conforming to Virginia ~~Erosion & Sediment Control~~ Stormwater Management Handbook Standard & Spec. 3-30 C-SSM-02 TOPSOILING.
 - 2. Graded.
- B. Topsoil Type T2:
 - 1. Imported borrow.
 - 2. Natural, fertile, friable loamy soil (loam, sandy loam, silty loam, sandy clay loam, or clay loam), of 20-70% sand, 10-60% silt, and 5-30% clay.

3. Characteristic of productive soils in the vicinity which produce desirable vegetation and obtained from naturally well-drained areas.
4. Reasonably free of roots, rocks larger than 1 inch (25 mm) in longest dimension, subsoil, debris, large weeds, and foreign matter.
5. Free of toxic substances or any other material or substance which might be harmful to plant growth or a hindrance to grading maintenance operations.
6. Acidity range (adjusted pH) of 6.0 to 7.0.
7. Containing a minimum of 2 percent organic matter.
8. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.
9. With additives as recommended in soil analysis report.

2.3 SOURCE QUALITY CONTROL

- A. Section 014000 – Quality Requirements: Testing and analysis of soil material.
- B. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698 (Standard Proctor) and D2487 (Classification of Soils).
- C. Testing and Analysis of Topsoil Material: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of, inorganic matter (sand, silt, & clay), deleterious material, pH, and mineral and plant nutrient content of topsoil. Report suitability of topsoil for growth of applicable planted material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil.
- D. If tests indicate materials do not meet specified requirements, change material and retest.
- E. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

- A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth.
- B. Remove lumped soil, boulders, and rock.
- C. Stockpile excavated material, suitable for reuse, in area designated on site.
- D. Remove excess material not being used from site.
- E. Remove excavated materials not meeting requirements for reuse from site.

3.2 STOCKPILING

- A. Stockpile materials on site at locations indicated on Drawings.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Prevent intermixing of soil types or contamination.
- E. Direct surface waters away from stockpile site to prevent erosion or deterioration of materials.
- F. Stockpile topsoil 8 feet (2.5 m) high maximum.
- G. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.
- B. If a borrow area is utilized, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.

END OF SECTION

SECTION 310516
AGGREGATE MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Course Aggregate Materials.
 - 2. Fine Aggregate Materials.
- B. RELATED SECTIONS (including but not limited to:)
 - 1. Appendix: Subsurface Investigation (Geotechnical) report; recommended needs for aggregate materials.
 - 2. Section 013300 – Submittal Procedures.
 - 3. Section 014000 – Quality Requirements: Testing aggregate fill materials.
 - 4. Section 312213 – Rough Grading.
 - 5. Section 312513 – Erosion and Sediment Control: Slope protection and erosion control.
 - 6. Section 312323 – Backfilling.
 - 7. Section 312317 – Trenching.
 - 8. Section 321216 – Asphalt Paving.
 - 9. Section 321313 – Concrete Paving.
 - 10. Section 331116 – Water Distribution System.
 - 11. Section 334600 – Subdrainage: Filter aggregate.
 - 12. Section 334100 – Storm Drainage.
 - 13. Section 333100 – Sanitary Sewer System.

1.2 REFERENCES

AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS

- A. AASHTO - M147 - Materials for Aggregate and Soil-Aggregate.

AMERICAN SOCIETY OF TESTING AND MATERIALS

- A. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- D. ASTM D3017 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

VIRGINIA DEPARTMENT OF TRANSPORTATION

- E. VDOT "Road & Bridge Standards & Specifications," latest edition.
- F. VDOT "Special Provision for Flowable Backfill" dated March 11, 2010.

1.3 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures.
- B. Manufacturer's Certificate: Submit name of imported materials suppliers to Geotechnical Engineer.

1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from a single source throughout the work.

PART 2 PRODUCTS

2.1 AGGREGATE MATERIALS

- A. Coarse Aggregate Type A1 (Utility Bedding, Haunching, & Initial Cover): Conforming to VDOT Std. #68, 7, or 78.
- B. Coarse Aggregate Type A2 (Drainage Fill): Conforming to VDOT Std. #57.
- C. Coarse Aggregate Type A3 (Base for Concrete Flatwork): Conforming to VDOT Std. #5, 56, or 57.
- D. Coarse Aggregate Type A4 (Aggregate Base under Bituminous Pavement): Conforming to VDOT Std. #21A or B, Type II (A or B as indicated in pavement sections on the Drawings).
- E. Fine Aggregate Type A5 (Sand for Bedding): Conforming to VDOT Std. Grade "C" Fine Aggregate, VDOT Std. #10 Course Aggregate, or equivalent. A minimum of 100% (by weight) must pass a 3/8" laboratory square opening sieve, 94-100% passing a No. 4 sieve, and a maximum of 25% (by weight) may pass a No. 50 sieve.
- F. Course Aggregate "Rip-Rap" (as referenced on plans by d50 value): A well graded rip-rap, in accordance with DCR and VDOT standards, consisting of field stone of approximately rectangular shape. Specific gravity of individual stones shall be 2.5 minimum. Mean stone diameter shall be as denoted by the "d50" value. The diameter of the largest stone size shall not be larger than 1.5 times the d50 size. The diameter of the smallest stone size shall not be smaller than 0.3 times the d50 size. Small fines will not be permitted.

2.2 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Source testing and analysis of aggregate material.
- B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698.
- C. If tests indicate materials do not meet specified requirements, change material or material source and retest.
- D. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 STOCKPILING

- A. Stockpile in sufficient quantities to meet Project schedule and requirements.
- B. Separate differing materials with dividers or stockpile apart to prevent mixing.
- C. Direct surface water away from stockpile site so as to prevent deterioration of materials.

3.2 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.
- B. If a borrow area is utilized, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.

END OF SECTION

SECTION 310900
GEOTECHNICAL ENGINEERING, INSPECTION AND TESTING

PART 1 GENERAL

1.1 DESCRIPTION

- A. Geotechnical investigation report.
- B. Earthwork quality assurance.
- C. Underground utility quality assurance.

1.2 RELATED SECTIONS (including but not limited to:)

- A. Section 312213 – Rough Grading.
- B. Section 312316 – Excavation.
- C. Section 312323 – Backfill.
- D. Section 312317 – Trenching.
- E. Division 33 Underground Utility Sections.
- F. Appendix: Subsurface Exploration Report.

1.3 GEOTECHNICAL INVESTIGATION REPORT

- A. A geotechnical investigation report has been prepared for the site of this work by an independent geotechnical engineer.
- B. A copy of the full geotechnical investigation report for this project is bound at the end of the Project Manual in the Appendix.
- C. This geotechnical investigation report was obtained only for the Architect's/ Engineer's use in design and is not a part of the Contract Documents.
- D. The report is provided for bidder's information, but is not a warranty of subsurface conditions. Owner assumes no responsibility for conditions of site or continuation of those conditions existing at the time of report generation.
- E. Bidders should visit the site and acquaint themselves with existing conditions.
- F. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but such investigations may be performed only under time schedules and arrangements approved in advance by the Architect.

1.4 EARTHWORK QUALITY ASSURANCE

- A. A qualified independent Soils Testing Laboratory, which staffs a Professional Geotechnical Engineer, registered in Virginia (herein after Geotechnical Engineer), will be retained by the Owner to observe and report performance or work in connection with Rough Grading, Excavating, Backfill, & Trenching , and any other earthwork related concern.
- B. The Geotechnical Engineer shall perform the following:
 - 1. Make a site inspection, review governing requirements for this work and the test results and make recommendations on applicable portions of the Work (traffic bearing areas, building foundation, , etc., as may be applicable to this project),
 - 2. All required tests to determine bearing capacity of soil (subgrade suitability) prior to placement of all footings, slabs, tanks, utilities, etc.
 - 3. Inspections,
 - 4. Testing of all proof-rolling and filling operations,
 - 5. Determination of materials (suitable, unsuitable, rock, etc., as may be applicable to this project),
 - 6. Quantify materials involving unit price payments as applicable,
 - 7. Submit certifications of all such tests and inspections as may be herein required, with a proper description of tested or inspected locations, to the Architect/Engineer with a copy to the Contractor. Location maps shall be submitted with each report identifying areas where testing occurred.
- C. All testing performed by the Geotechnical Engineer is solely in the interest of and for the protection of the Owner.
- D. The density of all finally placed or excavated material shall be as specified herein and as determined suitable by the Geotechnical Engineer.
- E. The Contractor shall be responsible for notifying the Geotechnical Engineer of his readiness for all tests in a timely manner and for providing access to the site so as to cause no delay to the project.
- F. All instructions and directions provided by the Geotechnical Engineer to the Contractor shall be in writing and immediately communicated to the Owner and Architect.
- G. When a soils test requested by the Contractor fails to meet the requirements of these specifications, the cost of all re-testing required shall be borne by the Contractor.
- H. Notwithstanding any tests, instructions, or decisions made by the Geotechnical Engineer, the Contractor shall not be relieved of his obligation to perform all grading and compaction work in accordance with the Contract Documents.
- I. The Contractor may, at his option, hire his own Soils Testing Service to assure himself that his work is in accordance with the Contract Documents.

1.5 UNDERGROUND UTILITY QUALITY ASSURANCE

- A. The Architect or a representative retained by the Owner, will observe and report performance on work in connection with Underground Utility installation and testing.
- B. The following shall be performed:
 - 1. Review governing requirements for installation of this work,
 - 2. Upon accepting condition of trench for pipe installation, observe placement of bedding, haunching, pipe, any anchorage or thrust blocking required, and initial cover to assure that pipe is installed in accordance with those requirements,
 - 3. Verification of appropriate pipe, joint, and fitting materials,
 - 4. Observation of all required tests to determine suitability of said pipe installation, and
 - 5. Submit certifications of all such inspections and observations as may be herein required, with a proper description of tested locations, to the Architect/Engineer with a copy to the Contractor.
- C. All utility inspection related work performed by the Architect or Owner's Representative is solely in the interest of and for the protection of the Owner.
- D. The Contractor shall be responsible for notifying the Architect of his readiness for all inspections and observations in a timely manner and for providing access to the site so as to cause no delay to the project.
- E. Approvals and Disapprovals provided by the during inspection to the Contractor shall be in writing and immediately communicated to the Owner and Architect/Engineer.
- F. When an inspection/observation requested by the Contractor fails to meet the requirements of these specifications, the cost of all re-inspection/observation required shall be borne by the Contractor.
- G. Notwithstanding any tests, instructions, or decisions made during inspections, the Contractor shall not be relieved of his obligation to perform all utility work in accordance with the Contract Documents.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 311000
SITE PREPARATION AND CLEARING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparation.
- B. Protection: Protect improvements and vegetation to remain within and beyond/outside limits of disturbance.
 - 1. Barriers, warnings, shoring, etc.
 - 2. Adjacent properties, waterways and the air
 - 3. Reference points,
 - 4. Existing improvements,
 - 5. Existing utilities, and
 - 6. Trees and vegetation.
- C. Demolition, Clearing & Grubbing:
 - 1. Remove surface debris.
 - 2. Demolish and remove existing site improvements. Designated paving and curbs.
 - 3. Clear site of plant life and grass.
 - 4. Remove trees and shrubs, including root systems, unless designated to remain.
- D. Topsoil Stripping: Excavate and stockpile topsoil.
- E. Removal: Clean up, remove and dispose of undesirable material off-site.
- F. Restoration: Restore existing finished surfaces disturbed to that of proposed finishes (preconstruction condition as a minimum).
- G. Utility Adjustments: Adjust new and existing utility tops to meet proposed finish grades.
- H. Definitions.
- I. Project Record Documents.

1.2 RELATED SECTIONS (including but not necessarily limited to)

- A. Appendix:
 - 1. Subsurface Investigation Report.
- B. Division 01: Permits, Fees, & Notices: Land Disturbing Permit.
- C. Division 01: Temporary Utilities: Water Service.
- D. Division 01: Temporary Controls: Surface Water and Dewatering. Dust. Noise.

Air pollution.

- E. Section 310900 – Geotechnical Engineering, Inspection, & Testing. Geotechnical Engineer.
- F. Section 310513 – Soil Materials: Definitions of subsoil and topsoil materials.
- G. Section 31 15 00 – Work Area Protection, MOT, Access.
- H. Section 31 22 13 – Rough Grading: Site subgrade contouring. References this section for Preparation, Protection, and Clean up, Removal and Disposal.
- I. Section 31 25 13 - Erosion and Sediment Control: Requirements for land disturbance, protection of stockpiles topsoil.
- J. Section 32 91 19 - Landscape Grading: Coordination of soil materials stockpile removal for finish grading and preparation for landscaping/seeding.

1.3 REFERENCES

- A. Virginia ~~Erosion & Sediment Control (ESC) Manual~~ Stormwater Management Handbook, latest edition: Temporary seeding, construction entrances and other measures or practices which may apply.
- B. Virginia Department of Health (VDH) "Waterworks Regulations", latest edition: Well or Monitoring Well abandonment.
- C. Virginia Department of Transportation (VDOT) "Road & Bridge Standards & Specifications", latest edition: Safety Items.
- D. Manual on Uniform Traffic Control Devices (MUTCD), latest edition (including the Virginia Supplement): Pavement Marking and Signage within right-of-way.

1.4 REGULATORY REQUIREMENTS

- A. Conform to all applicable codes. These include but shall not be limited to those pertaining to erosion and sediment control and disposal of debris.
- B. Obtain all required permits from authorities having jurisdiction.
- C. Erosion & Sediment Control (ESC): See Section 312513 - Erosion & Sediment Control for plan preparation, review, approvals, regulatory requirements, etc.
- D. Utility Companies: Administrative Requirements: Coordination & Meetings: Coordinate clearing Work with utility companies. Verify locations of existing utilities. Notify them prior to starting and comply with their requirements.
- E. Existing Signage within Right-of-Way: Any existing signs shall be relocated as necessary meeting all state and local ordinances including conformance in design and placement with the Virginia Supplement to the Manual on Uniform Traffic Control Devices (MUTCD), latest edition. Edge of signs shall be 12 feet off edge of

pavement or 6 feet off shoulder or 2 feet behind face of curb. Clear height shall be 7 feet above grade. Reference document shall take precedence.

1.5 DEFINITIONS

- A. Limit of Disturbance or Construction Limits: The extent that proposed contours, erosion and sedimentation control measures, subsurface utility work and surface improvements are indicated on the Drawings or as delineated as limits on Drawings plus Contractor trailer, storage and parking as defined in the Contract Documents.

1.6 PROJECT RECORD DOCUMENTS

- A. Accurately record on Project Record Documents the actual locations of utilities to remain, by horizontal dimensions from landmarks to remain, depth or elevations of inverts, and slope gradients while preparing for land disturbance and in providing protection of utilities.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Erosion and Sediment Control Materials: See Section 312513 - Erosion and Sediment Control for approved materials and products.
- B. See Section 310513 – Soil Materials: Definitions of subsoil and topsoil materials.

PART 3 EXECUTION

3.1 PREPARATION

- A. Accept premises as found. Owner assumes no responsibility for conditions of site or continuation of conditions existing at time of advertisement.
- B. Assure that all pertinent required permits have been obtained.
- C. Verify all site conditions pertinent to this work.
- D. Locate, identify and flag/mark for protection all bench marks, property corners and reference points. Verify that survey bench mark and intended elevations for the Work are as indicated.
- E. Contractor shall lay out all work and be responsible for all lines, elevations and measurements.
- F. Verify that existing trees/plant life designated to remain, are conspicuously marked as such.
- G. Drawings do not purport to show all objects existing on the site. Before commencing work, verify with the Architect all improvements to be protected, salvaged, relocated, removed or demolished. Existing utilities are indicated on the

Drawings in accordance with available records.

- H. Before any work is started, the Contractor shall contact all corporations, companies, individuals and local authorities owning, maintaining or regulating utilities, conduits, wires and pipes running to or on the property to make suitable arrangements for locating, protection, handling, relocation, adjusting, and/or removal and disposal/salvage of such lines or structures. Verify locations and elevations.
- I. Contact MISS UTILITY at least 48 hours in advance of land disturbing activities.
- J. Before any work is started, the Contractor shall contact all state and local authorities owning, maintaining or regulating adjacent rights-of-way to make suitable arrangements for protection, handling, relocation, and/or removal and disposal/salvage of such improvements involved in this Work (signs, structures, etc.). Verify locations, elevations and applicable codes.

3.2 PROTECTION

- A. General: Erect and maintain temporary bracing, shoring, lights, barricades, warning signs, etc., all in accordance with applicable rules and regulations.
- B. Protection of adjacent properties, waterways and the air:
 - 1. Prior to any land disturbance activity install Erosion and Sediment Control measures conforming to Section 312513 - Erosion and Sediment Control (ESC). See Site Drawings for specific practices required to prevent soil from washing from areas disturbed during clearing operations. Maintain all ESC measures required.
 - 2. Clearing shall be restricted to the area within the right-of-way, easements, and Construction Limits indicated on the Drawings.
 - 3. Any material which will result in dust shall be wet down during removal.
- C. Protection of Reference Points: Protect and maintain all bench marks, property corners, monuments and other reference points from damage or displacement. Do not cover. Obtain accurate replacement of any that is disturbed, destroyed or moved due to the work and furnish a certificate by a professional civil engineer or land surveyor that all such items have been relocated accurately.
- D. Protection of Existing Improvements:
 - 1. Conduct site clearing operations to ensure minimum interference with roads, streets, walks, utilities, and other adjacent improvements to remain. Do not close or obstruct streets, walks or other facilities without written permission from authorities having jurisdiction and prior approval by the Owner.
 - 2. Use all means necessary to protect existing improvements designated to remain. In the event of damage, immediately make all necessary repairs and replacements as directed by the Architect.
- E. Protection of Existing Utilities:
 - 1. Existing utilities, encompassing all water systems, storm and sanitary

sewer systems, gas lines, electric systems, telephone and communication systems, underground storage tanks, etc., and all accessories thereto, underground, on the surface or overhead, located in or affected by the construction of the work shall be relocated as required

2. Protect existing utilities noted to remain.
3. Coordinate the timing of utility adjustments to ensure that all new and existing utility tops are adjusted to proposed finish grades prior to stone base applications in paved areas, and prior to topsoil applications within lawn spaces.
4. Give advance notice to the Utility Owner of work to be removed or relocated. The work shall be performed by the Contractor or Utility Owner with arrangements and payment for this work being made by the Contractor.
5. If existing concealed utilities not shown or correctly indicated by the Contract Documents are encountered, the Contractor shall stop work in that area and notify the Architect and Utility Owner. Do not proceed until written instructions are received from the Architect.
6. The Contractor shall excavate with care to determine the exact location of existing utilities, including sizes and inverts. Also, stake and flag at this time for protection. This work shall precede pipe laying, grading, excavation and other construction as far as practicable, to permit adjustments where required.

F. Protection of Existing Trees and Vegetation:

1. Contractor shall assume that all existing vegetation on the premises is intended to remain unless specifically noted otherwise.
2. Protect existing trees, plant growth, and features against compacting the root zone, unnecessary cutting, breaking, skinning of roots, or bruising of bark, or damage from dust, debris, or chemicals. Conform to details and specifications of the ~~Virginia Erosion & Sediment Control~~ Stormwater Management Handbook for methods of protection.
3. Disposal of any adhesives, concrete, plaster, paints, thinners, or other volatile liquids or substances detrimental to vegetation shall be done in proper locations away from existing or new plant materials.
4. Repair or replace trees and vegetation damaged by construction operations, but not intended for demolition, in a manner acceptable to the Architect

3.3 DEMOLITION, CLEARING AND GRUBBING

- A. Removal of utilities may cause excavations beneath proposed buildings and improvements. All excavations performed for demolition purposes shall be backfilled and tested in accordance with the specifications.
- B. Clear areas required for access to site and execution of Work. Honor described or indicated Limits of Construction and Disturbance.
- C. Remove existing walks, pavement, fencing, curbs, minor buildings and structures where required for excavation or new construction or as indicated on the Site Drawings. Existing pavement to be removed or connected to shall be neatly cut in

straight lines at necessary locations required to accomplish required work. Existing pavement to be trenched through by the open cut method shall be neatly cut in straight lines at minimum width required to accomplish required work.

- D. Where asphalt or concrete walks or pavement are removed in locations proposed as lawn or planting beds, all existing bedding stone shall be removed. Underlying subsoil shall be loosened and prepared to receive fill, topsoil, or mulch as applicable.
- E. Upon encountering and well within limits of disturbance, verify first with A/E that well is not in use and that Owner desires it to be formally abandoned. If so desired Contract price will be adjusted by Change Order. Abandon well in accordance with Virginia Department of Health "Waterworks Regulations", Section 3.8 - Observation, Monitoring and Remediation Wells and Section 3.11 - Well Abandonment. Adjust top elevation of casing as required to maintain three (3) feet of cover from finished grade.
- F. Abandon in place, in accordance with applicable codes, all utility lines, septic tanks, drain fields, septic pits, dry wells, etc., not intended to remain, if it poses no conflict with the Work, will have three (3) feet of cover at finished grade and, in the opinion of the Architect, remaining in place does not have an adverse impact upon the project or intended use.
- G. Remove utility lines & structures, septic tanks, drain fields, septic pits, dry wells, etc., which conflict with the work or do not meet the preceding conditions. Provide for the relocation, raising or lowering of existing electric and telephone poles where required.
- H. Remove grass, trees, stumps, shrubs, roots, vines, weeds, brush, surface rocks, debris and all other extraneous material or objects from areas to be built upon or graded. Remove all vegetation to a sufficient depth to prevent regrowth.
- I. Conduct demolition, clearing and grubbing operations in such a manner as to minimize disturbance to subsoil and creation of dust. Remove existing foundation walls, floor slabs and footings in such a manner as to avoid disturbing underlying subgrade.
- J. Where trees are indicated to be left standing, stop topsoil stripping at drip line to prevent damage to main root system. Use only hand grubbing inside the driplines of trees to remain.
- K. Fill depressions caused by demolition, clearing and grubbing operations with controlled fill unless further excavation or grading is indicated and immediately follows.
- L. Do not allow water to pond in any excavation or depression. See Dewatering in Division 01: Temporary Controls.

3.4 STRIPPING TOPSOIL

- A. Excavate topsoil from areas to be further excavated, re-landscaped, or re-graded as indicated on the Drawings. Excavate to whatever depths encountered in a manner to prevent intermingling with underlying sub-soil or other objectionable material. Comply with the following:
 - 1. Do not excavate wet topsoil.
 - 2. Avoid including debris, stones and other extraneous matter in topsoil which will make it "unsuitable" under Section 31 05 13 – Soil Materials: Topsoil Materials.
 - 3. Leave subsoil surface free of trash, debris and foreign materials.
- B. Stockpile on site in an area approved by the Architect/Engineer. Comply with Section 31 25 13 - Erosion & Sediment Control; Topsoil Stockpile.

3.5 CLEANUP, REMOVAL & DISPOSAL

- A. Clean up debris resulting from site clearing and grading operations (earthwork related) continuously with the progress of the Work.
- B. Remove debris, rock, extracted plant life, unsatisfactory, and/or surplus (not being reused) soil materials, etc. from site.
- C. Any debris, rock, extracted plant life, etc. designated to be removed from the site shall become the property of the Contractor and shall be disposed at the Contractor's expense.
- D. Dispose of all material in accordance with all local, state and federal regulations governing same.

END OF SECTION

SECTION 311500
WORK AREA PROTECTION, MAINTENANCE OF TRAFFIC (MOT), AND ACCESS

1. General

- 1.1. Traffic Maintenance - All traffic control shall be subject to approval by the City Traffic Engineer (Transportation Department 540-853-2385). The City Traffic Engineer is not the City Project Manager or City Engineer. Changes to the traffic control plan, as directed by the City Traffic Engineer, shall not be a basis for additional compensation. The Contractor shall submit a traffic control plan sealed by a Professional Engineer registered in Virginia for review and approval prior to mobilization. All lane and street closures and detours shall be coordinated with the Transportation Department. Note that the Engineering and Transportation Departments are separate departments. Traffic control plans shall be submitted within the specified number of days outlined in the Submittals (Section 01 30 00) portion of this specification.
- 1.2. Any sign, to be posted on the job site/work zone for more than 72 hours, must be anchored into the ground with a steel/wooden post. Placing signs on trees, existing road sign posts, or mailbox posts, etc. shall not be allowed.
- 1.3. Work Area Protection – The Contractor shall maintain the work area in accordance with the Virginia Work Area Protection Manual, latest edition. The City shall not be responsible for any portion of work area protection or safety.
- 1.4. If a temporary road closure is required on the project, a traffic control plan conforming to the Virginia Work Area Protection Manual shall be submitted to the City of Roanoke for approval prior to starting construction. Contractor shall be required to provide all signage and devices in accordance with the Virginia Work Area Protection manual. In addition, the Contractor shall provide and maintain all signs for road/alley detours. **The City of Roanoke shall not provide any signs.**
- 1.5. Access - Coordinate citizens' access to driveways as much as possible. Access to properties along the project route shall be maintained during construction.
- 1.6. Contractor shall be responsible for providing all signage for the project. The Contractor shall not rely on City personnel to provide or maintain any signage.
- 1.7. There may be other Contractors in the adjoining areas. Incidental coordination with the Contractors may be required.

2. Products – Not Used

3. Execution – Not Used

END OF SECTION

SECTION 312213
ROUGH GRADING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Site Subgrade Contouring. General cutting, grading, filling, and rough contouring of the site for access drives, parking, site structures, building pads, landscaping features, etc., as applicable.
- B. Furnish all labor, materials, equipment, and incidentals necessary for earthmoving, grading, cutting, filling, and compaction to provide subgrade elevations as specified herein from finish grades indicated on the Drawings.
- C. Unauthorized excavation defined.

1.2 RELATED SECTIONS

- A. Appendix: Geotechnical Report, Subsurface Investigation.
- B. Section 310513 - Soil Materials.
- C. Section 310516 - Aggregate Materials.
- D. Section 311000 - Site Preparation and Clearing.
- E. Section 312316 - Excavating: Building excavation.
- F. Section 312323 - Backfilling: General building area backfilling.
- G. Section 312317 - Utility Trenching & Backfilling: Trenching and backfilling for utilities.
- H. Section 329119 - Landscape Grading: Finish grading with topsoil to contours.

1.3 REFERENCES

AMERICAN SOCIETY OF TESTING & MATERIALS

- A. ASTM C136 - Method For Sieve Analysis of Fine and Coarse Aggregates.
- B. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- D. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

- E. ASTM D2419 - Test Method For Sand Equivalent Value of Soils and Fine Aggregate.
- F. ASTM D2434 - Test Method For Permeability of Granular Soils (Constant Head).
- G. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- H. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.4 DEFINITIONS

- A. "Finish grade" refers to contours and spot grades indicated on the Drawings.
- B. "Subgrade" or "rough grade" refers to bottom of footings at foundation walls and columns, bottom of aggregate fill within trenches or under slabs-on-grade and paving, and finish grade less specified topsoil depth elsewhere. Refer to applicable Drawings and Schedules for distances below finish grade. "Subgrade" may also refer to the subsoil base upon which fill is to be placed
- C. "Unsuitable material" refers to any material beneath proposed subgrade in cut conditions and existing subgrade in fill conditions which in the opinion of the Geotechnical Engineer, after observing proof-rolling or other testing/observation, will not be a satisfactory base for supporting the proposed work above.

1.5 CLASSIFICATION OF EXCAVATION

- A. All cutting, filling, excavating and backfilling to the limits of rough grade as defined herein is "unclassified" except for Rock and Unsuitable Soils and it shall be the Contractor's responsibility to determine the subsurface character. Bidders are expected to examine the site and then decide for themselves the character of materials to be encountered. Claims for extra compensation arising from latent, subsurface conditions within the area defined will not be considered.
- B. Excavation beyond the indicated subgrade elevations or excavation side dimensions shall be replaced at Contractor's expense with material per schedule this section.

1.6 SUBGRADE SUITABILITY

- A. The Geotechnical Engineer shall inspect all subgrades below footings and below slabs on grade and the results of such inspections shall be reported to the Architect and Owner.
- B. As determined by the Geotechnical Engineer, any unsuitable material below limits of subgrade elevations shall be removed and replaced per schedule this section. Contract Price will be adjusted as identified on the Bid Form except as indicated in "C" below.

- C. Once any subgrade has been approved by the Geotechnical Engineer for pouring of footings, slabs, etc., if the pouring of concrete is delayed by the Contractor, for any reason, resulting in subsequent disapproval of said subgrade by the Geotechnical Engineer, any additional excavation required as a result of such subsequent disapproval shall be provided by the Contractor at no additional cost to the Owner.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Topsoil: Type T1 or T2 as specified in Section 310513.
- B. Subsoil Fill: Type S1 as specified in Section 310513.
- C. Structural Fill: Type S1 as specified in Section 310513.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 013000 – Administrative Requirements: Coordination.
- B. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 PREPARATION, PROTECTION, & CLEANUP

- A. Control water in accordance with Division 01 – Temporary Controls. Ponding water will not be permitted.
- B. Comply with Section 311000 - Site Preparation & Clearing: Preparation, Protection, Field Measurements, Cleanup.
- C. The Contractor shall be responsible for controlling on-site construction traffic to prevent softening or rutting of completed controlled fill work. Additional work required due to improper traffic control will be at the Contractor's expense.
- D. Identify required lines, levels, contours, and datum.
- E. Locate, identify, and protect above and below grade utilities that remain, from damage.
- F. Notify utility company to remove and/or relocate utilities, as applicable.

- G. Protect plant life, lawns, and other features remaining as a portion of final landscaping.
- H. Protect bench marks, survey control points, any existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 PROOF-ROLLING

- A. After all demolition, clearing, grubbing, and topsoil and organics stripping the exposed subgrade shall be proof-rolled. Proof-rolling shall be with a tandem axle dump truck or similar pneumatic tired equipment weighing at least 10 tons (20 tons max) to locate soft or other unsuitable areas. The number and direction of passes shall be as required by the Geotechnical Engineer.
- B. Any soft or compressible areas or unsuitable material encountered shall be removed and replaced per schedule this section. The Geotechnical Engineer shall observe the removal, document the volume, observe and test the replacement and immediately forward copies of documentation to the Architect/Engineer.
- C. Unless approved by the Geotechnical Engineer proof-rolling shall be a continuous operation until the entire site is complete.
- D. When extensive excavation is required to bring the site to rough grade, proof-rolling shall occur simultaneously with the excavation work, if possible.
- E. The Contractor shall provide assistance to the Geotechnical Engineer or his representative as required to accomplish this work and to accurately track the progress of proof-rolling.
- F. After proof-rolling the subgrade, areas to receive fill shall be uniformly scarified to a depth of 2". Water shall be added to the loosened material or it shall be allowed to dry as required so that the moisture content is within necessary limits of the optimum as judged or tested by the Geotechnical Engineer.

3.4 SUBSOIL EXCAVATION (Cutting)

- A. Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded.
- B. Work within 15 feet of any structure to remain shall be handled under Section 312316 – Excavating & Filling. Should the Architect or Geotechnical Engineer determine the structure to be in jeopardy by grading operations this distance may be increased.
- C. Do not excavate wet subsoil unless determined to be "unsuitable material".
- D. When excavating through roots of trees to remain, perform work by hand and cut roots with sharp ax.

- E. If rock is encountered, it shall be excavated to 12" below rough grade and replaced per schedule this section.
- F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.5 STOCKPILING

- A. Stockpile suitable excavated material per Section 312513 - Erosion & Sediment Control: Topsoil/Soil Materials Stockpile.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements. Stockpile materials on site at locations acceptable to Architect/Engineer. Avoid drainage ways and drip areas of trees. Remove excess material and material unsuitable for reuse as fill from site.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Prevent intermixing of soil types or contamination.

3.6 FILLING

- A. Before fill is placed, existing grade shall be prepared as specified in Section 311000, shall be dry and clean of all debris, and shall be proof-rolled in accordance with this section.
- B. Scarify proof-rolled, existing subgrade to a depth of 2" prior to placing fill.
- C. All fill materials shall be tested and approved by the Geotechnical Engineer prior to placement and shall meet or exceed the requirements as specified in schedule this section.
- D. Place fill to subgrade contours and elevations allowing for later placement of topsoil and pavements.
- E. Furnish additional fill material from off site if required to complete the work. Fill material from off-site is subject to approval of the Architect and Geotechnical Engineer.
- F. Filling operations for embankments having a slope greater than 1' vertically to 4' horizontally or other similar areas noted on the site plan shall be stepped or benched in 8" vertical lifts. Carry fill slope at least three feet horizontally beyond design rough grade, then cut back to well compacted material at subgrade elevations indicated on the Drawings.
- G. Do not place fill in water or mud or on frozen or frosty ground.
- H. Surfaces of new grades shall be left clean and ready to receive applicable finished surface. Remove all ruts and depressions to give a smooth and uniform subgrade.

- I. To avoid delay of the project, when wet weather will not permit placement of soil fill material under the building area, Contractor will be permitted the option of using structural fill type A3 or as acceptable to the Geotechnical Engineer, as the fill material at no additional cost to the Owner.
- J. Fill areas to contours and elevations with unfrozen materials.
- K. Place fill material on continuous layers and compact in accordance with the schedule at end of this section.
- L. Maintain optimum moisture content of fill materials to attain required compaction density.
- M. Slope grade away from building minimum 2 inches in 10 ft (1.5:100), unless noted otherwise. This is also the minimum for grassed areas.
- N. Make grade changes gradual. Blend slope into level areas.
- O. Remove surplus fill materials from site.

3.7 RESTORATION OF GRADES

- A. Restore to original grades and conditions all properties damaged by any activity related to this work and take adequate precautions to avoid settlements or cave-ins of properties higher than site, and settling, eroding or other damage to properties lower than site.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

3.8 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 0.1 foot (30 mm) within 100 feet of buildings, under all pavement and site improvements (such as athletic/play fields); and 0.25 foot (75 mm) on surrounding fields and slopes.

3.9 COMPACTION OF FILLS

- A. Required compaction tests shall be carried out according to ASTM D698 Standard Proctor Test by the Geotechnical Engineer.
- B. Field testing methods shall be as determined by the Geotechnical Engineer.
- C. Contractor shall be responsible for notifying Geotechnical Engineer as each lift is installed. Contractor shall not place additional lifts until tests indicate the fill is compacted to specified densities. Should any lifts be placed prior to approval of lower lifts, the work shall be removed at no additional cost to the Owner.
- D. Materials and densities shall be in accordance with schedule this section.

- E. The moisture content of the fill material shall be within 3% of the optimum range for maximum compaction during compaction. Add water as required. If excess water exists, it shall be reduced by harrowing, dicing and natural evaporating.

3.10 FIELD QUALITY CONTROL

- A. Testing: In accordance with ASTM D698.
- B. Work performed which does not meet technical or design requirements as determined by the Geotechnical Engineer will be removed, replaced and retested at no additional cost to the Owner. No deviations from the Contract Documents shall be permitted without specific and written approval from the Architect/Engineer.
- C. Thickness of lifts prior to compaction and distribution of tests, unless otherwise required by the Geotechnical Engineer, shall be accordance with the following table:

AREA	MAX. LIFT THICKNESS	TEST DISTRIBUTION (PER LIFT)
Lawn & unpaved areas	8"	1 per 10,000 s.f.
Backfills (Exterior)	8"	1 per 2,500 s.f.
Embankments (3H:1V & >)	8"	1 per 2,500 s.f.
Under Paving, Curbs, Walks, Footings, and Slabs on Grade	8"	1 per 1,000 s.f.

- D. Lift thickness given are for heavy compaction equipment. If hand operated equipment is used then lift thickness shall be one-half of those given above.
- E. Test distributions are minimum requirements with more required if deemed necessary by the Geotechnical Engineer. If fill area is linear in shape and less than 50' wide, provide one (1) test per 50 linear feet of the fill areas.
- F. Density requirements under slabs, footings and pavement shall be carried ten feet (10') beyond exterior edges.

3.11 STOCKPILE CLEANUP

- A. Comply with Section 329119 - Landscape Grading for finish grading and preparation of stockpile areas for landscaping/seeding.
- B. Comply with state and local erosion and sediment control ordinances by having stabilized all disturbed areas at completion of work.

3.12 SCHEDULES

- A. Fill Under Slab-On-Grade Building to 10 Feet Outside:
 - 1. Fill Type S1, to subgrade elevation, compacted to 95 percent,
 - 2. Inside foundation wall cover with Fill Type A3 (Base for Concrete Flatwork), 4 inches (100 mm) thick (unless detailed otherwise), compacted to 95 percent.
- B. Fill Under Grass Areas:
 - 1. Fill Type S1, to specified depth of topsoil below finish grade, compacted to 90 percent. See Section 329119 - Landscape Grading for topsoil depth.
- C. Fill Under Landscaped Areas:
 - 1. Fill Type S1, to specified depth of topsoil below finish grade, compacted to 90 percent.
- D. Fill For Landscape Berms:
 - 1. Fill Type S1, to specified depth of topsoil below finish grade, compacted to 85 percent.
- E. Fill Under Vehicular Asphalt or Concrete Paving, Pavers, Curbs and Concrete Dumpster Pad:
 - 1. Compact subsoil to 95 percent of its maximum dry density.
 - 2. Fill Type S1, to within two (2) feet of pavement subgrade, compacted to 95 percent.
 - 3. Fill Type S1, to pavement subgrade as indicated in applicable pavement section or schedule description, compacted to 98 percent.
- F. Fill Under Non-Vehicular Concrete Paving or Pavers (Walks):
 - 1. Compact subsoil to 95 percent of its maximum dry density.
 - 2. Fill Type S1, to pavement subgrade as indicated in applicable pavement section or schedule description, compacted to 95 percent.
- G. Fill to Correct Over-excavation:
 - 1. Fill Type A1, flush to subgrade elevation, compacted to 95 percent.
- H. Fill Over-Excavation of Demolished or Grubbed Material:
 - 1. Under Grassed Areas: Fill Type S1, to specified depth of topsoil below finish grade, compacted to 90 percent. See Section 329119 - Landscape Grading for topsoil depth.
 - 2. Under other improvements: Same as fill to Correct Over-Excavation or for specified surface.

- I. Topsoil Fill: See Section 329119 - Landscape Grading.

END OF SECTION

SECTION 312316 EXCAVATING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Excavating for building foundations.
- B. Excavating for slabs-on-grade, curbing, walks, landscaping, etc.
- C. Excavating for site structures.

1.2 RELATED SECTIONS

- A. Appendix: Geotechnical report; bore hole locations and findings of subsurface materials.
- B. Section 310900 - Geotechnical Engineering, Inspection, and Testing
- C. Section 312213 - Rough Grading: Classification of excavation. Topsoil and subsoil removal from site surface.
- D. Section 312323 - Backfilling.
- E. Section 312317 - Utility Trenching & Backfilling: Excavating for utility trenches.
- F. Section 312513 - Erosion & Sediment Control: Slope protection and erosion control.

1.3 DEFINITIONS

- A. Finish grade refers to contours and spot grades indicated on the Drawings.
- B. Subgrade or rough grade refers to bottom of footings at foundation walls and columns, bottom of crushed stone fill within trenches or under slabs-on-grade and paving, and finish grade less specified topsoil depth elsewhere. Refer to applicable Drawings and Schedules for distances below finish grade. Subgrade may also refer to the subsoil base upon which fill is to be placed.
- C. Where rock is encountered, Contractor shall over-excavate 12 inches below defined subgrade.
- D. Unsuitable material refers to any material beneath proposed subgrade in cut conditions and existing subgrade in fill conditions, which in the opinion of the Geotechnical Engineer, after observing proof-rolling or other testing/observation, will not be a satisfactory base for supporting the proposed work above.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that survey bench mark and intended elevations for the Work are as indicated. Identify required lines, levels, contours, and datum locations.

3.2 EXCAVATING

- A. Underpin adjacent structures which may be damaged by excavating work.
- B. Work within 15 feet of any structure to remain shall be handled under Excavation. Should the Architect or Geotechnical Engineer determine the structure to be in jeopardy by grading operations this distance may be increased.
- C. Excavate subsoil to accommodate building foundations, slabs-on-grade, curbing, and site structures, construction operations, etc.
- D. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 312323.
- E. Slope banks with machine to angle of repose or less until shored.
- F. Do not interfere with 45 degree bearing splay of foundations.
- G. Grade top perimeter of excavation to prevent surface water from draining into excavation. Hand trim excavation. Remove loose matter.
- H. Notify Architect/Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- I. Do not excavate wet subsoil unless authorized as "unsuitable material".
- J. When excavating through roots, perform work by hand and cut roots with sharp ax.

3.3 TOLERANCES

- A. Bottom of Footings: Excavate in excess of required dimension on detail from true line and grade.
- B. Sides of Footings: Excavate in excess of required dimension on detail from centerline of true alignment.

- C. Excavation for Misc. Structures: Plus or minus 0.04 foot (0.5 in) (13 mm) from true line and grade.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Assurance: Field inspection and testing. Geotechnical Engineer.
- B. Prevent soil in excavated areas previously considered suitable from becoming "unsuitable" due to rainfall or surface runoff and ponding. Measures to protect subgrade shall include, but not be limited to, delaying final excavation of bottom 8" of material to just prior to finished product placement, or installing a protective layer of lean concrete.
- C. Provide for visual inspection of bearing surfaces. Place no footing until soil bearing capacity has been verified by the Geotechnical Engineer.

3.3 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

SECTION 312317
UTILITY TRENCHING AND BACKFILLING

PART 1 GENERAL

1.1 SECTION INCLUDES (But is not limited to)

- A. Excavating trenches for utilities from inlets to indicated points of connection to municipal utilities, source, outfall, etc., as applicable.
- B. Compacted backfill from top of utility cover bedding/initial backfill to subgrade elevations.

1.2 RELATED SECTIONS

- A. Section 310900 - Geotechnical Engineering, Inspections, and Testing.
- B. Section 310513 - Soil Materials.
- C. Section 310516 - Aggregate Materials.
- D. Section 311000 - Site Preparation and Clearing: Preparation for land disturbance. Protection of the work. Demolishing structures. Clearing and grubbing. Stripping and stockpiling topsoil.
- E. Section 312213 - Rough Grading: Subgrade Suitability, Correction of Over-excavation.
- F. Section 329119 - Landscape Grading: Depth of topsoil.
- G. Division 33 - Water, Sanitary Sewer, Storm Drainage, Foundation Drainage Sections, as applicable.
- H. Division 23 - Underground Steam, Condensate, Chilled Water, Refrigerant, Fuel System Sections, etc., as applicable
- I. Division 26 - Underground Electrical and Communication Conduits

1.3 REFERENCES

- A. VDOT "Special Provision for Flowable Backfill" dated March 11, 2010.
- B. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.
- C. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- D. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm)

Drop.

- E. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.4 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.
- B. Bedding: Fill placed under pipe to provide support.
- C. Haunching: Fill placed from bedding to spring line of the pipe, also considered bedding, which further supports pipe in both the horizontal and vertical.
- D. Cover Bedding/Initial Backfill: Fill placed above haunching to protect pipe prior to further backfill.

1.5 FIELD MEASUREMENTS

- A. Verify that survey bench mark, control point, and intended elevations for the Work are as shown on the Drawings.

1.6 COORDINATION

- A. Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

1.7 PROJECT RECORD DOCUMENTS

- A. Accurately record on Project Record Documents the actual locations of existing utilities encountered, by horizontal dimensions, elevations or inverts, and general direction.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Backfill: Type S1 as specified in Section 310513 – Soil Materials.
- B. Coarse Aggregate (Utility Bedding): Type A1 as specified in Section 310516 - Aggregate Materials.
- C. Flowable Backfill: As specified in VDOT "Special Provision for Flowable Backfill" dated March 11, 2010.
- D. Concrete: Lean concrete with a compressive strength of 1,000 psi (7 MPa).

2.2 ACCESSORIES

- A. Buried Utility Warning and Identification Tape: Provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape or manufactured

specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved, with warning and identification imprinted in bold black letters continuously over entire tape length. Warning and identification shall be "CAUTION BURIED WATER LINE/SANITARY SEWER/STORM SEWER BELOW" or similar, as applicable. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

- B. Should Local Governing Authority require separate Detection Wire and Warning/Identification Tape, meet the local requirements regarding materials, function, and placement.

PART 3 EXECUTION

3.1 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Verify that all prerequisite work has been completed. Verify location and elevation of points of connection. Notify Miss Utility.
- C. Protect plant life, lawns and other features remaining as a portion of final landscaping.
- D. Protect bench marks, and any existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Maintain and protect above and below grade utilities which are to remain.

3.2 EXCAVATING

- A. Excavate subsoil required for utilities from origin to destination as indicated.
- B. Cut trenches sufficiently wide to enable safe installation and allow inspection. Remove water or materials that interfere with Work.
- C. Install trench forms of sufficient height and minimum width to reduce the amount of lateral excavation. Portions of excavations may approach adjacent property lines, pins, landscaping and tree root systems which shall be protected.
- D. Do not interfere with 45 degree bearing splay of foundations or as otherwise indicated by Geotechnical Engineer in Soils Report or from their field inspection.
- E. Hand trim excavation, including joints, as necessary. Remove loose matter.
- F. Remove any lumped subsoil, large stones, or other hard matter which could damage pipe or impede consistent backfilling or compaction.
- G. Cut out soft areas of subgrade not capable of compaction in place. See Section 312213 – Rough Grading for Subgrade Suitability. Backfill per schedule this

section.

- H. Correct areas over-excavated in accordance with Section 312213 – Rough Grading.
- I. Stockpile excavated material, if suitable for use and required for rough grading, in area designated on site, and remove excess material from site.

3.3 BEDDING & HAUNCHING

- A. Place Geotextile fabric, if applicable, as indicated in details in coordination with appropriate lifts of fill.
- B. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place bedding and haunching to spring line of pipe and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.

3.4 BACKFILLING

- A. Backfill trenches with unfrozen fill materials per applicable utility trench section to proposed subgrade per finished contours and elevations allowing for topsoil or pavement as applicable.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Backfill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.
- D. Employ a placement method that does not disturb or damage utilities in trench or any adjacent work.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Place Buried Utility Warning and Identification Tape continuous over each separate run of piping. Bury tape with printed side up and at the location indicated in the trench sections on the Drawings.
- G. Remove surplus fill materials from site.
- H. Leave fill material stockpile areas completely free of excess fill materials and restore to applicable proposed finished surface condition.

3.5 COMPACTING

- A. Percentage of maximum density requirements:
 - 1. Compact virgin subsoil (bottom of excavated trench) and each layer of backfill due to over-excavation to 95 percent of maximum dry density at +/-3% optimum moisture content as determined by ASTM D698

(Standard Proctor).

2. Compact each layer of backfill to not less than the scheduled percentages of maximum dry density at +/-3% optimum moisture content as determined by ASTM D698 (Standard Proctor).

- B. Equipment: Use power-driven hand tampers for compacting materials adjacent to structures and in trenches. Provide equipment capable of adding moisture to the soil material or for aerating the soil as determined necessary by moisture-density tests.
- C. Moisture Conditioning: Uniformly apply water in such a manner as to prevent free water appearing on the surface, either during or subsequent to compaction operations. Compaction by flooding is prohibited.
- D. Re-fill, re-grade and re-finish any area that becomes unsatisfactory due to freeze-thaw, erosion or settling. All areas or portions thereof that do not meet minimum density requirements shall be reworked and compacted until they meet the project density requirements.

3.6 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1-1/2 inches (0.12 ft) (37 mm) from required elevations.
- B. This tolerance shall not relieve the Contractor from providing minimum sections of finish surfaces or meeting critical spot grades shown on drawings.

3.7 FIELD QUALITY CONTROL

- A. Compaction testing will be performed in accordance with ASTM D698 (Standard Proctor) and ASTM D3017 (Moisture Content).
- B. Field testing methods shall be as deemed appropriate by the Project Geotechnical Engineer.
- C. Request inspection prior to and immediately after placing bedding.
- D. Frequency of Compaction Tests: One per lift per 200 LF of trench or fraction thereof.
- E. If tests indicate Work does not meet specified requirements, remove unacceptable Work, replace, compact, and retest.

3.8 PROTECTION OF FINISHED WORK

- A. Re-fill, re-grade and re-stabilize any area that becomes unsatisfactory due to freeze-thaw, erosion or settling, or vehicular traffic during construction.

3.9 SCHEDULE: See applicable trench sections on Drawings.

- A. Backfill Under Asphalt Pavement, Concrete Flatwork, and Road Shoulders:

1. To pavement subgrade, compacted to 100 percent.
- B. Backfill Through Embankments Under Grass Areas:
 1. To specified depth of topsoil below finish grade, compacted to 90 percent.
See Section 329119 - Landscape Grading.
- C. Backfill Under Grass:
 1. To specified depth of topsoil below finish grade, compacted to 90 percent.
See Section 329119 - Landscape Grading.
- D. Backfill Under Landscaped Areas:
 1. To 12 inches (300 mm) below finish grade, compacted to 90 percent.
- E. Backfill to Correct Over-excavation:
 1. Flush to required subgrade elevation, compacted to 95 percent. On a case by case basis, as approved by the Engineer, lean concrete to minimum compressive strength of 1000 psi (7 MPa) may be allowed.

END OF SECTION

SECTION 312318 ROCK REMOVAL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Removal of identified and discovered rock during excavation.
- B. Expansive tools to assist rock removal.
- C. Blasting is prohibited.

1.2 RELATED SECTIONS

- A. Appendix: Subsurface Investigation Report: Rock and weathered rock locations and depths.
- B. Section 312213 - Rough Grading: Subsoil materials. Backfilling.
- C. Section 312316 - Excavating: Building component excavation.
- D. Section 312323 - Backfilling: Backfill materials.
- E. Section 312513 - Utility Trenching & Backfilling: Utility excavation, backfill and compaction.

1.3 UNIT PRICE –PAYMENT

- A. Excavation and replacement of Rock shall be performed in accordance with the Bid Form. Identification and in situ measurement by the project Geotechnical Engineer shall be prerequisites for payment.

1.4 DEFINITIONS

- A. Definitions of Rip Rock, Blast Rock, and for Blast Rock for Trench Excavations shall be as defined within the Subsurface Geotechnical Report found with the Appendix. "Blast Rock" definitions shall refer to rock to be removed by mechanical means. Blasting onsite shall not be permitted.

1.5 SCHEDULING

- A. Schedule Work to avoid disruption to work in occupied buildings nearby.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Division 01.
- B. Verify site conditions and note subsurface irregularities affecting work of this section.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Deliver materials to job-site in their original, unopened containers, with all labels intact and legible at the time of use and bearing the manufacturer's warnings to be observed in the handling and use of chemicals.
- C. Provide adequate protection of all materials and equipment before, during and after execution of the Work.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

- A. Excavate and remove rock by the mechanical method.
- B. Drill holes and utilize expansive tools, wedges, or mechanical disintegration compound to fracture rock.
- C. Cut away rock at bottom of excavation to form level bearing.
- D. Remove shaled layers to provide sound and unshattered base for foundations.
- E. In utility trenches, excavate to 12 inches (300 mm) below invert elevation of pipe and 24 inches (600 mm) wider than pipe diameter.
- F. Remove excavated materials from site.
- G. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 312323 - Backfilling.

3.4 FIELD QUALITY CONTROL

- A. Provide for visual inspection of foundation bearing surfaces and cavities formed by removed rock

END OF SECTION

SECTION 312323 BACKFILLING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Building perimeter and site structure backfilling to subgrade elevations.
- B. Site backfilling.
- C. Fill under slabs-on-grade.
- D. Fill in landscaped beds/areas.
- E. Fill for over-excavation.
- F. Consolidation and compaction as scheduled.

1.2 RELATED SECTIONS

- A. Appendix: Geotechnical report; bore hole locations and findings of subsurface materials.
- B. Section 310900 - Geotechnical Engineering, Inspection, and Testing: Geotechnical Engineer.
- C. Section 310513 - Soil Materials.
- D. Section 310516 - Aggregate Materials.
- E. Section 312316 - Excavating.
- F. Section 312317 - Utility Trenching & Backfilling: Backfilling of utility trenches.
- G. Section 334600 - Subdrainage: Filter aggregate and filter fabric.
- H. Section 329119 - Landscape Grading: Filling of topsoil to finish grade elevation.
- I. Section 033000 - Cast-in-Place Concrete: Concrete materials.

1.3 REFERENCES

- A. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

- C. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- D. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- E. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.4 SUBMITTALS FOR REVIEW

- A. Samples: Submit to testing laboratory, in air-tight containers, 10 lb (4.5 kg) sample of each type of subsoil fill from each source to be used.
- B. Samples: Submit to testing laboratory, in air-tight containers, 10 lb (4.5 kg) sample of each type of aggregate fill from each source to be used.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Refer to specific trench sections provided on the Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify sub-drainage, damp proofing, or waterproofing installation has been inspected.
- B. Verify structural ability of unsupported walls to support loads imposed by the fill. Allow necessary time for curing and provide adequate bracing prior to backfilling.

3.2 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Type A4 fill and compact to density equal to or greater than requirements for subsequent fill material.
- C. Scarify and proof roll subgrade surface to a depth of 1 inch (13 mm) to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

- A. Backfill areas to contours and elevations with unfrozen materials.

- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Place geotextile fabric over Type A2 fill prior to placing next lift of fill.
- D. Soil Fill Type S1: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.
- E. Employ a placement method that does not disturb or damage other work.
- F. Maintain optimum moisture content of backfill materials to attain required compaction density.
- G. Backfill against supported foundation walls and retaining walls. Do not backfill against unsupported walls.
- H. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- I. Maintain minimum grade away from building per Section 312213 – Rough Grading.
- J. Make gradual grade changes. Blend slope into level areas.
- K. Stockpile in sufficient quantities to meet Project schedule and requirements where specified in Section 312213 – Rough Grading. Remove excess material and material unsuitable for reuse as fill from site.

3.4 TOLERANCES

- A. Top Surface of Backfill (Subgrade): Plus or minus 0.1 foot (30 mm) within 100 feet of buildings, under all pavement and site improvements (such as athletic/play fields); and 0.25 foot (75 mm) on surrounding fields and slopes.

3.5 FIELD QUALITY CONTROL

- A. Section 310900 - Geotechnical Engineering, Inspection, and Testing.
- B. Compaction testing will be performed in accordance with ASTM D698.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

- D. Frequency of Tests: Meeting requirements listed in Section 312213 – Rough Grading

	<u>Max. Lift Thickness</u>	<u>Tests (per Lift)</u>
Backfills (Exterior)	8"	1 per 2,500 s.f.
Under Paving, Curbs, Walks, Footings, and Slabs on Grade	8"	1 per 1,000 s.f.

3.6 PROTECTION OF FINISHED WORK

- A. Reshape and re-compact fills subjected to vehicular traffic.

3.7 SCHEDULE

- A. Interior Crawl Spaces:
1. Fill Type S1, sufficient to equalize load on wall exterior, compacted to 90 percent.
- B. Interior Slab-On-Grade:
1. Fill Type S1, per section on Drawings, compacted to 95 percent,
 2. Cover with Fill Type A3, per section on Drawings, compacted to 95 percent.
- C. Exterior Side of Foundation Walls, Retaining Walls and Over (geotextile protected) Granular Filter Material and Foundation Perimeter Drainage Stone:
1. Fill Type S1, per structural details to subgrade elevation, each lift, compacted to 90 percent.
- D. Fill Under Grass Areas:
1. Fill Type S1, to rough grade, compacted to 90 percent.
- E. Fill Under Landscaped Areas:
1. Fill Type S1, to rough grade, compacted to 90 percent.
- F. Fill For Berming:
1. Fill Type S1, to rough grade, compacted to 95 percent.
- G. Fill Under Asphalt or Concrete Paving:
1. Compact subsoil to 100 percent of its maximum dry density.
 2. Fill Type A4, to depth of pavement below finish paving elevation per pavements sections, compacted to 100 percent.
- H. Fill to Correct Over-excavation:
1. Lean concrete to minimum compressive strength of 1000 psi (7 MPa), OR
 2. Fill Type A4, flush to required elevation, compacted to 100 percent.

END OF SECTION

SECTION 312513
EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 WORK INCLUDED (But is not limited to)

- A. Furnish all labor, equipment and materials to complete and maintain Erosion and Sediment Control (ESC) measures necessary to prepare for and control proposed land disturbance per local and state regulations.
- B. Responsible Land Disturber defined.
- C. Install ESC Structures and Measures.
- D. Maintain Effectiveness of Structures and Measures.
- E. Control Water Run-off.
- F. Control Dust Accumulation.
- G. Control Amount of Disturbed/Unstabilized Area.
- H. Temporary and Permanent Stabilization of Disturbed Areas.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 00 & 01: Permits, Fees, & Notices: Land Disturbing Permit.
- B. Section 311000 – Site Preparation & Clearing: Topsoil Stripping and Stockpiling.
- C. Section 312213 – Rough Grading: Site subgrade contouring.
- D. Section 312316 – Excavating and Filling: Excavating for other than linear utility work.
- E. Section 312323 – Backfilling: Backfilling for other than linear utility work.
- F. Section 312317 – Utility Trenching & Backfilling.
- G. Section 334100 – Site Storm Drainage System.
- H. Section 329119 – Landscape Grading: Topsoiling.
- I. Section 329219 – Seeding: Temporary Seeding. Permanent Seeding. Dry-Seeding Mulch. Hydroseeding Mulch. Liquid Mulch Binder. Erosion Control/Revegetation Mats. Staples. Hydroseeding. Soil Supplements.
- J. Section 329223 – Sodding.

1.3 REFERENCES

- A. ~~Virginia Erosion & Sediment Control (ESC)~~ Stormwater Management (VSM) Handbook: Temporary seeding, construction entrances and other measures or practices which may apply.
- B. Virginia Department of Transportation (VDOT) "Road & Bridge Standards & Specifications": Outlet Protection, Channel Sections, Materials, Installation of Measures, etc. (but excluding references to measurement and payment).

1.4 DEFINITIONS

- A. Local Governing Authority (LGA) - The state agency, plan approving authority, municipal department or other entity which legally has jurisdiction over the referenced work or activity. This usually means the field official who makes or controls onsite inspections of the Work.

1.5 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all requirements of the Virginia Erosion & Sediment Control Law pertaining to this project as presented in the ~~Virginia Erosion & Sediment Control~~ VSM Handbook.
- B. Erosion & Sediment Control (ESC):
 - 1. The Contractor shall employ a Responsible Land Disturber who is certified by the Department of Conservation and Recreation. The name of this person is to be designated in writing by the Contractor to the State ESC plan approving authority (LGA) and the Owner along with copies of their certification prior to any land disturbance. The Responsible Land Disturber for this project shall be in charge of and is responsible for carrying out the land-disturbing activities on this project. The certified Responsible Land Disturber may change at any time during the life of this project, as long as the State ESC plan approving authority is notified in advance and in writing.
 - 2. Obtain and pay for such land disturbing permits as required by the plan approving authorities, including fees and bonds, per Division 0 & 1.
 - 3. The Contractor shall not begin land disturbance until all required permits have been obtained and, if required, posted at the site. Permits may include, but are not limited to, the following:
 - a) Local (or State) Land Disturbance Permit.
 - b) Virginia Stormwater Management Program (VSMP) Permit.
 - 4. The plans have been drawn according to specifications of the ~~Virginia Erosion and Sediment Control~~ VSM Handbook (Latest Edition) and pertinent state regulations. The ESC Narrative shall be considered part of these Contract Documents as required by the State ESC plan approving authority (LGA).

1.6 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures: Submittals.
- B. All products identified in PART 2 of this specification.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All Erosion and Sediment Control materials shall conform to the standards set forth in the ~~ESG~~ VSM Handbook unless indicated as VDOT Std. in which case they shall conform to the "Road & Bridge Stds. & Specs."
- B. Construction Entrance Stone: Provide in accordance with the ~~ESG~~ VSM Handbook ~~Std. & Spec. 3.02~~ C-SCM-03.
- C. Construction Road Stabilization Stone: Provide in accordance with ~~ESG~~ VSM Handbook ~~Std. & Spec. 3.03~~ C-SCM-02. Within areas to be paved and once rough grade has been obtained, the Contractor may use pavement base material as specified and/or indicated in the pavement section on Drawings.
- D. Outlet Protection or Storm Water Conveyance Channel Stone: Provide in accordance with VDOT Std. EC-1 Erosion Control Stone and Spec. 414.03(e) Erosion Control Stone. Stone shall be sound, durable, non-erodible shot rock or rock excavation free from seams, cracks, and other structural defects. Also see sized indicated on the Drawings.
- E. Outlet Protection Stone Geotextile Fabric for bedding shall conform to VDOT Std. & Spec. Section 245, which includes but is not limited to meeting the following requirements: apparent size opening equal to or greater than No. 50 sieve as tested per ASTM D4751, tensile strength @ 20% maximum elongation of 30 lbs/linear inch minimum as tested per VTM-52, puncture strength of 80 lbs minimum as tested per ASTM D4833, and have seams equal in strength to the basic material. Submit written documentation of test results from an independent commercial lab verifying that material meets specified requirements.
- F. Silt Fence: Woven fabric for use as silt fence around inlets or to protect slopes.
 - 1. Manufacturer - Product:
 - a) Amoco - Propex Silt Stop
 - b) Mirafi, Inc. - Mirafi 100X, Envirofence
 - c) Exxon - GTF 101-S
 - 2. Posts for staking silt fence shall be 1" x 2" wood with a minimum length of 48".

- G. Filter Fabric: Non-woven fabric for use in foundation drain systems, dry wells, lining beneath EC Stone, etc..
 - 1. Manufacturer - Product:
 - a) TC Mirafi – Mirafi 180N
 - b) Amoco Fabrics and Fibers Co. – ProPex 4547
 - c) Reemay, Inc. – Typar 3401
- H. Temporary & Permanent Seeding and Related Items: Provide in accordance with Section 329219 – Seeding.
- I. Water: Water shall be potable and provided in accordance with Section 015100 – Temporary Utilities: Temporary Water.

PART 3 EXECUTION

3.1 GENERAL

- A. Accept premises as found. Owner assumes no responsibility for conditions of the site or continuation of conditions existing at the time of advertisement.
- B. Temporary erosion and sediment control measures are required during construction and shall be installed prior to any clearing, grading or other construction, and to the minimum standards and specifications of the ~~ESC~~ VSM Handbook. Comply with all minimum standards of the Virginia Erosion and ~~Sediment Control~~ Stormwater Management Regulations, ~~4VAC50-30-40~~ 9VAC25-875 of the Code of Virginia.
- C. Permanent storm water management measures are required for the project and shall be installed to the minimum standards and specifications of the ~~ESC~~ VSM Handbook. Comply with all minimum standards of the Virginia Erosion and Stormwater Management Regulations, ~~4VAC3-20~~ 9VAC25-875 et seq.
- D. The erosion control and storm water management plans as approved by the LGA shall be made part of these Contract Documents. This includes the ESC Narrative.
- E. Prior to initial disturbance of earth, comply with all applicable standards and ordinances to prevent soil erosion and siltation. Install, construct and maintain such measures as shown on Drawings and all others as required by the inspecting authorities having jurisdiction.
- F. Be responsible for satisfying any and all erosion control and storm water management requirements for any land disturbing activities, including but not limited to on-site or off-site borrow, on-site or off-site stockpiling or disposal of waste materials. Before undertaking any land disturbing activity for which the Contract Documents do not specifically address erosion control and storm water management (such as off-site borrow and waste areas), contact the Regional Office of the Division of Soil and Water Conservation (SWC) or other LGA to determine what Erosion Control and storm water management measures are necessary. Completely satisfy all requirements of the LGA, including payment of design, review, and permit expenses, before continuing with the concerned activity.
- G. Dust Control: Any material which will result in dust shall be wet down during the

work.

- H. Use whatever means necessary to prevent mud and dirt from being carried onto public streets.
- I. Should mud and dirt accumulate on streets execute immediate cleaning methods to remove accumulation.

3.2 PREPARATION

- A. Assure that all pertinent required permits have been obtained.
- B. Notify LGA of intent to begin work.
- C. Verify that existing trees/plant life designated to remain, are conspicuously marked as such.

3.3 PROTECTION

- A. Protection of adjacent properties and waterways: Prior to any land disturbance activity install Erosion and Sediment Control measures. See Site Drawings for specific practices required to prevent soil from washing from areas disturbed during clearing operations. Maintain all ESC measures required.
- B. Protection of Existing Trees and Vegetation:
 - 1. Provide protection for existing trees, plant growth, and features designated to remain against compacting the root zone, unnecessary cutting, breaking, skinning of roots, or bruising of bark. Conform to details and specifications of the ~~ESC~~ VSM Handbook for methods of protection.
 - 2. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to the Architect.

3.4 EROSION & SEDIMENT CONTROL MEASURES

- A. General:
 - 1. The LGA reserves the right to require more ESC measures if field observation of in place measures shows they are inadequate for the task.
 - 2. Maintain erosion control during construction until permanent pavement, plantings and restoration of natural areas is effective in controlling erosion.
 - 3. Plan and execute construction by methods to control surface drainage from cut, fill, borrow and grading areas.
 - 4. Minimize amount of bare soil exposed at one time.
 - 5. Schedule operations so ground surface will be disturbed for shortest possible time before permanent construction is installed.
 - 6. Maintain large areas as flat as practicable to minimize soil transfer through surface flow.
 - 7. Storm Drainage System: Install as much of permanent system as soon as practicable and divert surface water into system, with remainder of system installed as soon as conditions allow. Coordinate with Section 334100 - Site Storm Drainage System.

8. Repair washed and eroded areas. Re-establish required grades, densities, elevations, profiles and contours. Re-seed as required.
- B. Temporary Construction Entrance:
1. A construction entrance is required at all locations where construction vehicles enter a public right-of-way. During wet weather conditions, clean the wheels of construction vehicles prior to their accessing public streets.
 2. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.02~~ C-SCM-03, to the extent shown on Drawings.
 3. No point of vehicular access onto the disturbed earthen portion of the site shall be utilized other than the Construction Entrance (CE) shown on Drawings. Access is allowed from pavement directly onto Construction Road Stabilization (CRS) but not from CRS onto disturbed earth.
 4. Place stone to the dimensions shown on Drawings (default: 12' width x 70' length, minimum) and at a depth of 6 inches minimum. A wash rack and temporary water service may be required by the LGA at their discretion.
 5. In addition to periodically adding clean stone to the construction entrance and maintaining the edges, the Contractor is required to clean all mud, soil and debris from public roadways which originates from the project site on a daily basis.
- C. Construction Road Stabilization:
1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.03~~ C-CSM-02, as required for the job trailer, construction parking, building access, and storage.
 2. Additionally 6-inch depth of roadway base stone shall be placed immediately after final subgrade elevations are established in the portions of the site indicated on Drawings. Should additional portions of the site require stabilizing, such as parking areas, the Contractor shall utilize the same stone size and depth as required herein for roads. See pavement sections on Drawings.
- D. Silt Fence:
1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.05~~ C-PCM-04 to the extent shown on Drawings.
 2. Drive posts a minimum of 12 inches into the ground at a maximum spacing of 10 feet. Maximum height above grade shall be 36 inches.
 3. At the base of the posts on the up hill side, excavate a continuous shallow trench.
 4. Staple, wire or attach filter fabric to the post according to the manufacturer's instructions, leaving 8 inches of fabric along the bottom.
 5. Extend bottom surplus of fabric into the trench. Backfill and compact the soil over the trench providing a secure anchor.
- E. Storm Drain Inlet Protection for Drop Inlets:
1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.07~~ C-SCM-04, using filter fabric as herein specified.
 2. Space posts around the perimeter of the inlet at 3 feet on center and drive 12 inches into the ground. The height above-grade of the posts shall be between 15 and 18 inches.
 3. Excavate a shallow trench around the perimeter of the posts.

4. Staple, wire or attach fabric to the posts according to the manufacturer's recommendations, leaving 8 inches of surplus fabric along the bottom.
 5. Extend bottom of fabric into the trench, backfill and compact over the trench.
- F. Storm Drain Inlet Protection for Curb Drop Inlets:
1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.07~~ C-SCM-04, using filter fabric as herein specified.
 2. Place fabric over throat of inlet such that at least 12 inches extends across the top surface of the structure and 12 inches extends across the flow line or gutter line.
 3. Place VDOT #1 stone along the top and gutter line edges of the fabric to anchor the edges, then place stone along throat area of inlet.
- G. Storm Drain Inlet Protection for Culverts:
1. Install and maintain in accordance with ~~ESC Std.~~ & VSM Handbook Spec. ~~3.08~~ C-SCM-05, using material as herein specified.
 2. Space posts around the perimeter of the culvert inlet placed approximately 6 feet up stream from the culvert at a maximum of 3 feet on center and drive 12 inches into the ground. The height above-grade of the posts shall be between 16 and 36 inches.
 3. Excavate a shallow trench around the perimeter of the posts.
 4. Staple, wire or attach fabric to the posts according to the manufacturer's recommendations, leaving 8 inches of surplus fabric along the bottom.
 5. Extend bottom of fabric into the trench, backfill and compact over the trench.
 6. If the above proves of insufficient to provide protection from silt entering the culvert, replace with the Optional Stone Combination as detailed in ~~ESC~~ VSM Handbook ~~Plate 3.08-4~~ Figure C-SCM-05-1.
- H. Outlet Protection or Storm Water Conveyance Channel:
1. After surrounding area has been brought to subgrade, excavate to subgrade elevations for OP or SCC as indicated from finish grade on plans less EC Stone depth in detail.
 2. Compact subgrade to requirements for surrounding subgrade under applicable earthwork section.
 3. Install bedding geotextile fabric in accordance with detail, overlapping joints 6 inches minimum and stapling per manufacturer's recommendations and entrenching entire perimeter of fabric 9 inches. Compact fabric entrenchment to requirements of surrounding subgrade.
 4. Place, do not dump, Erosion Control Stone to the dimensions and configuration indicated on the applicable detail.
- I. Erosion Control/Re-vegetation Mat:
1. Install Erosion Control Mat in accordance with VDOT Std. EC-2 or EC-3 in the locations shown on Drawings or as otherwise indicated.
 2. Install Re-vegetation Mat in the locations shown on Drawings or otherwise indicated. Mat shall conform to Part 2 of Section 329219 - Seeding.
 3. Shape and grade the channel or slope; remove all rock and debris.
 4. Place and compact topsoil to the depth previously specified.
 5. Apply fertilizer, lime and seed at the rates specified for seeded lawn areas in Section 329219 – Seeding.
 6. Place and secure the mat as described in Part 3 of Section 329219 –

Seeding.

- J. Temporary Check Dams in Swales:
1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.20~~ C-SCM-07.
 2. Place VDOT #1 stone in locations as necessary to control erosion such that the entire width of the swale is guarded. The maximum height of the dam shall not exceed 24 inches. The center portion shall be 6 inches lower than the outer edges.
 3. Upstream and downstream faces of the dam shall be sloped 2 feet horizontally for every one foot of height.
- K. Temporary Right-of-Way Diversion
1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.14~~ C-SCM-07.
 2. Place VDOT #1 stone or compacted earth at a maximum of 18 inches in height.
 3. Spacing shall be as specified in Table ~~3.14.A~~ C-ECM-07-2 at a maximum and as shown on the Drawings.
 4. All diversions shall be directed to an adequate receiving channel, pipe, or system.
 5. Adjust locations based upon field observations and changing site conditions.
- L. Temporary Sediment Trap
1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.13~~ C-SCM-11.
 2. Coordinate locations with other diversion measures.
 3. Contributing drainage areas shall not exceed 3.0 acres. Field adjust measures and diversions during construction where conditions cause drainage areas to approach the maximum 3.0 acres of drainage area.
 4. Perform maintenance inspections regularly along with cleanout procedures when measures approach 50% of the accumulated sediment depth.
- M. Sediment Basin (temporary) / Detention Basin (permanent):
1. Install sediment basin in accordance with and at the location shown on the Drawings. This shall be part of the first work accomplished since it is the primary measure to control sediment from leaving the site from further land disturbance.
 2. Basin shall double as the permanent detention basin and as such shall be carefully constructed to assure the long-term water restraining integrity of the earthen berm. Berm construction shall be performed in accordance with Virginia Stormwater Management Handbook (Latest Edition), Section ~~3.04~~ P-SUP-01, Earthen Embankments.
 3. Extreme care shall be taken when closing the berm across the existing drainage channel since it drains a large, developed area.
 4. As a sediment basin, the primary outlets shall be modified as detailed on the plans to act as dewatering devices.
 5. Upon stabilization of the site, the sediment basin shall be converted to the detention basin by cleaning out any sediment, dressing to rough grade, topsoiling to finished grade, seeding, and landscaping. The dewatering device shall be removed and all orifices cleanly trimmed (square, sharp,

without burrs, and removing any bends, tees or caps used for the dewatering device installation both inside and outside the outlet structure. Any concrete channel lining or pads proposed within the basin shall also be placed at this time.

N. Temporary Seeding:

1. Temporary seeding shall be applied to denuded areas within seven (7) days after final grade has been established and to portions of the site which may not be at final grade but which will remain inactive for more than 30 14 days and less than one year. Lawn areas and slopes may be topsoiled and permanently seeded only if this can be accomplished during the correct time of year for the permanent seed mixture specified in Section 329219 – Seeding. Permanent Seeding is required for areas which will remain dormant for more than one year.
2. Where the area is compacted, crusted or hardened, the soil surface shall be loosened by disking, raking, harrowing or other means.
3. Apply lime at a rate of 50 pounds per 1000 sq. ft. and ~~5-10-10~~ 10-20-10 fertilizer at ~~40~~ 14 pounds per 1000 sq. ft. Thoroughly mix into loosened soil.
4. Seed shall be evenly applied at a rate of 1-2 lbs. per 1000 sq. ft. to the prepared ground and mulched.
5. Slopes greater than 3:1 shall be hydroseeded. Other areas may be hydroseeded or dry seeded at the Contractor's option.
6. Hydroseeding operations shall include seed, fertilizer, mulch and binder in one operation. Areas which are hydroseeded from 6/1 to 9/1 or 12/1 to 3/1 shall be mulched with straw. Wood fiber mulch shall not be used during these times.
7. After mulching of dry seeded areas, mulch shall be stabilized using a liquid binder. Portions which continue to lose mulch due to wind or runoff shall be further stabilized with mulch stabilization netting. Install netting according to Section 329219 – Seeding.
8. Areas which fail to establish initial vegetative cover adequate in checking erosion shall be re-seeded as soon as such areas are recognized. Matting and blankets shall be installed on areas which fail to establish subsequent vegetative efforts.

O. Topsoil/Soil Materials Stockpile: Do not stockpile in drainage ways or within the drip line of trees. Stockpile to a depth not exceeding 8 feet (2.5 m) and with side slopes not exceeding 2H:1V. Protect from wind and water erosion and from admixture of debris.

P. Tree Protection:

1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3-38~~ C-SSM-01 to the extent shown on the Drawings, unless detailed otherwise. Also refer to Section 311000 – Site Clearing and Preparation and Section 312323 – Backfilling for filling within drip lines of vegetation to remain.
2. The limits of clearing shall be beyond the drip line of existing trees to remain.
3. Prior to clearing the site, protected trees shall be clearly identified with a bright colored surveyor's ribbon applied in a band circling the tree at heights of 4 and 8 feet.

4. No equipment, building materials or topsoil shall be placed within the drip line of protected trees.
5. 40 inch high snow fence shall be placed at the limits of clearing (drip line). Fence shall be maintained at all times.

3.5 REMOVAL OF TEMPORARY EROSION AND SEDIMENT CONTROLS

- A. Remove temporary erosion and sediment control measures within 30 days after permanent lawn areas have become substantially established as defined in Section 329219 - Seeding or after the temporary measures are no longer required as determined and authorized by the local program administrator. Permanently stabilize disturbed soil areas resulting from the disposition of temporary measures to prevent further erosion.

END OF SECTION

SECTION 313116
TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Soil treatment with termiticide.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of termite control product.
 - 1. Include the EPA-Registered Label for termiticide products.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For termite control products, from manufacturer.
- B. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Termiticide brand name and manufacturer.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes used, and rates of application.
 - 6. Areas of application.
 - 7. Water source for application.
- C. Warranties: Sample of special warranties.

1.5 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures: Submittals.
- B. All products identified in PART 2 of this specification.

- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- B. Source Limitations: Obtain termite control products from single manufacturer.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.8 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

- 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. BASF Corporation, Agricultural Products; Termidor.
 - b. Bayer Environmental Science; Premise 75.
 - c. FMC Corporation, Agricultural Products Group; Dragnet FT, Talstar, Prevail.
 - d. Syngenta; Demon TC, Prelude, Probuild TC.
2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified

concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

SECTION 321216
ASPHALT PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Asphaltic Concrete Paving; surface/wearing course and base/binder course.
- B. Surface sealer, primer/tack coat.
- C. Aggregate Base Course; depth and compaction.

1.2 RELATED SECTIONS

- A. Appendix: Subsurface Investigation/Geotechnical Report (for Contractor's use).
Geotechnical Engineer.
- B. Section 310900 - Geotechnical Engineering, Inspection, and Testing.
- C. Section 310513 - Soil Materials: Testing aggregate materials.
- D. Section 310516 - Aggregate Materials: Aggregate Base Course. Testing
aggregate materials.
- E. Section 312213 - Rough Grading: Site subgrade contouring. Preparation of site
for paving and base. Compaction testing.
- F. Section 312316 - Excavating: Excavating for other than linear utility work.
- G. Section 312323 - Backfilling: Backfilling for other than linear utility work.
- H. Section 312317 - Utility Trenching & Backfilling.
- I. Section 334100 - Site Storm Drainage Systems.
- J. Section 321723 - Pavement Marking & Signage.
- K. Section 329119 - Landscape Grading: Topsoil depth. Adjacent surface rough
grade.

1.3 DEFINITIONS

- A. Local Governing Authority (LGA) - The state agency, municipal department or
other entity which legally has jurisdiction over the referenced work or activity. This
usually means the field official who makes or controls onsite inspections of the
work.

1.4 REFERENCE STANDARDS

- A. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.
- B. Manual of Uniform Traffic Control Devices (MUTCD, including Virginia supplement), latest edition.
- C. Americans With Disabilities Act (ADA): 28 CFR Part 36, Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities; Final Rule dated July 26, 1991.
- D. Local Governing Authority Regulations pertaining to work of this section (i.e. handicapped parking marking and signage requirements, fire lane marking and signage requirements, etc.).

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with requirements of Reference Standards above. Refer to ACI 304 for any concrete related item not covered in Reference Standard.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with industry standards, the specified requirements and the methods for proper performance of the work of this section.
- C. Asphalt Mixing Plant: VDOT Certified.
- D. Obtain materials from same source throughout.

1.6 SUBMITTALS FOR REVIEW

- A. Submit certification from Asphalt batch plant for proposed mix design of each class of mix for information prior to beginning of work.
- B. All products identified in PART 2 of this specification.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not produce or place asphalt when the weather is rainy or foggy, when the base course is frozen or has excess moisture, or when the ambient temperature is less than 40 degrees F in the shade away from artificial heat.
- B. Other materials shall be placed or installed per manufacturer's recommendations.

1.8 BARRICADES AND SIGNALS

- A. Within public right-of-way, provide and maintain temporary signs, signals, lighting devices, markings, barricades, and channelizing and hand signaling devices in

accordance with DOT D-6.1 to protect personnel and new construction from damage by equipment and vehicles until the surface is approved by the VDOT Inspector, LGA, or Architect/Engineer, as applicable.

- B. On-site, provide and maintain temporary signs, signals, lighting devices, markings, and barricades to protect personnel and new construction from damage by equipment and vehicles until the surface is approved by the Architect/Engineer.

1.9 REGULATORY REQUIREMENTS

- A. VDOT review, approval and inspections per VDOT Stds.

PART 2 PRODUCTS

2.1 AGGREGATE BASE COURSE

- A. Aggregate Base under Asphalt Pavement: Coarse Aggregate Type A4 in accordance with Section 310516 - Aggregate Materials (see Pavement Sections on Drawings).

2.2 ASPHALTIC CONCRETE PAVING

- A. Primer, Tack & Seal Coats: In accordance with VDOT Section 210, Asphalt Materials.
- B. Asphalt Base Course: In accordance with VDOT Section 212.20, Type BM-25.0 bituminous concrete.
- C. Asphalt Surface Course: In accordance with VDOT Section 212.17, Type SM-12.5D bituminous concrete.

2.3 SOURCE QUALITY CONTROL AND TESTS

- A. Section 310900 – Geotechnical Engineering, Inspection, and Testing: Aggregate and asphalt testing. Compaction testing. Geotechnical Engineer.
- B. Have required tests made by Geotechnical Engineer (in lieu of VDOT) per Reference Standard. Submit all required information and results to the Owner. Test asphalt samples for depth and density.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate the Work and verify base conditions. Verify that all pre-requisite work (subsurface utilities, etc.) has been completed and is ready to receive the work of this section. Verify that compacted subgrade is dry and ready to support paving/surfacing and imposed loads. Verify that gradients and elevations of base are correct.
- B. Ensure that all existing utility structures, new or existing, have been adjusted to

meet proposed finished grades prior to paving.

3.2 PLACING AGGREGATE BASE COURSE

- A. For Asphalt Pavement: Begin spreading base material at the point nearest the source of supply. Permit traffic and hauling over the base. Fill ruts formed by traffic and reroll. After base course placement, continue machining and rolling until surface is smooth, compacted, well bonded, and true to the designed cross section. Compact to 100 percent ASTM D-698 maximum dry density. Maintain the base smooth and true to grade and cross section until asphaltic concrete placement.

3.3 PREPARATION

- A. Protect finished surfaces adjacent to asphalt work from overspray, damage by equipment, etc.
- B. For repair work, cut existing surface back to undisturbed material to provide uniform division lines between existing and new work.
- C. Butt new work to existing surfaces to result in smooth transitions and uniform sections.
- D. Before placing surface, inspect the subgrade and base for conformity with the specified section. If necessary, remove or add material to bring all portions of the subgrade and base to proper section and correct elevation. Thoroughly compact and inspect the adjusted section after correcting.
- E. Asphalt Pavement - Primer:
 - 1. Apply a prime coat on the finished stone base course at a rate of 0.25 gallon residual asphalt per square yard. Allow prime coat to cure for a minimum of 48 hours prior to placing asphaltic concrete. Apply cutback asphalts when the stone base course is dry. Lightly spray stone base with water immediately prior to application of emulsified asphalts. During prime coat placement, minimum ambient temperature shall be 50 degrees F and rising. Maintain and protect primed surfaces from damage until asphaltic concrete placement.
 - 2. Apply primer in accordance with VDOT Section 311 - Prime Coat.
 - 3. Apply primer to contact surfaces of curbs and gutters.
 - 4. Use clean sand to blot excess primer.
- F. Asphalt Pavement - Tack Coat:
 - 1. Apply tack coat on existing pavement to be overlaid at a rate of 0.10 gallon residual asphalt per square yard. Thoroughly clean surfaces to receive the tack coat immediately prior to application of tack coat. Tack coat shall be tacky at the time of asphaltic concrete placement.
 - 2. Apply tack coat in accordance with VDOT Standards.
 - 3. Apply tack coat to contact surfaces of curbs and gutters.
 - 4. Coat surfaces of manhole and drainage structure frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

- G. Asphalt Pavement - Seal Coats:
 - 1. Apply asphalt and cover material in accordance with VDOT Section 312 - Seal Coat.

3.4 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Install Work in accordance with VDOT standards.
- B. Place to compacted thickness identified in details on Drawings.
- C. Install drainage tops/frames in correct position and elevation.
- D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- E. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.5 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Place base/binder course to compacted thickness identified in details on Drawings.
- B. Place surface/wearing course within two (2) hours of placing and compacting binder course.
- C. Place surface/wearing course to compacted thickness identified in details on Drawings.
- D. Install drainage tops/frames in correct position and elevation.
- E. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- F. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.6 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch (6 mm) measured with 10 foot (3 m) straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch (6 mm).
- C. Variation from True Elevation: Within 1/2 inch (12 mm).
- D. Assure that drainage swales over pavement function as designed.

3.7 FIELD QUALITY CONTROL

- A. Field testing methods shall be as determined by the Geotechnical Engineer.

3.8 PROTECTION OF ASPHALT

- A. Immediately after placement, protect pavement from premature drying and excessive hot or cold temperatures. Also, protect pavement from mechanical injury for one (1) day or until surface temperature is less than 140 degrees F (60 degrees C).
- B. Do not permit pedestrian traffic over pavement for 7 days minimum after finishing.

3.9 SCHEDULES

- A. Refer to details on the Drawings.

END OF SECTION

SECTION 321313
PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete sidewalks, stairs, integral curbs, curb &/or gutters, median barriers, parking areas, and roads.
- B. Aggregate base course.

1.2 RELATED SECTIONS (including but not limited to)

- A. Section 013300 - Submittals.
- B. Section 014000 - Quality Requirements: Quality Assurance, Mock-ups
- C. Section 014110 - Inspection and Testing.
- D. Section 015700 - Traffic Regulation.
- E. Section 017000 - Execution Requirements: Protection of Completed Work.
- F. Section 310900 - Geotechnical Engineering, Inspections, and Testing.
- G. Section 310516 - Aggregate Materials: Aggregate base course.
- H. Section 312213 - Rough Grading: Preparation of site for paving and base.
- I. Section 312323 - Backfilling: Compacted subbase for paving.
- J. Section 321216 - Asphalt Pavement.
- K. Section 321723 - Pavement Markings & Signage: Pavement markings.
- L. Section 329119 - Landscape Grading: Preparation of subsoil at pavement perimeter.
- M. Section 033000 - Cast-in-place Concrete: Reinforcing, Joints, Curing.
- N. Section 055000 - Misc. Metals: Stair safety nosing and handrails.
- O. Section 079200 - Joint Sealers: Sealant for joints.

1.3 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings.

- B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- C. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
- D. ASTM C33 - Concrete Aggregates.
- E. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- F. ASTM C698 - Test Methods for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- G. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.

1.4 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures.
- B. Product Data: Provide data on joint filler, admixtures, curing compounds and ADA tactile warning mats.
- C. All products identified in PART 2 of this specification.
- D. Submit certification from Concrete batch plant for proposed mix design of each class of mix for information prior to beginning of work.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with requirements of Reference Standards above. Refer to ACI 304 for any concrete related item not covered in Reference Standard. Maintain one copy of the reference utilized onsite with Contract Documents.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with industry standards, the specified requirements and the methods for proper performance of the work of this section.
- C. Concrete Mixing Plant: VDOT Certified.
- D. Obtain materials from same source throughout.

1.6 REGULATORY REQUIREMENTS

- A. Conform to VDOT review, approval and inspections per VDOT Stds.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Materials, other than concrete, shall be placed or installed per manufacturer's recommendations.

PART 2 PRODUCTS

2.1 AGGREGATE BASE

- A. Aggregate for Base Course: Type A3 per Section 310516 - Aggregate Materials.

2.2 FORM MATERIALS

- A. Steel form material, profiled to suit conditions.
- B. Joint Filler (General Pavement): Asphalt impregnated fiberboard, 1/2 inch thick by full depth of concrete pavement less 1/2 inch allowance for joint sealant.
- C. Joint Filler (Curbing): Asphalt impregnated fiberboard, 1/2 inch thick by full depth of VDOT Std. CG-2 (curb only) or CG-6 (curb & gutter) as indicated less 1/2 inch allowance for joint sealant. See Drawings for delineation.
- D. Joint Filler (Petroleum locations): Refer to Section 033000 Cast In Place Concrete.

2.3 REINFORCEMENT

- A. Reinforcing Steel and Welded Steel Wire Fabric: Type specified in Section 033000 - Cast-in-Place Concrete.
- B. Dowels: ASTM A615; 40 ksi (276 MPa) yield grade, plain steel, galvanized finish.

2.4 CONCRETE MATERIALS

- A. Concrete shall be VDOT Std. Class A3 for walks and stairs and Class A4 within traffic bearing areas. See Drawings for delineations.
- B. VDOT Specification Modifications:
 - 1. Slump: Admixtures shall be added to adjust slump to 5.5 inches. Further adjustments shall be made to address workability during hot or cold weather conditions. Adhere to VDOT Specifications for slump when slip forms are used.
 - 2. Curing compounds shall dry clear (no pigment).
- C. Fine and Coarse Mix Aggregates: ASTM C33.
- D. Detectable Warning Surface: Per VDOT Std. CG-12.

- E. Water: Potable, not detrimental to concrete.

2.5 ACCESSORIES

- A. Method of Curing: Membrane Curing Compound meeting requirements of Section 033000 - Cast In Place Concrete.
- B. Joint Sealers: Specified in Section 079200.
- C. Safety Nosing and Handrails: In accordance with Section 055000 - Misc. Metals.
- D. ADA Tactile Warning:
 - 1. Cast Iron Plates: ADA Compliant, Gray Cast Iron Detectable Warning Surface Plates
 - a. Color: Brick Red
 - b. Slip resistant textured iron surface, minimum 0.8 coefficient of friction.
 - c. Purchase the number and size of panels required to create a continuous 2' wide tactile warning strip for the full width of the walkway, as indicated on the plans. Panel sizes should be the largest size available that will fit within the walkway width without requiring cutting or modification of panels. Provide pre-tapered plates to match curves as necessary.
 - d. Install using the "wet-set" method in freshly placed concrete and in strict accordance with manufacturer's installation instructions.
 - e. Erect units without damage to shape or finish, install in locations indicated on the plans. Install flush with surrounding concrete and fully supported by substrate. A variance in grade of any more than 1/4" will not be accepted. Apply slight vibration to fully set panels in fresh concrete.
 - f. Hand tool control joints at edges of panels and in locations shown on drawings. Control joints shall not exceed 6' in spacing.

2.6 FINISH

- A. Finish for exterior flatwork shall be per schedule at the end of this Section.
- B. Edges of exterior flatwork shall be quarter round tooled after broom finish and left with steel troweled appearance and slightest depression below the interior surface.
- C. Crack control joints for exterior flatwork shall be quarter round tooled after broom finish and left with steel troweled appearance and slightest depression below the interior surface.

2.7 SOURCE QUALITY CONTROL AND TESTS

- A. Section 014000 - Quality Requirements: Quality assurance testing.
- B. Section 310900 - Geotechnical Engineering, Inspections, and Testing.

- C. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of work.
- D. Tests on cement and aggregates will be performed to ensure conformance with specified requirements.
- E. Test samples in accordance with ACI 301.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate the Work and verify base conditions under provisions of Div. 1. Verify that all pre-requisite work (subsurface utilities, etc.) has been completed and is ready to receive the work of this section. Verify that compacted subgrade is dry and ready to support paving/surfacing and imposed loads. Verify that gradients and elevations of base are correct.

3.2 PLACING AGGREGATE BASE COURSE

- A. For Concrete Pavement: Place base material of sufficient width to support formed work. Compact to 100 percent ASTM D-698 maximum dry density. Maintain the base smooth, compacted, well bonded, and true to the designed cross section until concrete placement.

3.3 PREPARATION

- A. For repair work, cut existing surface back to undisturbed material to provide uniform division lines between existing and new work.
- B. Butt new work to existing surfaces to result in smooth transitions and uniform sections.
- C. Before placing surface, inspect the subgrade and base for conformity with the specified section. If necessary, remove or add material to bring all portions of the subgrade and base to proper section and correct elevation. Thoroughly compact and inspect the adjusted section after correcting.
- D. Moisten base to minimize absorption of water from fresh concrete.
- E. Coat surfaces of manhole and drainage structure frames with oil to prevent bond with concrete pavement.
- F. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.4 FORMING

- A. Steel forms are preferred. Wood forms with appropriate bracing may be allowed with prior approval of form installations by the Architect. Slip forms shall be used for all curb and gutter applications (with noted adjustment for slump).
- B. Place and secure forms to correct location, dimension, profile, and gradient.
- C. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- D. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.5 REINFORCEMENT

- A. Place reinforcement as indicated in details on Drawings.
- B. Interrupt reinforcement at expansion joints.
- C. Place dowels to achieve pavement and curb alignment as necessary to prevent differential settlement of adjacent work. One end of dowel shall be set in capped sleeve to allow longitudinal movement (typical of all installations).
- D. Provide dowels at expansion joints. Place dowels at 12 feet (3.66 m) OC maximum with two (2) per connection min.
- E. Provide keyed and doweled, longitudinal construction joints at maximum of 12 feet (3.66 m) OC where slabs exceed 500 SF and are not otherwise segmented by expansion joints.

3.6 PLACING CONCRETE

- A. Measure, mix, transport, and place concrete in accordance with ACI 304 unless superseded by VDOT Section 217.10. Curing (clear, no pigment) shall adhere to product manufacturer's recommended instructions. Use of admixtures shall be approved in advance by the Architect.
- B. Do not produce or place concrete when the weather is rainy or foggy, when the subgrade is frozen or has excess moisture, or when the ambient temperature is less than 40 degrees F in the shade away from artificial heat.
- C. Place concrete for curbs and gutters using the slip form technique.
- D. Ensure reinforcement, inserts, embedded parts, formed joints, etc. are not disturbed during concrete placement.
- E. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

- F. Place concrete to pattern indicated. Default to VDOT Spec. if none indicated.

3.7 JOINTS

- A. Place joint filler in pavement pattern placement sequence as indicated on the Drawings. Place joint filler between paving components and building or other appurtenances. Place joint filler where new concrete work meets existing concrete.
- B. For linear work place expansion joints at 30 foot (9 m) intervals unless otherwise indicated. Align curb, gutter, and sidewalk joints where adjacent.
- C. Set top to required elevations. Secure to resist movement by wet concrete.
- D. Recess top of filler ½ inch (13 mm) for joint sealant placement.
- E. Use joint sealant for caulking all joints in concrete pavements and walks.
- F. Provide tooled control joints per VDOT specs to pattern indicated (with 6' OC as default value). Verify pattern with Architect prior to concrete placement.
- G. Provide keyed joints as indicated.

3.8 EXPOSED AGGREGATE

- A. Wash exposed aggregate surface with clean water and scrub with stiff bristle brush exposing aggregate to match sample panel.

3.9 FINISHING & CURING

- A. Finish per schedule at the end of this section. Avoid over-finishing!
- B. Direction of Texturing: Transverse to pavement direction, unless otherwise indicated in schedule.
- C. Tactile Warning: Provide ADA required finish where indicated on Drawings. Finished product shall match sample panel.
- D. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with Manufacturer's instructions.

3.10 JOINT SEALING

- A. Separate pavement from vertical surfaces with ½ inch (13 mm) thick joint filler.
- B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

- C. Extend joint filler from bottom of pavement to within ½ inch (13 mm) of finished surface. Conform to Section 079200 for finish joint sealer requirements.

3.11 CURBS

- A. Install VDOT Std. CG-2 (curb only) and/or VDOT Std. CG-6 (curb & gutter) as delineated on the Drawings. Typically upslope curbing may be curb only. Provide also for dry-pan or reverse gutters at locations required to prevent ponded water. This shall be verified and coordinated in advance with the Architect.
- B. Wiped down or submerged curbs (see details) shall have machined finish matching typical CG-2 finish.

3.12 CONCRETE STAIRS

- A. Place stairs at locations indicated on the Drawings.
- B. Construct per details on the Drawings.

3.13 TOLERANCES

- A. Section 014000 - Quality Requirements: Quality Assurance. Tolerances.
- B. Maximum Variation of Surface Flatness: ¼ inch (6 mm) in 10 ft. (3 m).
- C. Maximum Variation From True Position: ¼ inch (6 mm).

3.14 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection and testing.
- B. Section 310900 – Geotechnical Engineering, Inspections, and Testing.
- C. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.
- D. Three concrete test cylinders will be taken for every 75 or less cu. yds. (57 or less cu m) of each class of concrete placed each day.
- E. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.
- F. One slump test will be taken for each set of test cylinders taken.
- G. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.15 PROTECTION

- A. Section 017000 – Execution Requirements: Protection of Completed Work.
- B. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- C. Do not permit pedestrian or vehicular traffic over pavement for 7 days minimum after finishing.

3.16 SCHEDULE

- A. Area Paving: As detailed on Drawings with Light broom finish as default. Verify with Architect prior to placement of concrete.
- B. Sidewalk Paving: Light broom, radius to ¼ inch (6 mm) radius, and trowel joint edges.
- C. Curbs and Gutters: Light broom.
- D. Inclined Vehicular Ramps: Broomed perpendicular to slope.

END OF SECTION

SECTION 321723
PAVEMENT MARKING AND SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pavement Marking & Related Signage.

1.2 RELATED SECTIONS

- A. Section 013300 - Submittal Procedures.
- B. Section 016000 - Product Requirements: Product delivery and Product Storage and Handling.
- C. Section 017000 - Execution Requirements: Spare Parts and Maintenance Products. Final Cleaning.

1.3 DEFINITIONS

- A. Local Governing Authority (LGA) - The state agency, municipal department, or other entity, which legally has jurisdiction over the referenced work or activity. This usually means the field official who makes or controls onsite inspections of the work.

1.4 REFERENCE STANDARD

- A. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.
- B. Manual of Uniform Traffic Control Devices (MUTCD, including Virginia supplement), latest edition.
- C. Americans With Disabilities Act (ADA): 28 CFR Part 36, Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities; Final Rule dated July 26, 1991.
- D. Local Governing Authority Regulations pertaining to work of this section (i.e. handicapped parking marking and signage requirements, fire lane marking and signage requirements, etc.).

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with requirements of Reference Standards above. Refer to ACI 304 for any concrete related item not covered in Reference Standard. Maintain one copy of the reference utilized onsite with Contract Documents.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and

experienced in the necessary crafts and who are completely familiar with industry standards, the specified requirements and the methods for proper performance of the work of this section.

- C. Obtain materials from same source throughout.

1.6 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures.
- B. Product Data: Provide data on paint materials.
- C. Submit certification from sign supplier for all signage provided that they meet applicable standards above.
- D. All products identified in PART 2 of this specification.

1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Section 016000 – Product Requirements: Product delivery and Product storage and handling.
- B. Deliver products to site in Manufacturer's sealed and labeled containers; inspect to verify acceptability.
- C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- D. Paint Materials: Store all paint materials in a single location at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by Manufacturer's instructions. Protect from danger of combustion.

1.8 REGULATORY REQUIREMENTS

- A. VDOT review, approval and inspections per VDOT Stds.

1.9 QUALIFICATIONS

- A. Applicator: Company specializing in performing work of this section with minimum three years documented experience.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

1.11 WARRANTY

- A. Section 017000 - Execution Requirements: Requirements for warranties.
- B. Furnish one-year manufacturer's warranty for traffic paints.

1.12 EXTRA MATERIALS

- A. Section 017000 – Execution Requirements: Spare Parts and Maintenance Products.
- B. Supply Owner with 1-gallon (4 L) of each color, type, and surface texture of paint material used in the work; store where directed.
- C. Label each container with color, type, texture, and locations where used, in addition to the manufacturer's label.

PART 2 PRODUCTS

2.1 EXISTING SIGNAGE

- A. Existing traffic signage may be reused if not damaged and meeting current specifications.
- B. Existing specialty signage shall be salvaged and relocated to new positions as directed by the Owner.

2.2 PAVEMENT MARKING AND SIGNAGE

- A. Provide all identification, fire lane, traffic control and ADA signage indicated on Drawings and per schedule this section. Signs shall meet minimum standards of local fire department/marshal, ADA and Manual of Uniform Traffic Control Devices (MUTCD, including Virginia supplement) for all components. Sign posts shall meet VDOT Stds. & Specs.
- B. Plans have been reviewed and approved by the local governing authority (LGA). If, upon construction compliance inspection by LGA building inspector, any signage is lacking per requirements of VDOT, ADA or local code, the Contractor shall provide and place such signs as necessary for compliance at no additional cost to the Owner.
- C. For work within public right-of-way, provide pavement marking in accordance with VDOT requirements.
- D. Provide pavement markings in accordance with VDOT Section 704. For travel lane marking on-site use same with omission of glass beads. For parking lot striping use "Ultra Hide" water reducible acrylic latex traffic paint as manufactured by Glidden, Benjamin Moore, Devoe, PPG or Sherwin-Williams or approved equal. Use white for pavement markings, and direction arrows on asphalt (OSHA yellow on concrete) unless otherwise required by reference standards.

- E. Provide temporary markings within the VDOT right-of-way in accordance with VDOT requirements.
- F. Reference ADA requirements and local regulations for handicapped space marking configuration and colors.
- G. Recommended Pavement Marking Manufacturer: Pavement Stencil Company, Roanoke, VA or equal.
- H. Do not hand-finish bollard tops. Where bollards are installed use bollard caps manufactured by Top Gard Construction Products, Noblesville, IN or equal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate the Work and verify pavement conditions. Verify that all pre-requisite work (subsurface utilities, etc.) has been completed and is ready to receive the work of this section. Verify that pavement is ready to support paving/surfacing and imposed loads. Verify that finish grade of lawn areas are correct.
- B. Verify that surfaces or substrate conditions, as applicable, are ready to receive Work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Do not apply paint to concrete surfaces until concrete has cured for 28 days
- E. Verify locations, requirements, and extent of work.

3.2 PREPARATION

- A. Surface Appurtenances: Remove or mask any adjacent or attached items which are not to receive applied material prior to preparing surfaces or finishing.
- B. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

3.3 APPLICATION

- A. Protection: Protect work of other trades, whether being painted or not, against damage by painting. Provide "Wet Paint" signs to protect newly painted surfaces.
- B. Procedure: Apply products in accordance with manufacturer's instructions.
- C. Dry Receiving Surface: Do not apply finishes to surfaces that are not dry. Allow applied coats to dry thoroughly before next coat is applied.

- D. Minimum Coating Thickness: Apply no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Appearance: Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- I. Prime concealed surfaces of woodwork with primer paint.
- J. Acceptance: Owner's representative shall determine quality and consistency of coverage, color and finishes. Remove, refinish or repaint work not complying with requirements.

3.4 PAVEMENT MARKINGS

- A. Unless indicated otherwise, provide lane and edge lines four inches (4") in width. Apply paint after asphaltic concrete has cured for a minimum of seven (7) days, and minimum ambient temperature is 40 degrees F. Apply lane and edge markings per manufacturer's recommendation. Apply paint and markings to clean, dry surfaces, protect adjacent surfaces from damage and protect surfaces from traffic until dry. Provide uniform paint film of sufficient thickness to completely conceal base material.
- B. On-site travel lanes and, excluding within parking lots, shall be marked in accordance with VDOT Spec. Section 704 - Pavement Markings & Markers. Requirements for markers and glass beads will not be required on-site. On-site shall mean not within public right-of-way. Note that the public right-of-way includes the bus loop and access thereto. See Schedule this section.
- C. Roadway improvements within public right-of-way shall be marked in accordance with VDOT Spec. Section 704 - Pavement Markings & Markers. Replace any markings damaged by construction. Pavement markings within public right-of-way shall be Type B.
- D. Place required pavement marking and signage in accordance with ADA or Manual of Uniform Traffic Control Devices (MUTCD including Virginia Supplement), as applicable. See Schedule this section. Provide 36 inch deep by 12" square VDOT Std. Class A3 concrete base for signs. See pavement marking and Exterior Handicap Sign detail on the Drawings.
- E. Travel lane stop bars shall be painted, white lines, twenty-four (24) inches in width and across the entire indicated lane width.

- F. Cross-walks, painted traffic islands, and no parking areas (as shown on plan) shall consist of a six (6) inch wide painted yellow line border, entirely on the asphalt (not spilling over onto concrete gutter, etc.), of the width indicated on the plans, with four (4) inch wide yellow lines painted eighteen (18) inches apart and at forty-five (45) degrees to the border throughout the enclosed area. Verify orientation with Architect prior to painting.

3.5 FIELD QUALITY CONTROL

- A. The Owner reserves the right to engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the project may be taken, identified, sealed and certified in the presence of the contractor. The testing agency will perform appropriate tests as required by the Owner. If tests show material being used does not comply with specified requirements, the contractor shall remove non-complying paint from the site, pay for the testing, and repaint surfaces previously coated with the rejected paint. If necessary, the contractor may be required to remove rejected paint from those surfaces if, on repainting with specified paint, the two coatings are incompatible.
- C. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.
- D. Repair lines and markings, which after application and curing do not meet following criteria:
 - 1. Incorrect Location: Remove and replace incorrectly placed patterns.
 - 2. Insufficient Thickness, Line Width, Paint Coverage, Glass Bead Coverage or Retention: Prepare defective material by acceptably grinding or blast cleaning to remove substantial amount of beads and to roughen marking surface. Remove loose particles and debris. Apply new markings on cleaned surface in accordance with this Section.
 - 3. Uncured or Discolored Material, Insufficient Bonding: Remove defective markings in accordance with this Section and clean pavement surface one foot (300 mm) beyond affected area. Apply new markings on cleaned surface in accordance with this Section.
- E. Replace defective pavement markings as specified throughout warranted period. Replace markings damaged by anti-skid materials, studded tires, tire chains, chemical deicers, snow plowing or other loss of marking material regardless of cause. When markings are damaged by pavement failure or by Owner's painting, crack sealing, or pavement repair operations, Contractor is released from warranty requirements for damaged work.
- F. Prepare list of defective areas and areas requiring additional inspection and evaluation to decide where material may need to be replaced.
- G. Replace failed or defective markings in entire section of defective markings within 30 days after notification when any of the following exists during warranty period:
 - 1. Marking exhibits obvious discoloration or pigment loss.
 - 2. More than 15 percent of area of continuous line within any line segment is missing.

3.6 CLEANING

- A. At the end of each workday, collect empty cans, rags, rubbish, and other discarded paint materials, place in closed metal containers, and remove daily from the site.
- B. After completing painting, clean all paint-splattered surfaces being careful not to cause harm to adjacent finished surfaces. Correct damage caused by painting to the satisfaction of the Owner's representative.
- C. At the completion of construction activities of all other trades, touch up and restore damaged or defaced painted surfaces.

3.7 SCHEDULES

- A. Pavement Marking:
 - 1. Stop Bar where indicated on Drawings measuring 24" deep by full width of asphalt in lane.
 - 2. "ONE WAY" as noted on the Drawings.
 - 3. "DO NOT ENTER" as noted on the Drawings.
 - 4. "STOP" at each stop bar where indicated (each lane as applicable).
 - 5. Traffic directional arrows where indicated on Drawings.
 - 6. LGA's Standard handicapped parking space and isle pavement marking in each handicapped space indicated by symbol on Drawings.
 - 7. Fire lane designation to LGA's Standards as indicated on the Drawings and as required by Fire Marshall.
 - 8. Pedestrian Crosswalk to MUTCD standards at location indicated on Drawings.
- B. Signage (locations as noted on the Drawings):
 - 1. "STOP" at each Stop Bar.
 - 2. "ONE WAY" with appropriate directional arrow
 - 3. "NO PARKING – FIRE LANE",
 - 4. "DO NOT ENTER",
 - 5. Right Turn Sign,
 - 6. LGA's Standard handicapped parking space signage at the head of each space and handicapped access signs,
 - 7. Fire lane designation to LGA's Standards as required by Fire Marshall,

END OF SECTION

SECTION 323113
CHAIN-LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Chain-Link Fences: Commercial.
 - 2. Swing, Sliding, and Automatic Gates.
- B. Related Section s include the following:
 - 1. Division 31 Section "Earthwork" for site excavation, fill, and backfill where chain-link fences and gates are located.
 - 2. Division 03 Section "Cast-in-Place Concrete" for concrete.

1.3 SUBMITTALS FOR REVIEW

- A. All products identified in PART 2 of this specification.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Height shall be 8'-0". Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with ASTM A 392 Class 1 zinc coated steel wire, CLFMI CLF 2445, and requirements indicated below:
 - a. Steel Wire Fabric: 2" No. 9 gauge vinyl coated, color black.

- 2. Selvage: Twisted top and knuckled bottom.
- B. Refer to Details on the Drawings.

2.2 COMMERCIAL FENCE AND GATE FRAMING

- A. Posts and Rails: Round cold-formed, electric-resistance-welded, steel pipe or tubing, with minimum yield strength of 45,000 psi and with outside dimension, minimum wall thickness, and weight complying with ASTM F 761 or ASTM F 654 for the following fence height and strength and stiffness requirements:
 - 1. Duty Rating: Medium.
 - 2. Tube or Pipe Diameter and Thickness: According to ASTM F 761.
 - 3. Tube Size and Thickness: According to ASTM F 654.
 - 4. Metallic-Coated Steel: Posts, rails, and frames protected with an external coating of not less than 0.6 oz. of zinc/sq. ft., a chromate conversion coating, and a clear, verifiable polymer film; with an internal protective coating of not less than 0.6 oz. of zinc/sq. ft. or 81 percent, not less than 0.3-mil- thick, zinc pigmented coating. Posts, rails, and frames shall be vinyl coated or powder coated black as noted on the Drawings.
 - 5. Post, rail, and frame diameters noted on the Drawings are intended as minimum sizes.

2.3 TENSION WIRE

- A. General: Provide horizontal tension wire at the following locations:
 - 1. Location: Extended along top and bottom of fence fabric.
- B. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire complying with ASTM A 817, ASTM A 824, and the following:
 - 1. Metallic Coating: Type II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:
 - a. Class 1: Not less than 0.8 oz./sq. ft. of uncoated wire surface.
 - b. Class 2: Not less than 1.2 oz./sq. ft. of uncoated wire surface.
 - c. Class 3: Not less than 2 oz./sq. ft. of uncoated wire surface.
 - d. Matching chain-link fabric coating weight.

2.4 FITTINGS & HARDWARE

- A. General: Comply with ASTM F 626.
- B. Gates: Center stop drop bar shall interlock with locking device or latch. Locking mechanism shall not require the use of a chain. Locks are not in contract. Provide gate keepers for double swing vehicular gates.
- C. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - a. Hot-Dip Galvanized Steel: 0.106-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

D. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

2.5 SECURITY FEATURES

- A. Barb Wire: ASTM A121 Coating Type Z, galvanized steel; 12.5 gage thick wire, 3-strand or double 3-strand where noted on the Drawings.
- B. Barbed Tape (Razor Wire): Galvanized steel, 0.98" gage, 1" pre-formed width, available in 18" and 24" loop diameter.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.
 1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.
 1. Install fencing on established boundary lines inside property line.

3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment as indicated on Drawings.
- D. Line Posts: Space line posts uniformly at 10 feet o.c.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.
1. Locate horizontal braces at midheight of fabric 6 feet or higher, on fences with top rail and at 2/3 fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric.
1. Bottom Tension Wire: Install tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- H. Chain-Link Fabric: Apply fabric to side facing the public. Leave 1 inch between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.
- J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at 1 end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

- K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

END OF SECTION

SECTION 329000
EXTERIOR PLANTING

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The extent of landscaping is shown on the drawings and shall include, but not be limited to:
 - 1. Supplying and installing trees, shrubs, groundcovers and other plant material.
 - 3. Finished grading of all planting areas.
 - 4. Staking and guying of plant materials.
 - 5. Fertilizing, spraying, pruning and mulching of all plant material.
 - 6. **Plant Guarantee and Maintenance Period.**

1.2 RELATED DOCUMENTS

- A. Section 329119: Landscape Grading.
- D. Section 310513: Soil Materials.

1.3 QUALITY ASSURANCE

- A. All plants shall meet or exceed the specifications as to quality and size as set forth by the plans or in the current edition of ANSI/Z60.1, "American Standard for Nursery Stock" for number one grade nursery stock as adopted by the American Association of Nurserymen, whichever is more stringent. No "park quality" materials will be acceptable. Any change in size shall first be approved by the A/E and Roanoke County. Substitutions will not be allowed unless adequate proof can be demonstrated that a specified plant cannot be found.
- B. Maintenance Instruction: Typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work. Meet with Owner, describe maintenance instruction at site prior to substantial completion.
- C. Chemical Application License: Application of herbicide, insecticides and other chemicals, shall be applied under the direction of a person licensed by the Commonwealth of Virginia to apply such chemicals. The License of the Applicator shall include certification for all plants indicated and be current.

1.4 PRODUCT HANDLING

- A. Deliver all materials to the Site in their original containers with all labels intact and legible at time of installation.
- B. Insofar as is practicable, plant materials shall be planted on the day of delivery. In the event this is not possible, the Contractor shall protect that stock not planted. Protect plants from sun or drying winds. Plants that cannot be planted immediately on delivery shall be kept in the shade, well watered and protected.

Plants shall not remain unplanted for longer than three days after delivery. ALL plants shall be lifted and handled from the bottom of the ball only. Plants moved with a ball will not be accepted if the ball is cracked or broken before or during plant operations. All foliage-bearing plants stored during summer months or winter months shall be treated with anti-dessiccants.

- C. In the event of damage or rejection, immediately make all replacements necessary to the approval of A/E and at no additional cost to the Owner.

1.5 UTILITIES

- A. The exact location of all existing and proposed underground and overhead utilities shall be verified by the Contractor and he shall conduct his work so as to prevent interruption of service and damage to any system. The Contractor shall protect existing structures and utility services and be responsible for their replacement if damaged by him or to make necessary adjustment in their location if required in order to complete the work of this contract.
- B. Should the Contractor damage any utility during his work, he shall replace and/or repair the utility as it existed prior to the damage at his own expense.

1.6 SEQUENCING AND SCHEDULING

- A. Planting time: Proceed with, and complete landscape work as rapidly as portions of site become available. Work within seasonal limitations for each kind of landscape work required.
- B. No planting shall be done in frozen ground, when snow covers the ground or when the site is muddy.
- C. If planting is done during the summer months special precautions will need to be taken to ensure that the plants do not dry out. If it is deemed necessary to plant during these months, plants will be treated with anti-desiccants, and be watered daily.

PART 2 PRODUCTS

2.1 FERTILIZER

- A. All Fertilizer shall be a commercial balanced formula with at least 25% organic material, and shall conform to applicable state fertilizer laws. Fertilizer will be "Briquettes" as manufactured by Wood Ace, or approved equal for trees. It shall be a slow release formula, and used as specified by manufacturer. Fertilizer shall be delivered mixed as specified, in standard size, unopened containers, showing weight, analysis, and name of manufacturer. If stored at the site, it shall be kept in a weatherproof place where its effectiveness will be unimpaired.
- B. Fertilizer for plant installations which occur in the Fall shall be a 5-10-10 analysis. Spring installations shall be 10-10-10 analysis.

2.2 TREE STAKING

- A. Tree Stakes: 2" x 2" wood posts, 8'-0" long.
- B. Rubber Hose: Two-ply, fabric-bearing hose having an inside diameter of not less than one-half inch, black in color.
- C. Guy Wire: Galvanized malleable iron wire No. 14 gauge.
- D. Turn Buckle: 1-5/16" diameter, with 4-1/2" lengthwise opening with threaded ends, and fitted with screw eyes. All parts are to be hot-dipped galvanized.
- E. Ground Anchors: Galv screw-in anchors, minimum 1/2 inch rod, 18 inch length.

2.3 PLANTING SOIL

- A. This shall be a fertile, friable soil typical of the locality. It shall be well drained without mixture of subsoil. It shall be clean and free of clay lumps, stones, roots, and deleterious substances two inches or more in diameter. It shall be a mixture of the following materials in quantities specified:
- B. For tree planting pits use Planting Soil "A". Planting Soil "A" shall be a mixture of the following materials in quantities specified: one part topsoil, and one part soil from the hole. Soil pH shall be maintained between 5.5 and 7.0. In holes which were in rock, replace rock with topsoil.
- C. Pit planted shrubs shall receive the same soil mix as trees. Use Planting Soil "A". In holes which were in rock, replace rock with topsoil.
- D. For shrub beds and flower beds, use Planting Soil "B". This soil shall be mixture of: one part humus, five parts topsoil. Soil pH shall be maintained between 6.0 and 7.0.

2.4 MULCH

- A. This shall be double shredded hardwood barkmulch used locally within the nursery trade for trees and shrubs or an approved equal. Color shall be selected by Architect.

2.5 PLANT MATERIALS

- A. This shall mean all trees and other plants required to be furnished for the project in accordance with plans and specifications.
- B. Refer to drawings for varieties and spacing of plant materials. Quantities shown on drawings shall take precedence over quantities shown on plant list.
- C. Substitutions will not be permitted unless adequate proof is submitted that the materials are not available. Substitutions must be approved by A/E prior to their installation.

PART 3 EXECUTION

- A. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify all such work is complete to the point where this installation may properly commence. If other work is not complete, do not begin work until it has been completed so as to allow for installation.
- B. Verify that planting may be completed in accordance with the original design and the referenced standards.

3.1 SOIL CONDITIONS

- A. Contractor shall inspect soil conditions and take notice of all soil or drainage conditions that may be detrimental to any plant material growth. Notify A/E in writing of all such conditions.

3.2 PREPARATION OF PLANTING SOIL

- A. Before planting, clean topsoil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.
- B. Place planting soil as follows:

Area	Volume of Planting Soil Mix
Shrubbery Plant Beds	12" Deep for entire bed.
Tree Pits and Shrub Pits	Equal to root ball in depth by 2.5 times ball diameter in width.

3.3 PLANTING AND SURFACE PREPARATION

- A. Tree Planting:
 - 1. Stake locations of all trees 5' and over in height and outlines of all tree masses.
 - 2. Rake surface clear of stones, debris, rubbish, and trash before pit excavation. Dispose of such material off site.
 - 3. Excavate pits as indicated on Drawings. Tree pits shall be excavated three times wider than the diameter of the root ball and only as deep as the root ball to be placed in the hole. If initially dug too deep, the soil added to bring it up to the correct level should be thoroughly tamped.
 - 4. The pit shall be cone-shaped, barely larger than the ball at the bottom and three times the ball diameter at the top as shown on drawing detail.
 - 5. Plants shall be set at the same relationship to finished grade as they were to the ground from which they were dug. Plants must be set plumb and braced in position until prepared topsoil has been placed around the ball and roots. Plants shall be set so that they will be the same depth one year later.
 - 6. The trunk of the tree is not to be used as a lever in positioning or moving the tree in the planting hole.

7. Because some nurseries practice tilling around trees the root flare may be buried several inches deep. In some cases the top of the root ball may be at ground level but the root flare actually is too deep. Proper planting depth requires the root flare to be at or slightly above the finished grade. It is important to determine how deeply the root flare is buried in the ball before it is placed in the planting hole. Sometimes the top of the ball may need to be removed until the root flare is at the proper planting depth. Remove the excess soil on the top of the root ball.
8. Ropes, strings, and wrapping from the top half of the root ball are to be removed after the plant has been set. All waterproof or water repellant wrappings shall be removed from the ball. Remove at least the top half of the wire basket before backfilling.
9. Mulch trees as shown on drawings. Remove any mulch from 1" of base of tree.

3.4 STAKING AND GUYING

- A. Trees shall be supported immediately after planting as shown on Drawings. The wire shall be encased in hose to prevent direct contact with bark of the tree and shall be placed around the trunk in a single loop. Wires shall be tightened and kept taut with turnbuckles.

3.5 PRUNING

- A. Each tree shall be pruned in accordance with standard horticultural practice to preserve natural character of plant. Prune only dead or excess material unless otherwise advised by A/E. Cuts over 3/4" in diameter shall be painted with an approved tree paint. Paint shall cover all exposed cambium as well as other exposed living tissue. Paint shall be waterproof, adhesive and elastic, antiseptic, free from kerosene, coal tar creosote or any other material injurious to the tree and shall be approved before it is used. Use "Woodtar" or an approved equal.
- B. All deciduous plants and trees shall be pruned immediately after planting, to the satisfaction of the A/E. Main leaders of trees shall not be cut back. Thin branches out and do not merely cut back. Long side branches, however, may be shortened.
- C. If the natural form of the plant is destroyed by careless pruning or thinning, the plant will be rejected.

3.6 SHRUB PLANTING AREAS

- A. Rake surface clear of stones, debris, rubbish and trash before pit excavation. Dispose of such material away from the Site. Rake and compact as above. Excavate holes as indicated and backfill with indicated soil mixture to depth shown.
- B. Place plants in holes as shown on Drawings. Plants placed in holes shall be placed in their pits so that after final settlement, they will stand at approximately the same depth as in the nursery or field. As the planting soil is backfilled around

the ball, it shall be placed in layers around the roots or ball. Each layer shall be carefully tamped in place in a manner to avoid injury to the roots or ball or disturbing the position of the plant. B&B plants shall have the burlap cut away or folded back from the top of the ball before applying water.

- C. After placing backfill and before final watering, apply fertilizer at a rate of 1/4 pound/foot of height for shrubs, or 1/8 pound/foot of height or spread for evergreens.

3.7 CLEAN-UP

- A. The Contractor shall, periodically or as directed during the progress of the work, remove and properly dispose of debris, rubbish, trash, clippings, prunings, and defective or unacceptable material. Keep clear of hazardous obstructions. Trash burning on the site will not be permitted.
- B. Except for the designated storage area, paved areas shall be kept clean of soil, fertilizer, mulch, trash and debris, and shall be maintained in a broom clean condition at all times.

3.8 PLANT GUARANTEE AND MAINTENANCE PERIOD

- A. **Contractor's Maintenance:**
 - 1. Contractor's responsibility to plant maintenance under this section shall commence when work is begun and continue until Substantial Completion Acceptance of the construction project. Maintenance shall include all necessary watering, cultivating, fertilizing, weeding, pruning, wound dressing, disease and insect control, protective spraying, replacement of unacceptable material, straightening plants which lean or sag, adjustment of any plants which settle or are planted too low, and other procedures consistent with good horticultural practices which are necessary to insure normal, vigorous and healthy growth of all work under this contract.
 - 2. In the event that treatment or replacement is made necessary as a result of damage caused by circumstances which are beyond the Contractor's control, and not wholly or partially as a result of an act or omission of the Contractor, such treatment or replacement will be authorized by the Owner by Change Order in accordance with the General Conditions.
 - 3. Contractor shall supply to Architect a comprehensive maintenance program for all plant materials on the site for the Owner's use. It should indicate such areas as, fertilizing, pruning, wound dressing, insect control, watering and general care necessary to insure survival of the material and good healthy plants.

3.9 CONTRACTOR'S GUARANTEE PERIOD

- A. **Planting work shall be guaranteed for one (1) year from date of Substantial Completion.** Replacement plants are guaranteed one year from their planting date.

- B. After Substantial Completion Acceptance of the construction project, if the Contractor is not responsible for maintenance because the Owner has taken-over this task, he is responsible to see that a proper maintenance program is being undertaken. The Contractor should make periodic site visits to insure that the Owner is supplying proper care for plant materials. Notify Architect in writing of observations within seven days of site visit.
- C. Should the Contractor not follow through on his inspection visits, and plant material dies due to lack of maintenance by the Owner, the Contractor could be held responsible and replacements made at his expense. It is his responsibility to advise the Architect of conditions that may affect his plant materials, and the guarantee. This will be in effect for the full one year plant guarantee.

3.10 FINAL INSPECTION

- A. Contractor shall notify the Owner and Architect upon completion of guarantee. Contractor shall request final inspection prior to end of guarantee period.
- B. Should any plant material be dead, or in an unhealthy state of growth as determined by the Architect at the end of the one year period, Contractor shall make all work acceptable and request a reinspection by the Owner and Architect. Any replaced plant material is guaranteed one year from the replacement plants' planting date.

END OF SECTION

SECTION 329013
TREE PROTECTION AND TRIMMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the protection and trimming of existing trees that interfere with, or are affected by, execution of the Work, whether temporary or permanent construction.
- B. Related Sections include the following:
 - 1. Section 011000 - "Summary" for limits placed on Contractor's use of the site.
 - 2. Section 015600 - "Temporary Facilities and Controls" for temporary tree protection.
 - 3. Section 311000 - "Site Clearing" for removal limits of trees, shrubs, and other plantings affected by new construction.
 - 4. Section 329000 - "Exterior Plants" for tree and shrub planting, tree support systems, and soil materials.

1.3 DEFINITIONS

- A. Tree Protection Zone: Area surrounding individual trees or groups of trees to remain during construction and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 QUALITY ASSURANCE

- A. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning)."
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
 - 1. Before tree protection and trimming operations begin, meet with representatives of authorities having jurisdiction, Owner, Architect, consultants, and other concerned entities to review tree protection and trimming procedures and responsibilities.
 - 2. Existing dogwood within interior courtyard near administration area may require minor pruning. Discuss with Architect prior to work within this area. This tree must be saved.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and toxic and other nonsoil materials.
 - 1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.
- B. Chain-Link Fence: Metallic-coated steel chain-link fence fabric of 0.120-inch- diameter wire; a minimum of 48 inches high; with 1.9-inch- diameter line posts; 2-3/8-inch- diameter terminal and corner posts; 1-5/8-inch- diameter top rail; and 0.177-inch- diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Temporary Fencing: Install temporary fencing around tree protection zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence and remove when construction is complete.
 - 1. Install chain-link fence according to ASTM F 567 and manufacturer's written instructions.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Do not store construction materials, debris, or excavated material inside tree protection zones. Do not permit vehicles or foot traffic within tree protection zones; prevent soil compaction over root systems.
- D. Maintain tree protection zones free of weeds and trash.
- E. Do not allow fires within tree protection zones.

3.2 EXCAVATION

- A. Install shoring or other protective support systems to minimize sloping or benching of excavations.
- B. Do not excavate within tree protection zones, unless otherwise indicated.

- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.
 - 1. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
- D. Where utility trenches are required within tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.
 - 1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

3.3 REGRADING

- A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond tree protection zones. Maintain existing grades within tree protection zones.
 - 1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.
- B. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.4 TREE PRUNING

- A. Prune trees to remain that are affected by temporary and permanent construction.
- B. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
- C. Pruning Standards: Prune trees according to ANSI A300 (Part 1):
 - 1. Type of Pruning: Cleaning, Thinning, Raising, Reduction.
 - 2. Specialty Pruning: Restoration, Utility.
- D. Cut branches with sharp pruning instruments; do not break or chop.
- E. Chip removed tree branches and dispose of off-site.

3.5 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.

- B. Remove and replace trees indicated to remain that die or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 - 1. Provide new trees of 6-inch caliper size and of a species selected by Architect when damaged trees more than 6 inches in caliper size, measured 12 inches above grade, are required to be replaced. Plant and maintain new trees as specified in Section 329300.
- C. Aerate surface soil, compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.6 DISPOSAL OF WASTE MATERIALS

- A. Burning is not permitted.
- B. Disposal: Remove excess excavated material and displaced trees from Owner's property.

END OF SECTION

SECTION 329119
LANDSCAPE GRADING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Providing, placing on previously prepared subgrade, and grading topsoil to finish grade.

1.2 RELATED SECTIONS

- A. Division 01 - GENERAL CONDITIONS: Including but not limited to:
 - 1. Coordination of the Work,
 - 2. Submittals; Procedure for submittals, and
 - 3. Protection of the finished Work.
- B. Section 310900 - Geotechnical Engineering, Inspection, and Testing: Geotechnical Engineer.
- C. Section 310513 - Soil Materials: Topsoil materials.
- D. Section 311000 - Site Preparation and Clearing: Preparation for land disturbance, protection of the Work, and stripping and stockpiling topsoil.
- E. Section 312213 - Rough Grading: Site subgrade contouring; general cutting, grading, filling and rough contouring the site. Dewatering excavations and water control.
- F. Section 312317 - Utility Trenching & Backfilling: Utility excavation, backfill and compaction. Excludes bedding and setting utilities. References this section for provision and placement of topsoil.
- G. Section 312513 - Erosion & Sediment Control: Topsoil stockpile protection.
- H. Section 329219 - Seeding: Temporary and permanent seeding. Topsoil testing.

1.3 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures.
- B. Topsoil source.
- C. Bioretention Filter Materials.
- D. All products identified in PART 2 of this specification.

PART 2 PRODUCTS

2.1 MATERIAL

- A. Topsoil: Fill Type T1 or T2 as specified in Section 310513 – Soil Materials.
- B. Aggregate: As required in Section 310516 – Aggregate.
- C. Bioretention Soil Mix: As required in Section 310513 – Soil Materials.
- D. Non-woven Geotextile Fabric: As required in Section 312513 – ESC.
- E. Underdrain: As required in Section 334600 – Subdrainage.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that building, utility and miscellaneous backfilling have been inspected.
- B. Verify that subgrade has been contoured and compacted and that uneven areas, low spots, and stockpiles have been eliminated.
- C. Do not place topsoil within areas yet to be disturbed by other trades. This may include utility, sidewalk, paving, trellis, sprinkler system or fencing operations.

3.2 SUBGRADE PREPARATION

- A. Establish limits, providing for smooth transition to undisturbed area or other finishes.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch (13 mm) in size. Remove subsoil contaminated with petroleum products, cleaners, paint products, or waste concrete or asphalt.
- C. Scarify subgrade to depth of 3 inches (75 mm) where topsoil is scheduled. Re-scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.3 PLACING TOPSOIL

- A. Use all acceptable, on-site, stockpiled topsoil before importing topsoil. It shall be the Contractor's responsibility to determine the need to import topsoil to complete the project. Latent requests for additional costs due to importing topsoil will not be considered.
- B. Do not deliver or place topsoil in frozen, wet or muddy condition.
- C. Place topsoil in areas where seeding to thickness as scheduled. Manually spread topsoil close to trees, plants, site improvements, and buildings to prevent damage. Place topsoil during dry weather.
- D. Fine grade topsoil eliminating rough or low areas. Maintain profiles and contour of subgrade.
- E. Remove roots, weeds, rocks and foreign material while spreading.

- F. Lightly compact placed topsoil.
- G. Unless otherwise noted or indicated, compacted surface of placed topsoil shall be 1/2" below top of header boards, walks, pavements, and utility structures. Where upslope and against curb, flush with top of curb to allow positive drainage.
- H. All required topsoil (per schedule) shall be in place prior to any landscaping activities within the area to immediately receive landscaping.
- I. Leave stockpile area and site clean and raked, matching existing grade before placement of stockpile or proposed grade, as applicable, and ready to receive landscaping. Grade site surface to prevent free-standing surface water.

3.4 BIORETENTION FILTER

- A. Install bioretention filters in accordance with ~~Minimum Standard 3.11~~ the standards and specifications provided in P-FIL-05 Bioretention of the Virginia Stormwater Management Handbook.
- B. Bioretention soils are very sensitive to sediment laden stormwater; filter shall not be installed until all upstream areas have been completely stabilized and A/E has approved installation.
- C. Prior to final completion, Contractor will be responsible for protecting bioretention filter from sediment laden stormwater. Any damage caused to the bioretention filters due to upstream erosion shall be repaired or replaced at the Contractor's expense.
- D. Excavate bioretention filter to a depth as required to contain all layers of the filter and maintain a 0.5% minimum slope on the underdrain pipe. Mechanically compact to 95% a layer of clay soil at the base of the filter to serve as a liner. The clay liner shall be a minimum of 12" in thickness. Onsite soils meeting the ASTM D2487 CL or CH group classification shall be acceptable for use in the liner.
- E. All areas within the limits of bio-retention filters shall receive 30" of suitable bioretention soil mix over perforated piping and a gravel base as shown on plan details. Drainage Stone shall be Aggregate Type A2 - VDOT Std #57, double washed, Pea Gravel Filter shall be Aggregate Type A7 - VDOT Std #8, double washed. Bioretention Mix shall be installed in 12-18" layers. Lightly tamp, but do not compact. Mechanized compaction of the Bioretention Mix is not permitted.
- F. Coordinate the installation of soil and insure that finished grades are as shown on the grading plans. The finished bed shall be level and lower (see plan detail) than the surrounding ground after the amendments have been "tilled in" and mulch added.
- G. Test the planting soil to verify the ph is between 6.0 and 7.0. These tests shall be made available to the Owner upon request. Add lime or sulfur as necessary to adjust the soil to the proper ph.

- H. Add fertilizer at the rate of 2 pounds of 10-10-10 per 100 square feet. Till the entire area to a minimum depth of 6" until all ingredients are thoroughly mixed. Rake the entire area to a smooth even surface.
- I. Place plants in holes in the locations shown on Drawings. Plants placed in holes shall be placed in their pits so that after final settlement, they will stand at approximately the same depth as in the nursery or field. As the planting soil is backfilled around the ball, it shall be placed in layers around the roots or ball. Each layer shall be carefully hand tamped in place in a manner to avoid injury to the roots or ball or disturbing the position of the plant. B&B plants shall have the burlap cut away or folded back from the top of the ball before applying water. See Section 329000 for additional planting requirements.

3.5 TOLERANCES

- A. Top of Topsoil (Top of Mulch in Bioretention Filter): Plus or minus 1/2 inch (13 mm) adjacent to improvements; 1 inch (25 mm) within 100 feet of buildings or athletic or play fields; and 2 inches (50 mm) on surrounding fields and slopes.

3.6 PROTECTION

- A. Section 017000 – Execution Requirements: Protection of Completed Work.
- B. Comply with Section 311000 – Site Preparation and Clearing: Protection.
- C. Protect landscaping and other features remaining as final work.
- D. Protect any/all existing site improvements including structures, fences, sidewalks, utilities, paving and curbs.

3.7 SCHEDULES

- A. Compacted topsoil thickness at the following areas:
 - 1. Seeded Grass: 4 inches (100 mm).
 - 2. Ground Cover Areas: 8 inches (200 mm).
 - 3. Perennial Bulb Beds: 12 inches (300 mm).
 - 4. Planter Boxes: 12 inches (300 mm) and to within 3 inches (75 mm) of box rim.
 - 5. Landscape Berms: 12 inches (300 mm).
 - 6. Steep slopes where hard fescue or crown vetch re proposed as stabilization: no topsoil required.

END OF SECTION

SECTION 329219 SEEDING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. All labor, materials, equipment and incidentals necessary to provide a complete installation of all tillage, pH balancing, fertilizing, seeding, and mulching of all disturbed areas within the Contract limits not occupied by structures, pavement or plantings, as indicated on the Drawings and specified herein.
- B. Topsoil testing.
- C. Erosion Control/Temporary Seeding.
- D. Permanent Seeding/complete stabilization with natural materials.
- E. Maintenance.
- F. Lawn guarantee.

1.2 RELATED SECTIONS

- A. Division 01 - GENERAL CONDITIONS: Including but not limited to:
 - 1. Coordination of the Work,
 - 2. Submittal Procedures,
 - 3. Closeout Procedures,
 - 4. Protection of Completed Work.
- B. Section 310513 - Soil Materials: Topsoil.
- C. Section 312317 - Utility Trenching & Backfilling: Backfilling to subgrade over utilities.
- D. Section 312513 - Erosion & Sediment Control: References EC / Temporary Seeding.
- E. Section 329119 - Landscape Grading: Preparation of subgrade and provision and placement of topsoil in preparation for the work of this section.

1.3 REFERENCE STANDARDS AND QUALITY ASSURANCE

- A. All materials, preparations and workmanship shall be performed by experienced workmen regularly engaged in the work of this section. Seeding work shall be performed by a single firm specializing and experienced in landscape work.
- B. All products shall be applied or installed in strict conformance with the manufacturer's written instructions and acceptable trade practices.

- C. All products shall be labeled in accordance with the U.S. Department of Agriculture Rules & Regulations.
- D. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- E. Have topsoil classified and analyzed to determine nutritional requirements of soil for establishment of lawns.
- F. FS O-F-241D - Fertilizers, Mixed, Commercial.

1.4 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer composition.

1.5 DEFINITIONS

- A. Noxious Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.
- B. Satisfactory stand of grass: A dense, vigorous and well established cover of living grass of the specified mixture where no individual lawn area has unacceptable portions in excess of one percent of its area or gaps larger than a circle 4 inches in diameter.
- C. Establishment period: The establishment period for lawn areas shall be the time from installation until final acceptance, as determined by the Architect.

1.6 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedure.
- B. Soil analysis report: Testing will be at the Contractor's expense.
- C. Certification that imported topsoil is free from weeds.
- D. Certificates of inspection as required by governing authorities.
- E. Other data substantiating that materials comply with specified requirements.
- F. Manufacturer's or vendor's certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species.
- G. All products identified in PART 2 of this specification.

1.7 SUBMITTALS AT PROJECT CLOSEOUT

- A. Section 017000 - Execution Requirements: Contractor's Closeout Submittals to Architect.
- B. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.
- C. Guarantee and warranties.

1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Section 016000 – Product Requirements.
- B. Fertilizer, soil amendments, and seed shall be delivered to the site in the original, unopened, undamaged containers bearing the manufacturer's guaranteed analysis, name, trade name, trademark, and statement of conformance to state and federal laws. Labels shall be intact and legible. In lieu of containers, fertilizer and soil amendments may be furnished in bulk with a certificate indicating the above information accompanying each delivery. All such certificates shall be submitted to the Architect to confirm quantities of materials used on project.
- C. During delivery and storage, seed, fertilizer, soil amendments, straw and matting shall be kept in dry storage free from the effects of weather and away from contaminants. Should any material become wet or damaged, reject immediately and replace at no cost to the Owner.
- D. Precautions shall be taken to protect containers from rupture prior to use.

1.9 MAINTENANCE SERVICE

- A. Provide service and maintenance of seeded areas through establishment period (see definitions above).

1.10 INITIAL ACCEPTANCE

- A. Establishment of new lawn: Contractor shall be responsible for providing a finished lawn of a satisfactory stand of grass (see definitions above). Any areas which fail to show a satisfactory stand of grass shall be reworked and reseeded at the Contractor's expense with the same seed as originally used thereon until all required areas are satisfactorily covered.

1.11 GUARANTEE AND WARRANTIES

- A. Contractor shall guarantee all seeding work for a period of one (1) year. Guarantee period shall begin on the date of acceptance of the established lawn for the entire project, as determined by the Architect.
- B. Provide written warranties within thirty (30) days of final acceptance.

PART 2 PRODUCTS

2.1 SEED MIXTURE

- A. State-certified seed of the latest season's crop, labeled in conformance with U.S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable State seed laws.
- B. All seed shall be Blue Tag Certified Seed with varieties strictly conforming to those listed on the Virginia Turfgrass Variety Recommendations, latest edition, published by Virginia Polytechnic Institute and State University.
- C. Permanent Seeding: Lawn areas shall be seeded with a mixture of 80 percent by weight (typ) improved or turf-type Fescue, 10 percent Bluegrass and 10 percent Ryegrass. The improved Fescue component shall be composed of three subspecies, each composing between 20 and 40 percent of the Fescue component. The Bluegrass shall be composed of equal parts of three subspecies. The Ryegrass component shall be of a single species of perennial ryegrass. Seed at 5-8 #/1000 square feet. Seeding shall be between April 1 and May 31, or August 15 and October 15.
- D. Seed that has become wet, moldy, or otherwise damaged will not be acceptable.
- E. Erosion Control/Temporary Seeding:
 - 2/16 to 4/30 Annual rye grass (*Lolium multiflorum*) Apply at 60-100#/acre.
 - 5/1 to 8/4531 German Millet (*Setaria italica*) Apply at 50#/acre.
 - 9/1 to 2/15 50/50 Mix of annual ryegrass (*Lolium multiflorum*) & cereal (Winter) rye (*Secale cereale*) Apply at 50-100#/acre

2.2 SOIL MATERIALS

- A. Topsoil: As specified in Section 310513 – Soil Materials: Topsoil Materials.

2.3 ACCESSORIES

- A. Straw Mulch Material:
 - 1. Straw shall be stalks from oats, wheat, rye, barley or rice that are free from noxious weeds, chemicals, mold, decay or foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
 - 2. Straw shall be in an air-dry condition suitable for placing. Straw supplied for mechanical application shall be chopped.
- B. Wood Cellulose Mulch Material:
 - 1. Mulch supplied for use with hydraulic application of grass seed and fertilizer shall consist of specially prepared wood cellulose fiber. Wood cellulose fiber shall not be utilized however from 6/1 to 9/1 or 12/1 to 3/1. During this

- time, straw mulch shall be utilized.
2. Processing of wood cellulose fiber shall be in such a manner that it will not contain germination or growth inhibiting elements.
 3. Wood cellulose fiber shall be dyed an appropriate color to allow visual metering of its application.
 4. Wood cellulose fiber shall have the property of becoming evenly dispersed and suspended when agitated in water.
 5. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like ground cover which readily absorbs water and allows infiltration to the underlying soil.
 6. Weight specifications from suppliers and for applications shall refer to air dry weight of the fiber, a standard equivalent to 10 percent moisture.
- C. Binder for Mulch: Emulsified asphalt, ASTM D977-86, Grade SS-1.
- D. Fertilizer: Commercial fertilizer shall conform to all applicable state and federal regulations and be certified by the Virginia Department of Agriculture and Consumer services to be in accordance with the type and quantity of material indicated on the bag labels. For EC / temporary seeding, it shall have a minimum guaranteed analysis of 5 percent nitrogen, 10 percent phosphorus, and 10 percent soluble potash or approved equal. For permanent seeding, it shall have a minimum guaranteed analysis of 14 percent nitrogen, 20 percent phosphorus, and 14 percent soluble potash or approved equal.
- E. Soil Amendments:
1. Lime: To pH balance soil, ground, natural, dolomitic limestone containing not less than 85% of total carbonates with a minimum of 30% magnesium carbonates, ground so that not less than 90% passes a 10-mesh sieve and not less than 50% passes a 20-mesh sieve.
 2. Aluminum Sulfate: To pH balance soil, commercial grade in dry power form.
 3. Superphosphate: Soluble mixture of treated minerals; 20% available phosphoric acid.
- F. Water: Potable.
- G. Mulch Stabilization Netting: Plastic or natural fiber netting used to prevent displacement of straw mulch, manufactured by:
1. American Excelsior Co. - Erosion Control Netting
 2. Belton Industries - Soil Anti-wash/Geojute
 3. CONWED Fibers - Erosion Control Netting
- H. Re-vegetation Mats/Erosion Control Mats:
1. Mats manufactured specifically to hold moisture without the additional use of mulch, and retard erosion, manufactured by:
 2. Re-vegetation Mats:
 - a. North American Green, Inc. - SC150 Blanket
 - b. American Excelsior Co. - Curlex Blanket
 - c. Gulf States Paper Corp. - Hold/Gro
 - d. CONWED Fibers - Futerra Revegetation Blanket

- e. CONTECH Constr. Prod., Inc. - Excelsior Erosion Control Blankets
- 3. Erosion Control Mats:
 - a. North American Green, Inc. - P350
 - b. Landlok - TRM 450
- I. Staples: Plain iron wire, No. 8 gauge or heavier, with a minimum in-ground length of 6 inches.
- J. Stakes: Softwood lumber, chisel pointed.
- K. String: Inorganic fiber.
- L. Landscape Fabric: 3.0 oz. Or better non-woven polyester, commercial weed restrictor fabric. UV stabilized
- M. Other Materials: All other materials, not specifically described but required for a complete and proper seeding operation, shall be selected by the Contractor and subject to the approval of the Architect.

2.4 TESTS

- A. Provide and pay for the services of a testing agency certified by the state to:
 - 1. Classify the topsoil in accordance with the Uniform Soil Classification System and provide percentages of sand, silt and clay.
 - 2. Perform an analysis of topsoil to be used, and make a determination of pH and nutritional requirements of the soil for establishment of lawns.
 - 3. Analyze fertilizer to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- B. Submit sample of fertilizer and topsoil proposed (one per source) to approved testing laboratory in sealed containers to prevent contamination. Sample size shall be as required by laboratory.

PART 3 EXECUTION

3.1 EXAMINATION / COORDINATION

- A. Series 01300 – Administrative Requirements: Coordination.
- B. Verify that prepared subsoil base and utility installation work is complete.
- C. Verify that Landscape Grading (topsoil material and depth) is complete, correct and ready to receive the work of this section.

3.2 EROSION CONTROL/TEMPORARY SEEDING

- A. Temporary seeding shall be applied to denuded areas within 7 days after final grade has been established, if season is improper for permanent seeding, and within 7 days to portions of the site which may not be at final grade but which will remain inactive for more than 30 days and less than one year. Lawn areas,

athletic fields and slopes may be topsoiled and permanently seeded only if this can be accomplished during the correct time of year for the permanent seed mixture specified. Permanent Seeding is required for areas which will remain dormant for more than one year.

- B. Where the area is compacted, crusted or hardened, the soil surface shall be loosened by disking, raking, harrowing or other means.
- C. Apply lime at a rate of 50 pounds per 1000 sq. ft. and commercial fertilizer at 10 pounds per 1000 sq. ft. Thoroughly mix into loosened soil.
- D. Seed shall be evenly applied at a rate of 2 lbs. per 1000 sq. ft. to the prepared ground and mulched.
- E. Slopes greater than 3:1 shall be hydroseeded. Other areas may be hydroseeded or dry seeded at the Contractor's option.
- F. Hydroseeding operations shall include seed, fertilizer, mulch and binder in one operation. Areas which are hydroseeded from 6/1 to 9/1 or 12/1 to 3/1 shall be mulched with straw. Wood fiber mulch shall not be used during these times.
- G. After mulching of dry seeded areas, mulch shall be stabilized using a liquid binder. Portions which continue to lose mulch due to wind or runoff shall be further stabilized with mulch stabilization netting. Install netting as specified herein.
- H. Areas which fail to establish vegetative cover adequate in checking erosion shall be re-seeded as soon as such areas are recognized.

3.3 PERMANENT SEEDING - GENERAL

- A. Seeding shall not be done when the ground is frozen, snow covered, saturated, or in any other condition which would make establishment and survival of lawns unlikely.
- B. At the time of beginning seed bed preparation, topsoil shall be in a loose, friable condition, free from stones over 1" in any dimension, sticks, roots and other extraneous matter. If topsoil has become crusty, hardened or eroded since being spread, it shall be a part of this work to restore the soil to the loose condition described above.
- C. Prior to preparation of undisturbed areas, remove vegetation and debris and dispose of such material off-site; do not turn under into soil being prepared for seed bed. Loosen existing grade to a depth of 4", remove all debris which surfaces.
- D. Contractor shall hydroseed all slopes 3 to 1 or steeper. All other areas shall be dry-seeded or hydroseeded at the Contractor's option unless noted otherwise on the Drawings.

3.4 SEED BED PREPARATION:

- A. Work areas of 3 to 1 slope and less to a smooth even surface free from irregularities, ridges or depressions. Prepared areas shall meet required finish grade elevations and shall drain adequately.
- B. Areas greater than 3 to 1 slopes shall be left in a roughened state but meeting required finish grade elevations. Repair all washed and eroded portions.
- C. Spread fertilizer at the rate of 25 lbs. per 1000 sq. ft. or as recommended otherwise by the soil test report. Add pH balancing agents at rate recommended by soil test reports to achieve a pH of 6.0 to 7.0 for turf grass seeding. For vegetative cover other than turf grass, achieve the pH level best suited for that material as suggested by the testing agency. Under circumstances where it is not possible to obtain soil tests, apply lime at a rate of 100 lbs./1000 sq. ft. Blend additives thoroughly into upper 4" of topsoil.
- D. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- E. Blend additives thoroughly into upper 4" of topsoil. Remove any rock or other debris which may surface. Till areas until soil is loose and friable and all soil amendments are uniformly distributed.
- F. Moisten prepared areas if soil is dry. Water thoroughly, then allow surface moisture to evaporate. Do not create muddy soil conditions.

3.5 DRY SEEDING NEW LAWNS:

- A. Within 3 days of finish grading and seed bed preparation, sow seed using a spreader or seeding machine at the rate of 5 lbs. per 1000 sq. ft. Do not seed when wind velocity exceeds 5 mi. per hour. Distribute seed evenly over entire area by sowing equal quantity in 2 directions at right angles to each other.
- B. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- C. Rake seed lightly into top 1/4" of soil, firm entire area with a roller not exceeding 90 lbs. per foot of roller width, and water with a fine spray.
- D. Unless indicated otherwise on the Drawings, protect newly seeded areas by spreading mulch to a uniform and continuous depth of 1/2" loose measurement (70-90 lbs./1000 sq. ft.). Anchor mulch by one of the following methods:
 - 1. Liquid mulch binder, applied at the rate of 10 gal. per 1000 sq. ft. Mask adjacent areas to prevent over-spray damage.
 - 2. Tractor-drawn mulch anchoring equipment, limit use to slopes 3:1 and less. Machinery shall be operated along the contour.
 - 3. Mulch stabilization netting.
- E. Install erosion control/re-vegetation mat in areas designated on the Drawings.

- F. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches (100 mm) of soil.

3.6 HYDROSEEDING NEW LAWNS (Required for 3:1 and greater slopes)

- A. The slurry shall be prepared and applied to yield the following rates:
 - 1. Seed: 5 lbs. per 1000 sq. ft.
 - 2. Fertilizer: 25 lbs. per 1000 sq. ft.
 - 3. Mulch: 35 lbs. per 1000 sq. ft.
- B. Hydroseed mulch is to be an integral part of the slurry mix; it shall be added after the seed and fertilizer have been thoroughly mixed and shall be applied uniformly to all seeded areas.
- C. Areas which are hydroseeded from 6/1 to 9/1 or 12/1 to 3/1 shall be mulched with straw. Wood fiber mulch shall not be used during these times.

3.7 SEED PROTECTION

- A. Identify seeded areas with stakes and string around area periphery. Set string height to 12 inches (300 mm). Space stakes at 10 feet max. (3 m).
- B. Cover seeded slopes where grade is 3H:1V or greater with re-vegetation mats.
- C. Place re-vegetation mats or erosion control mats in ditches where indicated on the Drawings.

3.8 NETTING/MAT PLACEMENT:

- A. Laying the Net/Mat:
 - 1. Start laying net/mat from top of swale/slope and unroll downgrade. Mat shall be placed minimum 12" beyond edges of swale and 18" beyond top and bottom of slopes.
 - 2. Allow to lay loosely on soil - do not stretch or pull.
 - 3. To secure: Upslope ends of net/mat should be buried in a slot or trench no less than 6 inches deep. Tamp earth firmly over net/mat. Staple every 12 inches across the top end.
 - 4. Edges shall be stapled every 3 feet. Where 2 strips are laid side by side, the adjacent edges shall be overlapped 3 inches and stapled together.
 - 5. Staples shall be placed down the center of net/mat strips at 3-foot intervals. DO NOT STRETCH when applying staples.
- B. Joining Strips: Insert new roll of net/mat in trench, as with upslope ends. Overlap the end of the previous roll 18 inches, turn under 6 inches, and staple across end of roll just below anchor slot and at the end of the turned-under portion every 12 inches.
- C. At Bottom of Slopes: Lead net/mat out onto a level area before anchoring. Turn ends under 6 inches, and staple across end every 12 inches.

- D. Provide 12 inch (300 mm) overlap of adjacent rolls. At sides of ditches, lay fabric laps in direction of water flow.
- E. Check Slots: On highly erodible soils and on slopes steeper than 4:1, erosion check slots should be made every 15 feet. Insert a fold into a 6-inch trench and tamp firmly. Staple at 12-inch intervals across the downstream portion.
- F. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- G. Rolling: After installation, net/mat should be rolled to ensure firm contact with soil.

3.9 MAINTENANCE DURING ESTABLISHMENT PERIOD:

- A. The Contractor shall be responsible for all maintenance during the establishment period. This period may extend beyond the Date of Substantial Completion if lawns are not deemed acceptable at that time. Maintenance shall include watering, fertilizing, removal of straw mulch, weed eradication, mowing, trimming, clipping removal, the reconstruction of all areas failing to yield vital stands, and the reconstruction of all area damaged by erosion or other occurrence.
- B. Stands in lawn areas shall be mowed at regular intervals to maintain at a maximum height of 2-1/2 inches (65 mm). Do not cut more than 1/3 of height at any one mowing. Soil stability areas shall not be mowed.
- C. Neatly trim edges and hand clip where necessary.
- D. Immediately remove clippings after mowing and trimming.
- E. Water to prevent grass and soil from drying out with hoses and portable sprinklers in areas that do not receive water from irrigation. Contractor to regularly rotate location of portable sprinklers to ensure that no single area becomes saturated.
- F. Roll surface to remove minor depressions or irregularities.
- G. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

- H. After the third cutting of the establishment period but prior to inspection by the Architect, lawn areas within the scope of this Contract shall be fertilized with a mixture having 50% or more of the total nitrogen in a water insoluble form:

<u>Time of Application</u>	<u>lbs. Total Nitrogen per 1000 sq. ft.</u>
August 15 - Nov. 15	1-1/2 to 2
April 15 - June 15	1 to 1-1/2

- 3.10 LANDSCAPE FABRIC PLACEMENT: Place between soil and mulch in all mulched planted areas for weed control.

3.11 CLEAN-UP AND PROTECTION

- A. Keep pavements clean and work area in an orderly condition.
- B. Remove from the site, all equipment, surplus materials, debris, etc. resulting from the seeding work as herein specified.
- C. Protect seeded areas and materials from damage due to operations by other contractors, trades and trespassers. Maintain protection during installation and until final acceptance. Treat, repair or replace damaged seeded areas as herein before specified.

3.12 INSPECTION AND ACCEPTANCE:

- A. When establishment period is completed, Architect will, upon written request, make an inspection to determine acceptability.
- B. Work may be inspected for acceptance in sections agreeable to the Architect, provided all work for that section is complete.
- C. When inspected work is not acceptable, replace or remedy rejected work. Continue all applicable requirements of Contract until re-inspection and acceptance by the Architect.

3.13 GUARANTEE

- A. The Contractor shall be responsible for providing a finished lawn by Substantial Completion if possible. The Contractor shall produce dense, vigorous, well established lawns and shall maintain lawn areas until final acceptance of the work by the Owner. Any areas which fail to show a uniform stand of grass shall be reworked, and reseeded at the Contractor's expense with the same seed as originally used thereon, and such reseeded shall be replaced until all required areas are covered with a satisfactory stand of grass.
- B. Re-seeding of bare areas must be accomplished through mechanical means using a slit-seeder or a core aerator.

- C. Contractor's responsibility to maintain shall begin when work is begun and continue until maintenance program is accepted by Owner.
- D. In the event that treatment or replacement is made necessary as a result of damage caused by circumstances which are beyond the Contractor's control, and not due wholly or partially as a result of any act or omission by the Contractor, such treatment or replacement will be authorized by the Owner by Change Order in accordance with the General Conditions.

END OF SECTION

SECTION 331116
WATER MAINS AND SERVICES

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not limited to)

- A. Pipe and fittings for exterior water system including distribution main, domestic service and fire service, as applicable.
- B. Valves, fire hydrants, fire department connection, and domestic water hydrants.
- C. Bedding and compaction.
- D. Adjustment of existing utility structures to meet proposed work.
- E. Provide an approved, operational underground exterior water service and fire service piping system from five (5) feet outside the building through connection to existing system.

1.2 RELATED SECTIONS

- A. Applicable sections of Division 1 - GENERAL CONDITIONS: Including but not limited to:
 - 1. Section 013100 – Coordination of the Work.
 - 2. Section 013300 – Submittal Procedures: Procedures for submittals.
 - 3. Section 014000 – Quality Requirements: Aggregate and concrete testing.
 - 4. Section 015600 – Temporary Facilities and Controls: Dewatering excavations and water control.
 - 5. Section 106000 – Products Requirements: Product delivery, handling, storage, and protection.
 - 6. Section 017000 – Execution Requirements: Contract Closeout, Project Record Documents.
- B. Section 310513 – Soil Materials: Soil and aggregate materials.
- C. Section 310516 – Aggregate Materials.
- D. Section 311000 - Site Preparation and Clearing: Preparation for land disturbance, protection of the Work.
- E. Section 312213 – Rough Grading.
- F. Section 312317 - Utility Trenching & Backfilling: Excavation, backfill, compaction, testing, Trace Wire & ID Tape.
- G. Section 331300 - Disinfection of Water Distribution System: Disinfection of site service utility water piping.

1.3 REFERENCES

- A. AMERICAN SOCIETY OF TESTING & MATERIALS (ASTM)
- B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
- C. AMERICAN WATER WORKS ASSOCIATION (AWWA)
- D. AMERICAN WELDING SOCIETY (AWS)
- E. FACTORY MUTUAL RESEARCH CORP. (FM)
- F. MANUFACTURERS' STANDARDS SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
- G. NATIONAL FIRE PREVENTION ASSOCIATION (NFPA)
- H. UNDERWRITERS LABORATORIES (UL)
- I. UNI-BELL PLASTIC PIPE ASSOCIATION (UNI)
- J. VIRGINIA DEPARTMENT OF HEALTH (VDH)
 - 1. Virginia Department of Health (VDH) "Waterworks Regulations," latest edition, hereinafter Waterworks Regulations.
- K. SOILS
 - 1. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
 - 2. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
 - 3. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 4. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- L. COPPER
 - 1. ANSI/ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 - 2. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - 3. ASTM B32 - Solder, Metal.
 - 4. ASTM B88 - Seamless Copper Water Tube.
 - 5. AWS A5.8 - Brazing Filler Metal.
- M. PVC
 - 1. ASTM D1785 - Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, 120.
 - 2. ASTM D2241 - Polyvinyl Chloride (PVC) Plastic Pipe, (SDR-PR).
 - 3. ASTM D2672 - Bell-End Polyvinyl Chloride (PVC) Plastic Pipe.
 - 4. ASTM D2466 - Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
 - 5. ASTM D2467 - Socket-Type Polyvinyl Chloride (PVC) Plastic Pipe Fittings,

Schedule 80.

6. ASTM D2564 - Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings.
7. ASTM D2774 - Underground Installation of Thermoplastic Pressure Piping.
8. ASTM D3139 - Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
9. ASTM D2855 - Making Solvent-Cemented Joints With Poly Vinyl Chloride (PVC) Pipe and Fittings
10. ASTM F402 - Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings
11. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
12. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.
13. UNI B3 - Installation of Polyvinyl Chloride (PVC) Pressure Pipe Complying With AWWA C900.

N. DUCTILE IRON

1. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other liquids.
3. ANSI/AWWA C110 - Gray Iron and Ductile Iron Fittings, 3 Inch Through 48 Inches, for Water and Other Liquids.
4. ANSI/AWWA C111- Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.
5. ANSI/AWWA C115- Rubber-Gasket Joints for Ductile Iron and Grey-Iron Flanged Pressure Pipe and Fittings.
6. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
7. ANSI/AWWA C153 - Ductile-Iron Compact Fittings, 3 Inch Through 16 Inch, for Water and Other Liquids.
8. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.
9. ANSI/AWWA C606 - Grooved and Shouldered Type Joints.
10. ASTM A48 - Gray Iron Castings.

O. PE PIPE

1. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, 1/2 inch through 3 inch, for Water
2. ASTM D3035 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.

P. VALVES, ETC

1. ANSI/AWWA C500 - Gate Valves (Double Disc), 3 through 48 in NPS, for Water and Sewage Systems.
2. ANSI/AWWA C502 - Dry Barrel Fire Hydrants.
3. ANSI/AWWA C504 - Rubber Seated Butterfly Valves.
4. ANSI/AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS.
5. ANSI/AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.

6. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.
7. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.
8. MSS SP80 - Bronze Gate, Globe, Angle and Check Valves.
9. MSS SP71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
10. UL 246 - Hydrants for Fire - Protection Service.

Q. FIRE SERVICE

1. NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances."
2. NFPA 13, "Standard for the Installation of Sprinkler Systems."

1.4 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures: Submittals.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. All products identified in PART 2 of this specification.
- C. Manufacturer's Certificate: Certify that above referenced products meet or exceed specified requirements.
- D. Submit NFPA "Contractor's Materials and Test Certificate for Underground Piping." Use NFPA 13 Version with Owner Representative signature block.

1.5 PROJECT RECORD DOCUMENTS

- A. Section 017000 – Execution Requirements: Contract Closeout.
- B. Record actual locations of piping mains, valves, connections per the As-Built Survey requirements of Specifications 31 10 00 – Site Preparation and 31 22 13 – Rough Grading.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- D. Certify in writing to the Owner and to the Architect that the "System" has been approved and is ready for use.
- E. Maintenance Data: Submit maintenance data and parts list for the fire water system materials and products.

1.6 QUALITY ASSURANCE

- A. Code Compliance: Comply with:
 1. VDH Waterworks Regulations,
 2. Local water system standards and specifications,
 3. Local Fire Department/Marshal Regulations or Standards: Comply with governing regulations pertaining to hydrants, including hose coupling threading and matching of connections, and
 4. Owner's Insurance Company requirements.

- B. Install fire water systems in accordance with NFPA 24.
- C. Valves: Manufacturer's name and pressure rating shall be marked on valve body.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 – Product Requirements: Deliver, store, protect and handle products to site: Material & Equipment.
- B. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.1 PIPE & FITTINGS (4" & larger)

- A. Ductile Iron Pipe (buried applications): AWWA C151/ANSI 21.51, minimum thickness Class 51 with a minimum working pressure of 250 psi.
 - 1. Fittings: Ductile or grey iron, AWWA C110/ANSI 21.10 with a pressure rating not less than the pipe or AWWA C153/ANSI A21.53 with a working pressure of not less than that of the pipe.
 - 2. Joints: Mechanical joints per AWWA C111.
 - a. Bituminous Coating & Cement Lining: AWWA C104, Standard thickness for pipe and fittings.
 - b. Examples Meeting the Criteria or 1-3 above include, but are not necessarily limited to:
 - 1. Clow Super Bell-Tite Push-on Joint Ductile Iron Pipe.
 - 2. Pipe Tyton (Push-on) Joint Ductile Iron Pipe.
 - 3. Griffin Super Bell-Tite Push-on Joint Ductile Iron Pipe.
- B. Ductile Iron Pipe (non-buried applications): AWWA C-151/ANSI 21.51, minimum thickness Class 53.
 - 1. Cement Lining: AWWA C104, Standard thickness, for pipe and fittings.
 - 2. Joints: AWWA C115 flanges or AWWA C606 grooved and shouldered joints. Provide flange joints with AWWA C111 full faced rubber gaskets for each flange in piping. Provide flanges, connection pieces, transition gaskets, transition sleeves and other adapters as required to complete the piping installation.
 - 3. Fittings:
 - a. AWWA C110/ANSI 21.10 (flanged), or AWWA C606 (grooved & shouldered) and pressure rating not less than the pipe.
 - 4. Grooved and shouldered joints shall be as manufactured by Victaulic Company of America of Easton, Pennsylvania or approved equal. The supplier of the grooved and shouldered joints shall be a factory certified representative of this piping system.
- C. PVC Pipe (4" - 12"): ANSI/AWWA C900 pressure Class 150 (DR18) with ductile iron pipe equivalent OD.
 - 1. Joints: ASTM D3139 push-on or ASTM D3139 and AWWA C111 compression type mechanical joints, as applicable. ASTM F477 gaskets for push-on joints for pipe and AWWA C111 gaskets for push-on joints and mechanical joints for joint connections between pipe and metal fittings,

valves, and accessories.

- D. Examples Meeting the above Criteria include, but are not necessarily limited to:
 - 1. Johns-Manville Blue Brute PVC Water Pipe, DR18, Class 150
 - 2. Johns-Manville PVC Class Water Pipe, DR18, Class 150
 - 3. Clow Super Main 900 Water Main, DR18, Class 150
 - 4. CertainTeed Vinyliron Pipe, DR18, Class 150
 - 5. National C900 Pipe, DR18, Class 150
 - 6. Extrusion Technologies Inc. (ETI) C900, DR18, Class 150
- E. Fittings: ANSI/AWWA C110, ductile iron, with a pressure rating not less than the pipe and AWWA C104 standard thickness cement lining.

2.2 PIPE & FITTINGS (smaller than 4-inch diameter)

- A. Copper Tubing (for water piping only): ASTM B88, Type K:
 - 1. Fittings:
 - a. ANSI/ASME B16.18, cast copper and brass, solder joint fittings, or
 - b. ANSI/ASME B16.22, wrought copper, solder joint fittings.
 - 2. Joints:
 - a. ASTM B32, 95-5 tin antimony solder, or
 - b. Plumbing Code approved lead free solder, or
 - c. Compression connection, as applicable.
- B. Polyvinyl Chloride (PVC) Pipe: ASTM D2241, SDR-21 (200 psig rated).
 - 1. Joints: ASTM F477 rubber gaskets for push-on pipe.
 - 2. Pipe and fittings shall bear the seal of approval of the National Sanitation Foundation for potable water service.
 - 3. Pipe and fittings shall be of the same PVC material and shall be one of the following pipe/fitting combinations, as marked on the pipe and fitting, respectively: PVC 2120/PVC II; PVC 2116/PVC II.
 - 4. Examples Meeting the above Criteria include, but are not necessarily limited to:
 - a. Johns-Manville Ring-Tite PVC Pressure Pipe (D2241) Bell & Spigot
 - b. Clow PVC Bell-Tite Pressure Rated Pipe (D2241) Bell & Spigot
- C. Polyethylene Pipe: AWWA C901 ASTM D3035, with outside Dimension Ratio (DR) of 11.
 - 1. Joints: Butt fusion.
 - 2. Fittings: AWWA C901, molded.

2.3 INSULATING JOINTS

- A. Provide between pipes of dissimilar metals a rubber gasket or other approved type of insulating joint or dielectric coupling which shall effectively prevent metal-to-metal contact between adjacent sections of piping.

2.4 BALL VALVES - Up to 2 Inches (50 mm)

- A. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, [AWWA] [IPS] [compression] inlet end, [compression]

[IPS] outlet [with electrical ground connector], with control rod, extension box [and valve key].

2.5 GATE VALVES - Up to 3 Inches (75 mm):

- A. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, extension box and valve key.

2.6 GATE VALVES - 3 Inches (75 mm) through 14 Inches (350 mm)

- A. UL/FM Rated, Iron or ductile iron body, bronze trim, non-rising stem with square nut, single wedge, rubber encapsulated resilient seat, mechanical joint ends, control rod, available as post indicator, extension box and valve key. ANSI/AWWA C509 except with wall thicknesses exceeding the min. requirements of AWWA C153.
 - 1. Valves shall have a double O-ring stem seal, a minimum stem diameter of 7/8 inch for valves larger than six (6) inches, and shall open left (counter-clockwise).
 - 2. Valves shall be designed for a working pressure not less than that specified for the connecting pipe.
 - 3. Valves shall be coated inside and out with a fusion bonded epoxy coating meeting AWWA C550.
 - 4. Valves for above ground mounting or installed in vaults shall have flanged ends.
 - 5. Valves for buried installation shall have mechanical joints conforming to AWWA Std. C111 unless otherwise specified.
 - 6. Gate valves shall be supplied from a single manufacturer.
 - 7. Supply post indicator where indicated on the Drawings or as required by NFPA 24.
 - 8. Examples meeting the above criteria include, but are not necessarily limited to:
 - a) American Flow Control Model AFC-2500, by American Darling Valve (Ductile Iron)

2.7 SWING CHECK VALVES (smaller than four inches)

- A. MSS SP80, Class 125, except sizes 2.5 inches and larger shall conform to MSS SP71, Class 125.

2.8 SWING CHECK VALVES (4 inches to 24 inches (100 mm to 600 mm))

- A. Check valves shall conform with the specifications in ANSI/AWWA Standard C508. Valves shall be iron body, bronze trim, [45] [22] degree swing disc, renewable disc and seat, flanged ends. Valves shall be equipped with an outside weighted arm. Provide piston type anti-slam device on all check valves where indicated.

2.9 FIRE DEPARTMENT CONNECTIONS (FDC)

- A. Provide 90-degree cast brass siamese connections and sleeve assembly, with two 2-1/2 inch fire department inlet female hose connections, thread per local fire dept. requirements, and self closing brass double clapper valves. Provide rough brass covers with chains. Acceptable FDC manufacturers include but are not limited to:

1. Allen Manufacturing Div.
2. Moon, Inc.
3. Croker-Standard Div.
4. Fire-End & Croker Corp.
5. Elkhart Brass Mfg. Co., Inc.

2.10 FIRE HYDRANTS

- A. Hydrant: Type as required by utility company.
- B. Examples meeting the above criteria include, but are not necessarily limited to:
 1. American Flow Control Model B-84-B, AMERICAN-DARLING VALVE
 2. Mueller Centurion A423, by Mueller Co.
 3. Kennedy K81D
 4. AVK Model 2780
- C. Hydrant Extensions: Fabricate in multiples of 6 inches (150 mm) with rod and coupling to increase barrel length.
- D. Hose and Pumper/Steamer Connections: Two (2) 2-1/2 inch hose connections and one (1) 4-1/2 inch pumper connection per utility company requirements. Nozzle threads shall be National Standard.
- E. Operating nut shall be National Standard, pentagon shape (1.5" point to flat) and turn counter-clockwise to open unless otherwise required by local utility company.
- F. Finish: Primer and two coats of enamel to color required by utility company. All barrels shall be painted silver and the bonnet shall be painted with red reflective paint as required by utility company.
- G. Tools: Provide two (2) complete sets of tools required for maintenance and/or repair.

2.11 WATER VAULT

- A. Vault detailed is manufactured by Clearflow Co., and is available pre-assembled. Allow for proper delivery time.
- B. Backflow Prevention: Provided within vault as detailed on the Drawings.
- C. Meter Assembly: Provided within vault as detailed on the Drawings.

2.12 FROSTPROOF YARD HYDRANT

- A. Provide a self-draining, non-freezing, low lead, Sanitary yard hydrant.
- B. A lockable feature is required.
- C. Riser shall be steel pipe with a cast iron casing guard.
- D. Principal interior operating parts shall be brass and removable from yard hydrant for servicing without excavation.

- E. Yard hydrant shall be set in four cubic yards (4 CY) of crushed stone to allow for proper drainage.
- F. Yard hydrant shall be Woodford Sanitary Yard Hydrant, Model S4H meeting ADA requirements for height and a 5 lbs. maximum operating force to operate.

2.13 ACCESSORIES

- A. General: Provide flanges, connecting pieces, transition glands, transition sleeves, and other adapters as required for a complete and operational system.
- B. Structure top adjustments: Provide grade rings, brick and mortar, or extensions as required for adjusting structure top elevations to meet proposed finish grades.
- C. Thrust Block/Anchorages: Provide at all tees, wyes, crosses, plugs, caps, bends, valves and hydrants.
- D. Valve Box: Each valve on buried piping shall be provided with an adjustable cast-iron valve box of a size suitable for the valve. Provide each cast-iron box with a heavy coat of bituminous paint. The head shall be round and the lid shall have the word "WATER" cast on it. The least diameter of the box shaft shall be 5.25 inches.
- E. Trace Wire for Non-Metallic Piping: Comply with Section 312317 - Utility Trenching & Backfilling.
- F. Buried Utility Warning and Identification Tape: Comply with Section 312317 - Utility Trenching & Backfilling.
- G. Identification Tags and Plates: Provide valves with tags or plates numbered and stamped for their usage. Plates and tags shall be of brass or non-ferrous metal and shall be mounted or attached to the valve.
- H. Rim Adjustments: Provide pre-cast grade rings or install brick and mortar as necessary to level, raise or lower existing or new manhole frames and covers to meet finish grade. Adjustments of 8 inches or less in height shall not be considered for additional compensation.

2.14 BEDDING MATERIALS

- A. Bedding & Haunching: Coarse Aggregate Type A1 (Utility Bedding, Select Backfill) as specified in Section 310516 - Aggregate Materials.
- B. Cover Bedding/Initial Backfill: Soil Type S1 or S2 as specified in Section 310513 - Soil Materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate with the WVWA for all required meetings, inspections, and approvals.
- B. Verify that building service connection, point of water service connection and

municipal utility water main size, location and invert are as indicated.

- C. Verify that grades are within six (6) inches of finished subgrade prior to the commencement of this work. Minimum clear cover over all water pipe shall be three (3) feet.
- D. Inspect all new water piping material upon receipt and immediately prior to installation to verify that it is in acceptable condition and proper working order. Mark all damaged material, remove it from the site at the first opportunity and replace it promptly so the work will not be delayed.
- E. For new and existing water utilities affected by new work, verify that structure top elevations have been adjusted to meet proposed finished grades.

3.2 PREPARATION

- A. Provide adequate means and methods for lowering sections of pipe and associated items into trenches. Do not drop or dump pipe, fittings, valves, or any other water piping material.
- B. Have all necessary arrangements made to complete the work and place it in operation without delays.
- C. Prepare pipe connections to equipment with flanges or unions.

3.3 SEPARATION

- A. Water Piping Installation Parallel to Sewer Piping
 - 1. Normal Conditions: Water piping shall be laid at least ten (10) feet horizontally from a sewer or sewer manhole wherever possible, measured edge to edge.
 - 2. Unusual Conditions: When local conditions prevent ten (10) feet horizontal separation, the water piping may be laid closer to a sewer or sewer manhole provided that:
 - a. The bottom (invert) of the water piping shall be at least 18 inches above the top (crown) of the sewer piping.
 - b. Where this vertical separation cannot be obtained, the sewer piping shall be constructed of AWWA-approved water pipe and pressure tested in place without leakage prior to backfilling.
 - c. The sewer manhole shall be of water-tight construction and tested in place.
- B. Water Piping Installation Crossing Sewer Piping
 - 1. Normal Conditions: Water piping crossing above sewer piping shall be laid to provide a separation of at least 18 inches above the top (crown) of the sewer piping.
 - 2. Unusual Conditions: When local conditions prevent the vertical separation described above, the following construction shall be used:
 - a. Sewer piping passing over or under water piping shall be constructed of AWWA-approved water pipe and pressure tested in place without leakage prior to backfilling.

- b. Water piping passing under sewer piping shall, in addition, be protected by providing the 18 inch vertical separation described above, adequate structural support for the sewer piping to prevent excessive deflection of the joints and the settling on and breaking of the water piping, and that the length (min. 18 feet) of the water piping be centered at the point of crossing so that joints shall be equidistant and as far as possible from the sewer piping.
- C. Sewer Manholes
 - 1. No water piping shall pass through or come in contact with any part of a sewer manhole.

3.4 BEDDING

- A. Excavate pipe trench in accordance with Section 312317 - Utility Trenching & Backfilling for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated. See Drawings for trench detail.
- B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches (150 mm) compacted depth, compact to 95 percent. Continue until pipe springline elevation is reached and hand excavate an accurate pipe shape to invert required. After setting pipe, where hand excavation is irregular against pipe, hand fill and tamp for an even fit tight to pipe at springline.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.5 INSTALLATION - PIPE

- A. Connection to Existing Water Systems: Connection to existing system will be made by the Contractor and coordinated with the Western Virginia Water Authority. Use tapping and drilling machine valve and mechanical joint type sleeves for connections to be made under pressure. Bolt sleeves around mains; bolt valve conforming to AWWA C500 to the sleeve. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, all without interruption of service. Notify the Owner in writing at least fifteen (15) days prior to the date the connections are required; receive approval before any service is interrupted. Furnish all materials and labor required to make connections into the existing water supply systems.
- B. The Contractor shall be responsible for all public notification of service interruptions of the water main. Comply with all WVWA requirements regarding safety, temporary services and installation procedures.
- C. The Contractor shall comply with the Waterworks Regulations pertaining to separation of water and sanitary sewer.
- D. Establish elevations of buried piping to ensure not less than 3 ft (900 mm) of cover.

3.6 UTILITY ADJUSTMENT

- A. Adjust the tops of all affected water utility structures whether new or existing to meet finished grades. Provide grade rings, brick and mortar, or extensions for existing or new structures such that tops meet proposed finish grades. Adjustments of 8 inches or less in height shall be made at no additional cost to the Owner.
- B. Coordinate timing of adjustment work to be prior to stone base applications for paved areas and prior to topsoil applications in lawn spaces.

3.7 DUCTILE IRON

- A. Install ductile iron piping and fittings in accordance with ANSI/AWWA C600.

3.8 POLY-VINYL CHLORIDE (PVC)

- A. Install PVC piping and fittings to ASTM D2774.
- B. Inspect pipe, fittings, valves, and accessories before and after installation; those found defective shall be replaced with new materials. Ream pipe and tube ends and remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, removing scale and dirt, on inside and outside, before assembly and maintain in a clean condition.
- C. Route pipe in a straight line, unless otherwise indicated on the Drawings. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.
- D. Cut pipe accurately to measurements established at the site and work into place without springing or forcing and making proper provision for expansion and contraction of piping without stressing pipe or joints. Replace pipe or fitting that does not allow sufficient space for proper installation of joint material with new pipe or fittings of proper dimensions. Blocking or wedging between bells and spigots will not be permitted.
- E. Install pipe to indicated elevations and grade to within tolerance of 5/8 inch (20 mm). Ensure firm and uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Keep trenches free of water. At the end of each days work, close open ends of pipe temporarily with wood blocks or bulkheads.
- F. Install access fittings to permit disinfection of water system performed under Section 331300 - Disinfection of Water Distribution System. Position drains at low points.
- G. Conduct testing.
- H. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main, vertical and horizontal, and behind fire hydrant as recommended by manufacturer. See detail on the Drawings.

- I. Install trace wire continuous over top of non-metallic pipe. Coordinate with Section 312317 - Utility Trenching & Backfilling.
- J. Place cover bedding/initial backfill to depth indicated in trench section on the Drawings, compacted to 95%.
- K. Backfill pipe trench in accordance with Section 312317 - Utility Trenching & Backfilling for work of this Section.

3.9 SPECIAL REQUIREMENTS FOR INSTALLATION OF DISTRIBUTION PIPING

- A. Ductile Iron Pipe and Fittings:
 - 1. AWWA C600 for pipe installation, joint assembly, valve and fitting installation, and thrust restraint, except as otherwise specified hereunder. Provide AWWA C600 joint assembly for push-on joints. Provide AWWA C600 joint assembly for mechanical joints and with the recommendations of Appendix A to AWWA C111. Make flanged joints up tight; avoid undue strain on flanges, fitting, valves, and other accessories. Use full-sized bolts for the bolt holes; use of the undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoined flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overtraining the flange. When any flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified for flanged joints, except that bolts with insulating sleeves shall be full size for the bolt holes. Assure that there is no metal-to-metal contact between dissimilar metals after joint has been assembled.
- B. Polyvinyl Chloride (PVC) Pipe and Fittings:
 - 1. UNI B3 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings, except as specified hereunder. Make push-on joints with elastomeric gaskets using either elastomeric gasket bell-end pipe or elastomeric gasket couplings. Use push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
 - 2. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of UNI B3 for laying the pipe. Assemble push-on joints for connection to fittings, valves, and other accessories with the requirements of AWWA C600 for joint assembly. Assemble compression-type joints and mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners in accordance with the requirements of UNI B3 and AWWA C600, and Appendix A to AWWA C111. Cut off spigot end of pipe for compression-type joint and mechanical-joint connections and do not re-bevel.
- C. Pipe Anchorage:
 - 1. Provide anchorage of buried piping shall be installed at all 22.5 degrees and sharper bends, and tees. Dead ends of piping shall be securely blocked in the direction of flow.

2. Provide reaction anchors of concrete blocking, metal harness, retainer gland type, or restrained joint type pipe at all changes in direction of pressure pipelines and as shown on the Drawings.
3. Use of metal harness restraints shall be approved by the Engineer.
4. Concrete thrust blocks (reaction backing) shall have a minimum compressive strength of 3000 psi. Dead ends restrained with concrete shall have the concrete bearing solidly against the piping and affording a minimum of 3 square feet of bearing area against a vertical trench face (undisturbed earth) for 3- and 4-inch piping, and in accordance with the drawing details for piping 6-inch diameter and larger.

3.10 SETTING OF VALVES AND VALVE BOXES

- A. Valve, Air Release, Meter and Blow-Off Chambers (as applicable):
 1. Drain to surface where not subject to flooding by surface water or to absorption pit located above seasonal water table elevation per Waterworks Regulations Section 3.53 C, otherwise to manufacturer's recommendation.
 2. Install valves with operator stems in the vertical plane through the pipe axis and perpendicular to the pipe axis. Locate valves where shown on the Drawings. Thoroughly clean before installation. Check valves for satisfactory operation.
 3. Equip all underground valves without gearing or operators with valve boxes. Set box in alignment with valve stem centered on valve nut. Set the valve box to prevent transmitting shock or stress to the valve. Set the box cover flush with the finished ground or pavement surface.
 4. Valve, Air Release, Meter and Blow-Off Chambers
 - a. Drain to surface where not subject to flooding by surface water or to absorption pit located above seasonal water table elevation per Waterworks Regulations Section 3.53 C, otherwise to manufacturer's recommendation.
 - b. Provide chambers/boxes in accordance with manufacturer's recommendations and of adequate size to permit ease of access and maintenance.

3.11 SPECIAL REQUIREMENTS FOR INSTALLATION OF WATER SERVICE PIPING

- A. Metallic Piping:
 1. Install pipe and fittings in accordance with the general requirements for installation of piping and with the applicable requirements of AWWA C600 for pipe installation, except as otherwise specified in the following paragraphs.
- B. Joints for Copper Tubing:
 1. Cut copper tubing with square ends; remove fins and burrs. Replace dented, gouged, or otherwise damaged tubing with new tubing. Before making joint, clean ends of tubing and interior of fitting or coupling with wire brush or abrasive. Apply a rosin flux to the tubing end and on recess inside of fitting or coupling. Insert tubing end into fitting or coupling for the full depth of the recess and solder. For compression joints on flared tubing, insert tubing through the coupling nut and then flare tubing with flaring tool.

- C. Flanged Joints:
 - 1. Make flanged joints up tight; avoid undue strain on flanges, valves, fittings, and accessories.
- D. PVC Piping
 - 1. Install pipe and fittings in accordance with the general requirements for installation of piping and with the applicable requirements of ASTM D2774 and ASTM D2855, except as modified herein. ASTM F402 for safe handling of solvent cements.
 - 2. Jointing
 - a. Make solvent-cemented joints and assemble in accordance with ASTM D2855. Make pipe joints to other pipe materials in accordance with the recommendation of the PVC pipe manufacturer, as approved.
- E. Installation of Valves and Valve Boxes:
 - 1. Valves and valve boxes shall be set plumb, with valve boxes centered directly over the valves. Valve boxes shall be located outside the area of the roads and streets whenever possible. Earth fill shall be tamped around the valve box to a distance of 4 feet on all sides of the box, or to the undisturbed trench face if less than 4 feet. Clean foreign matter from interior of valves before installation. Stuffing boxes shall be tightened and the valve shall be inspected in open and closed positions to ensure that all parts are in proper working order.
 - 2. Install a full-ported shut-off valve below each Air Release or Combination Air Valve in the event servicing is required.

3.12 INSTALLATION - FIRE HYDRANT ASSEMBLIES

- A. Set valves on solid bearing.
- B. Center and plumb valve box over valve. Set box cover flush with finished grade. The Contractor shall locate and uncover all valve boxes after pavement/surface treatment of roads and adjust the tops to final road grades, if necessary.
- C. Set Fire Department Connection (FDC) plumb and locate centerline of nozzles perpendicular to roadway.
- D. Set hydrants plumb and locate pumper nozzle perpendicular to roadway.
- E. Set hydrants to grade in accordance with manufacturer's recommendations, with nozzle centers at least 20 inches (500 mm) above ground.
- F. Locate control valve 4 inches (100 mm) minimum away from hydrant.
- G. Provide a drainage pit 36 inches (900 mm) square by 24 inches (600 mm) deep filled with 2 inch (50 mm) diameter washed gravel. Encase elbow of hydrant in gravel to 6 inches (150 mm) above drain opening. Do not connect drain opening to sewer.
- H. Paint hydrants in accordance with requirements of local fire department.

3.13 FIELD TESTS AND INSPECTIONS OF WATER MAINS

- A. Perform all field tests, and provide all labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with contract requirements. Allow concrete to cure a minimum of 5 days before testing any section of piping where concrete thrust blocks have been provided.
- B. Field Testing of System:
 - 1. The Contractor may backfill over the pipe as laid, except as noted below. The bell holes shall either be left open or reopened for a visual inspection of the joints during the test period. The bell holes of all dry joints may be backfilled following this test. All leaking joints shall be reconnected (or tightened as necessary) and retested and all pipe, valves and fittings and other materials found defective under this test shall be removed and replaced at the Contractor's expense.
 - 2. Exception: When the open trench or open bell holes necessary for a visual inspection and test of the joints present a hazard to safety and welfare, or in an emergency, and/or special case, the operation incident to trenching, pipe laying, backfilling and testing shall be so coordinated as to minimize the lineal footage of open trench and that portion of the system tested in accordance with this section.
 - 3. This portion or portions of the system shall be tested between valves or temporary plugs in sections of not more than 2,500 lineal feet.
- C. Pressure and Leakage Test:
 - 1. Test Restrictions and Certification:
 - a. Per "Contractor's Material and Test Certificate for Underground Piping" following this section.
 - b. Test pressure shall not vary by more than +/-5 psi for the duration of the test.
 - c. Valves shall not be operated in either direction at differential pressure exceeding the rated valve working pressure. Use of a test pressure greater than the rated valve pressure can result in trapped test pressure between the gates of a double-disc gate valve. For tests at these pressures, the test setup should include provision, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or fully opened if desired.
 - d. Test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.
- D. Pressurization:
 - 1. After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to the required hydrostatic pressure at the point of testing to provide the minimum required pressure at the high point in the test section. Each valved section of pipe shall be slowly filled with water, and the specified test pressure, based on the evaluation of the lowest point of the line or section under test and corrected to the elevation of the test

gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Owner. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test.

- E. Air Removal:
 - 1. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied.
- F. Examination:
 - 1. All fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until it is satisfactory to the Owner.
- G. Flushing: Per Test Certificate unless test section is a fire service line, then flushing shall be in accordance with NFPA 24.
- H. Leakage Defined
 - 1. See Test Certificate.
- I. Allowable Leakage
 - 1. See Test Certificate.
- J. When hydrants are in the test section, the test shall be made against closed hydrant valves.
- K. Acceptance of Installation:
 - 1. Acceptance shall be determined on the basis of allowable leakage. If any test of laid pipe disclosed leakage greater than that specified in Paragraph "H" above, the contractor shall, at his own expense, locate and make approved repairs as necessary until the leakage is within the specified allowance.
 - a. All visible leaks are to be repaired, regardless of the amount of leakage.

3.14 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 331300 -Disinfection of Water Distribution System.

3.15 SERVICE CONNECTIONS

- A. Provide all sleeves, caulk or other materials required to provide a watertight connection at buildings or through walls or foundations.

3.16 FIELD QUALITY CONTROL

- A. Field trench inspection and compaction testing shall be performed under provisions of Section 312317 - Utility Trenching & Backfilling.
- B. Compaction testing will be performed in accordance with ANSI/ASTM D698 Standard Proctor. Field testing methods shall be as deemed appropriate by the Geotechnical Engineer.
- C. Installation and testing shall be inspected in accordance with Section 310900 – Geotechnical Engineering, Inspections & Testing
- D. Disinfection testing shall be performed in accordance with Section 331300 - Disinfection of Water Distribution System.
- E. All equipment shall be tested in operation to demonstrate compliance with the contract requirements.
- F. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

Contractor's Material and Test Certificate for Underground Piping

PROCEDURE

Upon completion of work, inspection, and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

PROPERTY NAME

DATE

PROPERTY ADDRESS

PLANS

ACCEPTED BY APPROVING AUTHORITIES (NAMES)

ADDRESS

INSTALLATION CONFORMS TO ACCEPTED PLANS

☐ YES ☐ NO

EQUIPMENT USED IS APPROVED

☐ YES ☐ NO

IF NO, STATE DEVIATIONS

INSTRUCTIONS

HAS PERSON IN CHARGE OF FIRE EQUIPMENT BEEN INSTRUCTED AS TO LOCATION OF CONTROL VALVES AND CARE AND MAINTENANCE OF THIS NEW EQUIPMENT?

IF NO, EXPLAIN

☐ YES ☐ NO

HAVE COPIES OF APPROPRIATE INSTRUCTION AND CARE AND MAINTENANCE CHARTS BEEN LEFT ON PREMISES?

IF NO, EXPLAIN

☐ YES ☐ NO

LOCATION

SUPPLIES BUILDINGS

UNDERGROUND
PIPES AND
JOINTS

PIPE TYPES AND CLASS

TYPE JOINT

PIPE CONFORMS TO _____ STANDARD

☐ YES ☐ NO

FITTINGS CONFORM TO _____ STANDARD

☐ YES ☐ NO

IF NO, EXPLAIN

JOINTS NEEDING ANCHORAGE CLAMPED, STRAPPED, OR BLOCKED IN ACCORDANCE WITH _____ STANDARD

IF NO, EXPLAIN

☐ YES ☐ NO

TEST
DESCRIPTION

FLUSHING: Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags and outlets such as hydrants and blow-offs. Flush at flows not less than 390 GPM (1476 L/min) for 4-inch pipe, 880 GPM (3331 L/min) for 6-inch pipe, 1560 GPM (5905 L/min) for 8-inch pipe, 2440 GPM (9235 L/min) for 10-inch pipe, 3520 GPM (13323 L/min) for 12-inch pipe. When supply cannot produce stipulated flow rates, obtain maximum available.

HYDROSTATIC: Hydrostatic tests shall be made at not less than 200 psi (13.8 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.3 bars) for two hours.

LEAKAGE: New pipe laid with rubber gasketed joints shall, if the workmanship is satisfactory, have little or no leakage at the joints. The amount of leakage at the joints shall not exceed 2 qts. per hr (1.89 L/h) per 100 joints irrespective of pipe diameter. The leakage shall be distributed over all joints. If such leakage occurs at a few joints the installation shall be considered unsatisfactory and necessary repairs made. The amount of allowable leakage specified above may be increased by 1 fl oz per in. valve diameter per hr. (30 mL/25 mm/h) for each metal sealed valve isolating the test section. If dry barrel hydrants are tested with the main valve open, so the hydrants are under pressure, an additional 5 oz. per minute (150 mL/min) leakage is permitted for each hydrant.

Figure 8-1 (b) Part 1.

FLUSHING TEST	NEW UNDERGROUND PIPING FLUSHED ACCORDING TO _____ STANDARDS BY (COMPANY) <input type="checkbox"/> YES <input type="checkbox"/> NO IF NO, EXPLAIN _____		
	HOW FLUSHING FLOW WAS OBTAINED <input type="checkbox"/> PUBLIC WATER <input type="checkbox"/> TANK OR RESERVOIR <input type="checkbox"/> FIRE PUMP		THROUGH WHAT TYPE OPENING <input type="checkbox"/> HYDRANT BUTT <input type="checkbox"/> OPEN PIPE
	LEAD-INS FLUSHED ACCORDING TO _____ STANDARD BY (COMPANY) IF NO, EXPLAIN _____ <input type="checkbox"/> YES <input type="checkbox"/> NO		
	HOW FLUSHING FLOW WAS OBTAINED <input type="checkbox"/> PUBLIC WATER <input type="checkbox"/> TANK OR RESERVOIR <input type="checkbox"/> FIRE PUMP		THROUGH WHAT TYPE OPENING <input type="checkbox"/> Y.CONN TO FLANGE & SPIGOT <input type="checkbox"/> OPEN PIPE
HYDROSTATIC TEST	ALL NEW UNDERGROUND PIPING HYDROSTATICALLY TESTED AT _____ PSI FOR _____ HOURS		JOINTS COVERED <input type="checkbox"/> YES <input type="checkbox"/> NO
LEAKAGE TEST	TOTAL AMOUNT OF LEAKAGE MEASURED _____ GALS _____ HOURS		
	ALLOWABLE LEAKAGE _____ GALS _____ HOURS		
HYDRANTS	NUMBER INSTALLED	TYPE AND MAKE	ALL OPERATE SATISFACTORILY <input type="checkbox"/> YES <input type="checkbox"/> NO
	WATER CONTROL VALVE LEFT WIDE OPEN <input type="checkbox"/> YES <input type="checkbox"/> NO IF NO, STATE REASON _____		
	HOSE THREADS OF FIRE DEPARTMENT CONNECTIONS AND HYDRANTS <input type="checkbox"/> YES <input type="checkbox"/> NO INTERCHANGEABLE WITH THOSE OF THE FIRE DEPARTMENT ANSWERING ALARM		
REMARKS	DATE LEFT IN SERVICE _____		
SIGNATURES	NAME OF INSTALLING CONTRACTOR _____		
	TESTS WITNESSED BY		
	FOR PROPERTY OWNER (SIGNED)	TITLE	DATE
	FOR INSTALLING CONTRACTOR (SIGNED)	TITLE	DATE
ADDITIONAL EXPLANATION AND NOTES			

Figure 8-1 (b) Part 2.

END OF SECTION

SECTION 331300
DISINFECTION OF WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not necessarily limited to)

- A. Disinfection of all equipment, pipe lines, and all structures in the water project with which water comes in contact and/or which have been contaminated by the Contractor's operations shall be accomplished after completion of construction and immediately before the system or unit is placed in operation.
- B. Testing and reporting results.

1.2 RELATED SECTIONS

- A. Applicable sections of Division 01 – GENERAL CONDITIONS: Including but not limited to:
 - 1. Coordination of the Work,
 - 2. Submittals: Procedures for submittals,
 - 3. Quality Control or Testing Laboratory Services: Testing water samples. Field inspection and testing,
 - 4. Material & Equipment: Delivery, storage and handling, and
 - 5. Contract Closeout: Project Record Documents, Requirements.
- B. Section 331116 – Water Mains and Services

1.3 REFERENCES

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

VIRGINIA DEPARTMENT OF HEALTH (VDH)

- A. VDH "Waterworks Regulations," latest edition, hereinafter Waterworks Regulations.
- B. ANSI/AWWA B300 – Standard for Hypochlorites.
- C. ANSI/AWWA B301 – Standard for Liquid Chlorine.
- D. ANSI/AWWA B302 – Standard for Ammonium Sulfate.
- E. ANSI/AWWA B303 – Standard for Sodium Chlorite.
- F. AWWA C651 – Standards for Disinfecting Water Mains.
- G. ANSI/AWWA C652 – Standards for Disinfecting Water Storage Facilities.

1.4 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of applicable of Division 01: Contract Closeout: Project Record Documents, Requirements.
- B. Disinfection report; record:
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and time of completion.
 - 3. Test locations.
 - 4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - 5. Date and time of flushing start and completion.
 - 6. Disinfectant residual after flushing in ppm for each outlet tested.
- C. Bacteriological report; record:
 - 1. Date issued, project name, and testing laboratory name, address, and telephone number.
 - 2. Time and date of water sample collection.
 - 3. Name of person collecting samples.
 - 4. Test locations.
 - 5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
 - 6. Coliform bacteria test results for each outlet tested.
 - 7. Certification that water conforms, or fails to conform, to bacterial standards of VDH Waterworks Regulations.
 - 8. Bacteriologist's signature and authority.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA C651.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS & DILUTION MEDIUM

- A. Disinfecting Agent: The disinfection agent shall be liquid chlorine ANSI/AWWA B301, or sodium hypochlorite solution ANSI/AWWA B303. Dry hypochlorite ANSI/AWWA B300, similar and equal to "HTH" may also be used as the disinfecting agent.
- B. Potable water.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Piping shall be cleaned immediately after placing and all open ends shall be adequately sealed to prevent entry of debris.

- B. Unless the Contractor adheres to AWWA C651 concerning pipe cleanliness and prevents contamination of pipe, fittings and valves during construction, disinfection will be difficult.
- C. All sediment and foreign matter including debris resulting from cutting, welding or fabrication shall be removed from entire water distribution system including water lines and hydrants, followed by thorough flushing with potable water at a minimum velocity of 2.5 ft/sec to remove any sediment which may have collected during operation with raw water. In cases where this velocity is not attainable or is ineffective, cleaning devices such as foam swabs or "pigs" will be considered.
- D. Perform scheduling and disinfection activity with start-up, testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

- A. Provide and attach required equipment to perform the work of this Section.
- B. Pressure Testing: After the valves and piping have been installed, they shall be subjected for one hour to a hydrostatic pressure test of 150 pounds per square inch at the points of reading when the system is put into operation. Any defective material shall be replaced by the Contractor with sound material.
- C. Disinfection: All water lines shall be disinfected prior to being placed in operation. Potable water shall be introduced into the pipe line at a constant flow rate. This water shall receive a chlorine dosage which will result in a chlorine concentration of 100 mg/L in a "slug" of the water. An approved hypochlorite solution injected by a metering pump or liquid chlorine injected by a solution-feed chlorinator and booster pump may be used. The chlorine shall be added long enough to ensure that all portions of the pipe are exposed to the 100 mg/L chlorine solution for at least 3 hours. The Chlorine residual shall be checked at regular intervals not to exceed 2000 feet to ensure that adequate residual is maintained. As the chlorinated water passes valves and other appurtenances, they shall be operated to ensure disinfection of these appurtenances.

After the required retention period, the heavily chlorinated water shall be flushed from the pipe line using potable water until chlorine measurements show a concentration no greater than that generally prevailing in the source system. Comply with AWWA C651 requirements for disposal of disinfecting water with high chlorine concentrations.

After flushing the waterlines, two series of bacteriological samples shall be taken 24 hours apart. Collect one set of samples at intervals of 1,200 ft. of waterline, plus one set at each end of the new line and at the end of each branch (minimum of three sets total). Sets of two consecutive biological samples, taken at least 24 hours apart, which show no contamination, will indicate acceptable disinfection and the water lines may be placed in service.

- D. Disinfect permanent system devices removed for system disinfection by exposing to a chlorine solution for a similar time period (method shall be approved in the

field). Replace same devices, being sure not to contaminate in the process.

3.3 QUALITY CONTROL

- A. Submit under provisions of applicable section of Division 01: Quality Control or Testing Laboratory Services: Testing water samples. Field inspection and testing.
- B. Test samples in accordance with AWWA C651.
- C. Approval of Disinfection: The complete disinfection program and methods followed, especially if materially different from those specified, shall be in accordance with directives of VDH and all methods employed shall have the approval of VDH. Definite instructions as to the collection and shipment of samples shall be requested from VDH and shall be followed in all respects. Final approval of the bacterial samples shall be received from VDH prior to the time that water mains are placed in service and allowed to be used for distribution of potable water. The Contractor shall deliver copies of the approved test data for the Owner and the Engineer.
- D. All references made above to VDH shall also apply to the local utility purveyor, as applicable.

END OF SECTION

SECTION 333100
SITE SANITARY GRAVITY SEWER SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not limited to)

- A. Sanitary gravity sewerage piping, fittings and accessories, and bedding.
- B. Connection of building sanitary drainage system to municipal sewer.
- C. Cleanout access and manholes.
- D. Utility top elevation adjustment.
- E. Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein from approximately five (5) feet outside building walls.

1.2 RELATED SECTIONS

- A. Applicable sections of Division 01 - GENERAL CONDITIONS: Including but not limited to:
 - 1. Coordination of the Work,
 - 2. Soil and aggregate testing, compaction testing, and inspection of bearing surfaces,
 - 3. Material delivery, storage and handling,
 - 4. Project Record Document Requirements, and
 - 5. Procedures for Submittals.
- B. Section 226600 – Chemical Waste Systems for Laboratory and Healthcare Facilities.
- C. Section 310900 – Geotechnical Engineering, Inspection, & Testing: Underground Utility Quality Assurance.
- D. Section 312213 – Rough Grading: Site subgrade contouring. General cutting, grading, filling and rough contouring the site. Geotechnical Engineer. Subsoil and aggregate materials. Classifications of Excavation. Unauthorized excavation defined. Excavation. Dewatering.
- E. Section 312317 - Utility Trenching & Backfilling: Excavating for sewer system piping and structures. Inspection of bearing surfaces. Bedding & haunching. Trace Wire for Non-Metallic Piping. Initial backfill. Backfill over piping up to subgrade elevation. Warning & ID Tape. Protection of utility from disturbance and damage during backfill operation.

1.3 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Latest revision shall be assumed.

AMERICAN SOCIETY OF TESTING & MATERIALS (ASTM)

- B. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
- C. ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
- D. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- E. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- F. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe

UNI-BELL PLASTIC PIPE ASSOCIATION (UNI)

- G. UNI B5 - Installation of Polyvinyl Chloride (PVC) Sewer Pipe
- H. UNI B6 - Low Pressure Air Testing of Installed Sewer Pipe

VIRGINIA DEPARTMENT OF TRANSPORTATION (VDOT)

- I. VDOT - Virginia Department of Transportation "Road & Bridge Standards & Specifications"

VIRGINIA DEPARTMENT OF HEALTH (VDH)

- J. VDH - Virginia Department of Health "Sewage Conveyance and Treatment (SCAT) Regulations."
- K. VDH - Virginia Department of Health "Sewage Handling and Disposal (SH&D) Regulations."
- L. VDH – Virginia Department of Health "Waterworks Regulations."

1.4 QUALITY ASSURANCE

- A. Qualifications of Installers: Use skilled and experienced workmen to ensure proper installation of the products specified herein. Workmen shall be thoroughly familiar with codes covering work of their trade and work to be performed under this contract. In the acceptance or rejection of installed Work, no allowance shall be made for the lack of experience on the part of the workmen.
- B. Comply with all standards specified in this Section.

1.5 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures: Submittals.
- B. Manufacturer's Product Data:
 - 1. Provide manufacturer's standard drawings or catalog cuts for pipe, pipe accessories, and fittings.
 - 2. Provide manufacturer's drawings for metal work.
 - 3. All products identified in PART 2 of this specification.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise. Production control tests shall have been performed at the intervals or frequency specified in the referenced publication. Other tests shall have been performed within three years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project. Include:
 - 1. Pipe and fittings, including factory applied linings,
 - 2. Pipe joint materials,
 - 3. Cast iron frames and covers,
 - 4. Precast concrete manhole sections.

1.6 DELIVERY, STORAGE, HANDLING, AND PROTECTION

- A. Delivery and Storage
 - 1. Piping: Inspect materials delivered to the site for damage; store with minimum of handling, on site in enclosures or under protective covering and not directly on the ground. Store plastic piping, jointing materials and rubber gaskets out of direct sunlight. Keep inside of pipes and fittings free of dirt and debris.
 - 2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
- B. Handling: Handle pipe, fittings, and other accessories in such a manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs or replace. Carry, do not drag, pipe to the trench.
- C. Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of other trades.

- 1.7 Damage: in the event of damage, immediately make all repairs and replacements necessary to the approval of and at no additional cost to the Owner or Engineer.

PROJECT RECORD DOCUMENTS

- A. Record location of pipe runs, connections, manholes, cleanouts, structure top elevations and all pipe invert elevations.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities (active or abandoned).

1.8 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this section. Conform to materials' manufacturer's installation recommendations. Code shall take precedence.
- B. The Contractor shall comply with the VDH Waterworks Regulations Section pertaining to separation of water and sanitary sewer. Comply also with VDOT Std. UB-1 where separation requirements cannot be maintained.

1.9 COORDINATION

- A. Verify that field measurements and elevations are as indicated.
- B. Coordinate the Work with earthwork, trenching, point of connection to building sanitary plumbing, and connection to municipal sanitary sewer.
- C. Assure that structure tops will be at proposed finish grade and slope and that pipe cover is as specified.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

- A. Plastic Gravity Sewer Pipe & Fittings (12" and less in diameter with 10' max. bury): Conform to ASTM D3034, Type PSM, Poly-Vinyl Chloride (PVC) material, SDR-35; inside nominal diameter as indicated on Drawings. Examples meeting design criteria:
 - 1. National Pipe Company, PVC Sewer Pipe (SDR 35),
 - 2. Robintech, King's Joint PVC Sewer Main (SDR-35),
 - 3. Clow, Deflec-Tite PVC Sewer Pipe (SDR-35), or
 - 4. Approved equal.
- B. Refer to Section 226600 for Acid Neutralization Waste Piping Materials.
- C. Joints: Bell and spigot type suitable for elastomeric gasket joints conforming to ASTM D3212.
- D. Gaskets: Conform to ASTM F477.

2.2 PIPE ACCESSORIES

- A. Joints of Dissimilar Pipe: Provide standard manufactured fitting specifically for

the proposed connection by same manufacturer of either type pipe or provide mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required and with gaskets conforming to ASTM F477.

2.3 MANHOLES

- A. Manholes indicated on Drawings shall be precast VDOT Std. MH-2 with nominal shaft diameter of 4 feet unless otherwise indicated. Taper shape shall be as indicated on Drawings by symbol or description. No parging will be permitted on interior manhole walls.
- B. Manhole frames and covers shall conform to VDOT Std. MH-1 except as herein modified. The frame shall be drilled to permit using 3/4 inch diameter bolts to secure it to the structure. Three such bolts shall be used per frame at 120 degrees. The words "SANITARY SEWER" shall be cast into the cover so as to be plainly visible. Covers shall be solid with two (2) "pick holes" at opposing edges.
- C. Steps shall be per VDOT Std. ST-1 placed in line with vertical wall of eccentric tapers or as creates most desirable access in other situations. All structures in excess of 3'-6" depth shall be provided with steps.
- D. Shaping shall be per VDOT Std. IS-1. All structures shall be provided with shaping.
- E. Base Pad (Precast): VDOT Standard B-1.
- F. Base Pad (Cast-in-place): VDOT Std. B-2 footing.
- G. Resilient Pipe Sleeve: For pipes from 4" to 22" diameter, provide resilient connectors in the wall of the reinforced concrete base/riser made of rubber with stainless steel sleeves and clamps, all conforming to ASTM C-923 equal.
- H. Riser Joint Sealant: Provide flexible rubber gasket conforming to ASTM C443 to create permanently flexible watertight joints.
- I. Waterproofing: Provide a 2 component, low-modulus, chemically cured coal tar epoxy polyimide waterproofing vapor barrier to manhole exteriors. It shall be spray applicable cure to a durable, flexible consistency.
- J. Rim Adjustments: Provide pre-cast grade rings or install brick and mortar as necessary to level, raise or lower existing or new manhole frames and covers to meet finish grade. Adjustments of 8 inches or less in height shall not be considered for additional compensation.

2.4 CLEANOUTS

- A. Per detail(s) on Drawings.

2.5 BEDDING & BACKFILL MATERIALS

- A. See Section 312317 - Utility Trenching & Backfilling for:
 - 1. Bedding & Haunching,
 - 2. Cover Bedding/Initial Backfill, and
 - 3. Backfill Materials.

2.6 UTILITY ADJUSTMENT

- A. Provide grade rings, brick and mortar, or extensions for existing or new structures such that tops meet proposed finish grades. Adjustments of 8 inches or less in height shall be made at no additional cost to the Owner.

2.7 CONCRETE MATERIALS

- A. Concrete Materials not otherwise described herein shall be as specified in Section 033000 - Cast-In-Place Concrete.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that all prerequisite work has been completed. Verify location and elevation of points of connection. Notify Engineer of any discrepancies.
- B. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 GENERAL

- A. See Section 312317 - Utility Trenching & Backfilling: Excavating for sewer system piping and structures. Inspection of bearing surfaces. Bedding & haunching. Trace Wire for Non-Metallic Piping. Initial backfill. Backfill over piping up to subgrade elevation. Warning & ID Tape. Protection of utility from disturbance and damage during backfill operation.

3.3 INSTALLATION - PIPE

- A. These General Requirements for installation of pipelines apply except where specific exception is made in the following paragraph entitled, "Special Requirements." "Also" shall mean in addition to the general requirements.
- B. Obtain required approvals before making connection to existing line. Conduct work so that there is minimum impact from any interruption of service on existing line.
- C. Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Ream pipe and tube ends and remove fins and burrs from pipe and fittings. Provide adequate means and methods for lowering sections of pipe and associated items into trenches. Do not drop or dump pipe, fittings, or any other sewer piping material. Before placing in position, clean pipe, fittings and accessories, removing scale and dirt, on inside and outside, before assembly and maintain in a clean condition.
- D. Install pipe, fittings, and accessories in accordance with ASTM D2321 (PVC) and manufacturer's instructions. Seal joints watertight.
- E. Route pipe in straight line. Lay non-pressure pipe with bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around unless a curved section is indicated on Drawings.
- F. Cut pipe accurately to measurements established at the site and work into place without springing or forcing and making proper provision for expansion and contraction of piping without stressing pipe or joints. Replace pipe or fitting that does not allow sufficient space for proper installation of joint material with new pipe or fittings of proper dimensions. Blocking or wedging between bells and spigots will not be permitted.
- G. Tolerance: Lay pipe to slope gradients indicated on Drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m). Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose.
- H. Ensure firm and uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Keep trenches free of water. At the end of each days work, close open ends of pipe temporarily with plugs, wood blocks or bulkheads.
- I. Install haunching to springline of pipe (compacted thickness) per Section 312317 - Utility Trenching & Backfilling.
- J. Conduct required testing of piping system.

- K. Install trace wire continuous over top of non-metallic pipe and place cover bedding/initial backfill above springline of pipe per Section 312317 - Utility Trenching & Backfilling.
- L. Connect to building sanitary plumbing outlet and municipal sewer system, septic tank & drainfield, or on-site treatment, as applicable.

3.4 SPECIAL REQUIREMENTS

- A. PVC Plastic Piping: Also conform to the requirements of UNI B5 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of UNI B5 for joint assembly. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.5 INSTALLATION - CLEANOUTS

- A. Location/spacing: As indicated on Drawings, at all angular changes of direction and at 60 feet O.C. maximum in gravity lines not between manholes.
- B. Establish location, top elevation and pipe inverts and install wye as indicated in pipe installation above.
- C. Set vertical piping (adjusted to make ferrule or cover at proper finish grade), backfill per Section 312317 - Utility Trenching & Backfilling, then set cleanout ferrule.
- D. Level top surface of backfill, form for the concrete collar pad (coordinating with adjacent work as necessary), and cast-in-place.
- E. Traffic Bearing Only: Set adapter so that in the completed work the cleanout plug has 2 inches minimum to 6 inches maximum clearance beneath the cover but no deeper than flush with the concrete anchor pad. Fill from cleanout invert with VDOT Std. #26 coarse aggregate to beneath the concrete anchor pad. Wrap cleanout adapter with welder's cloth followed by aluminum flashing prior to placing concrete. See detail on Drawings for other dimensions. Mount cover frame on grout to slope and elevation of finished traffic surface. Anchor frame with 5/8" bolts to anchor pad.

3.6 MANHOLE CONSTRUCTION

- A. Construct base slab of cast-in-place concrete or use precast concrete base sections as indicated. Make inverts conforming with VDOT Std. IS-1 Shaping. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as the manhole size will permit. For cast-in-place concrete construction, key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. Make joints between precast manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints for precast concrete manholes. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the

recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, applicable local utilities standards shall take precedence over the above.

- B. Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and rises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.
- C. Apply waterproofing to exterior of structures, which have fully cured, to a minimum dry film thickness of 35 mils.

3.7 UTILITY ADJUSTMENTS

- A. Adjust new and existing structure tops affected by new work to meet proposed finish grades.
- B. Coordinate timing of adjustments to be prior to stone base applications for paved areas and prior to topsoil applications for lawn spaces.

3.8 FIELD QUALITY CONTROL

- A. The Engineer or other assigned Owner's representative will conduct field investigations and witness field tests specified in this section. The Contractor shall provide sufficient notice of tests for Owner's representative to be present (24 hours minimum). The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished as set forth in applicable section of Division 1; Temporary Utilities. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the Drawings and Specifications.
- B. Trench, Bedding and Compaction Tests: Per Section 312317 - Utility Trenching & Backfilling.
- C. Tests for Non-Pressure Lines: Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the other end of the segment/run of pipe. When pressure piping is used in a non-pressure line for non-pressure use, test as specified for non-pressure line.
- D. Leakage Test: Test lines for leakage by low-pressure air tests. Prior to testing for leakage, place and compact haunching. When necessary to prevent pipeline movement during testing, place cover bedding/initial backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make

satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

- E. Low-Pressure Air Test for PVC Piping: Test in accordance with UNI B6, including the allowable pressure drop. Make calculations in accordance with the Appendix to UNI B6.
- F. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.9 SCHEDULE

- A. Sanitary Gravity Line: Indicated on the Drawings as "SS". Size: as indicated on Drawings and Profiles.
- B. Cleanout: As indicated on Drawings by "SSCO".

END OF SECTION

SECTION 334100
SITE STORM DRAINAGE SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not limited to)

- A. Site storm drainage piping, fittings and accessories, and bedding.
- B. Drainage system from origin at inlets and/or connection to building rain leaders or downspouts to connection to municipal sewers or outfall, as applicable.
- C. Manholes, drop inlets (yard, sump or curb), detention basin structure(s).

1.2 RELATED SECTIONS

- A. Applicable sections of Division 01 - GENERAL CONDITIONS: Including but not limited to:
 - 1. Frequency of Tests,
 - 2. Coordination of the Work,
 - 3. Soil and aggregate testing, compaction testing, and inspection of bearing surfaces,
 - 4. Material delivery, storage and handling,
 - 5. Project Record Document Requirements, and
 - 6. Procedures for Submittals.
- B. Section 310900 - Geotechnical Engineering, Inspection, & Testing: Underground Utility Quality Assurance.
- C. Section 310513 - Soil Materials: Sub-soil materials.
- D. Section 310516 - Aggregate Materials.
- E. Section 312213 - Rough Grading: General cutting, grading, filling and rough contouring the site. Classification of Excavation. Unauthorized excavation defined.
- F. Section 312513 - Erosion & Sediment Control.
- G. Section 312323 - Backfilling.
- H. Section 312317 - Utility Trenching & Backfilling: Excavating for sewer system piping and structures. Inspection of bearing surfaces. Backfilling over piping up to subgrade elevation.
- I. Section 334600 - Subdrainage: Foundation, retaining wall and or slab-on-grade weep drainage system.

1.3 REFERENCES

VIRGINIA DEPARTMENT OF TRANSPORTATION (VDOT)

- A. VDOT "Road & Bridge Standards & Specifications", latest edition (hereinafter VDOT Std. ...).
- B. VDOT Memorandum LD-94(D)121.11 dated May 12, 1994 "Drainage Structure Criteria" - Polyethylene, Corrugated exterior, smooth interior (type S)

AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS (AASHTO)

- C. AASHTO M-198B - (flexible butyl resin sealant (ConSeal))

AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

- D. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- E. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- F. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets. (for use in structure risers)
- G. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
- H. ASTM D698 (Standard Proctor) - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- I. ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- J. ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- K. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- L. ASTM D3033 - Type PSP Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- M. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- N. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- O. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- P. ASTM F405 - Polyethylene perforated drain pipe.

1.4 DEFINITIONS

- A. Bedding: Fill placed under pipe to provide support.
- B. Haunching: Fill placed from bedding to springline of the pipe, also considered bedding, which further supports pipe in both the horizontal and vertical.
- C. Cover Bedding/Initial Backfill: Fill placed above haunching to protect pipe prior to further backfill.

1.5 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures: Submittals.
- B. All products identified in PART 2 of this specification. Include joint sealer for concrete pipe.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of pipe runs, connections, drainage structures, structure top elevations and invert elevations for each pipe.
- B. Identify and describe unexpected variations in subsoil conditions or discovery of uncharted utilities.

1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for materials and installation of the Work of this section.

1.8 COORDINATION

- A. Coordinate the Work with termination of rain water leaders outside building, trenching, connection to foundation drainage system (as applicable), grading and erosion & sediment control/stabilization, and local governing authorities for work off-site.

1.9 QUALITY ASSURANCE

- A. For concrete pipe and structures, all work shall be performed in accordance with the VDOT Road & Bridge Standards; however, the Contractor shall note that the City requires that the bell/spigot or tongue/groove connection be 100% complete with no missing sections. This requirement takes precedence over the VDOT RBS, any ASTM specifications, or any concrete trade association literature, etc.

PART 2 PRODUCTS

2.1 DRAINAGE PIPE MATERIALS

- A. Pipe materials have been indicated on the plans, profiles and Schedule at the end of this section. All storm drainage pipes 15" diameter or greater shall be constructed of Reinforced Concrete. If no material is specifically required, the Contractor shall have the option of choosing the following.
- B. Cast Iron Pipe (CIP) (max. 12" diameter): VDOT Spec. Section 232, Service type, inside nominal diameter as indicated on Drawings, bell and spigot end.
- C. Concrete Pipe (CP) (max. 12" diameter): VDOT Spec. Section 232.02 (a) 1. a. Plain concrete culvert pipe, non-reinforced; inside nominal diameter as indicated on Drawings, standard or modified tongue-and-groove joints.
- D. Reinforced Concrete Pipe (RCP): VDOT Spec. Section 232.02 (a) 1. b. Reinforced concrete culvert pipe, circular, Class III (for 14' max. cover and H-20 live load); mesh reinforcement; inside nominal diameter as indicated on Drawings. Utilize bell and spigot joint connections with mastic joint compound, pre-formed mastic or butyl joint sealer. Note that tongue-and-groove joints shall not be allowed.
- E. Plastic Pipe (Poly-vinyl Chloride - PVC) (max. 12" diameter): VDOT Spec. Section 232.02 (g) 2. PVC Storm Drains; inside nominal diameter as indicated on Drawings.
- F. Plastic Pipe (HDPE) (12" to 36" diameter): HDPE (high density poly-ethylene) corrugated storm drain and culvert pipe, type S (smooth interior wall); inside nominal diameter as indicated on Drawings. Pipe shall conform to AASHTO M-294. Corrugated interior pipe will not be allowed.
- G. Plastic Pipe (HDPE) (42" to 48" diameter): HDPE (high density poly-ethylene) corrugated storm drain and culvert pipe, type S (smooth interior wall); inside diameter as indicated on the Drawings. Pipe shall have a minimum pipe stiffness of 20 psi for 42" pipe and 17 psi for 48" pipe at 5% deflection; Pipe shall conform to AASHTO M-294. Corrugated interior pipe will not be allowed.
- H. Plastic Pipe (PE) (only use in locations specifically indicated on the drawings): Perforated, corrugated, poly-ethylene (PE) pipe; inside nominal diameter as indicated on Drawings.

2.2 ACCESSORIES

- A. Joints of Dissimilar Pipe: Provide standard manufactured fitting specifically for the proposed connection by same manufacturer of either type pipe or stainless steel mechanical clamp contracting ring type, neoprene ribbed gasket for positive seal (Fernco type).
- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required flared end sections, tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

- C. Filter Fabric: Per Section 312513 - Erosion & Sediment Control, Silt Fence/Filter Fabric.
- D. Filter Cloth: (Encourages drainage) Woven geotextile fabric Manufactured by LINQ, Model #GTF 200 S.
- E. Geotextile Fabric: (Structural support) Non-woven geotextile fabric, Manufactured by LINQ Model #GTF 180 EX.
- F. Trace Wire for Non-Metallic Piping: Comply with Section 312317 - Utility Trenching & Backfilling.
- G. Buried Utility Warning and Identification Tape: Comply with Section 312317 - Utility Trenching & Backfilling.
- H. Hydraulic Cement Mortar: Mortar for concrete pipe to concrete structure connections shall conform to ASTM C270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar but in no case shall exceed 6 gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with proper covering until satisfactorily cured.

1. Grout shall not be allowed in lieu of mortar..

2.3 DRAINAGE STRUCTURES

- A. VDOT Standard or Modified VDOT Standard structures where indicated on the Drawings. Modified VDOT Standard structures shall conform to VDOT Standards for all work except structure shape or configuration modified per detail on Drawings. No parging will be permitted on interior walls.
- B. Manhole style access covers shall be labeled as "STORM SEWER".
- C. Gratings: Unless noted otherwise, all grates shall be cast iron material. Gratings within sidewalks, plazas, or areas that receive pedestrian traffic shall be ADA compliant.
- D. Nominal shaft diameter as required for proposed piping or as otherwise indicated on Drawings (48 inches (1200 mm) minimum for round or square, unless otherwise noted).
- E. Throat inlet lengths shall be as indicated on Drawings.
- F. Concrete manhole taper shape and orientation shall be as indicated by symbol on Drawings.
- G. Steps shall be per VDOT Std. ST-1 placed in line with vertical wall of eccentric tapers or as creates most desirable access in other situations. All structures over

3.5 feet deep, from top to invert out, shall be provided with steps.

- H. Flow channel shaping shall be per VDOT Std. IS-1. All structures shall be provided with shaping.
- I. Base Pad (Precast): As detailed in VDOT Standard B-1 for VDOT Std. structures, otherwise per detail on drawings.
- J. Base Pad (Cast-in-place): VDOT Std. B2 footing.
- K. Riser Joint Sealant: Provide flexible rubber compression gaskets to create permanently flexible watertight joints.

2.4 AREA DRAINS

- A. Refer to schedule and details on the Drawings for in-line drains and drain basins.

2.5 EXTERIOR MECHANICAL AREA FLOOR DRAINS

- A. Floor Drain: Coated cast iron construction, deep two-piece body with double drainage flange, non-puncturing flashing clamp collar, weepholes, bottom outlet, 12.625" dia. round bronze top-grate with 43.5 sq. in. free area minimum, removable deep sediment bucket which supports a medium-duty loose-set anti-silting grate with perimeter slots, size to match shaft construction below. JOSAM 32330 Series, SUPER-FLO 12-5/8" Top w/ Bucket (2" to 8" pipe outlet).
- B. Shaft Construction: Pipe type and size shall match horizontal run of pipe indicated on Drawings (minimum 4" to maximum 8" shaft). Bell end at top of shaft shall be adjusted to set finished grade of final product.

2.6 CLEANOUTS

- A. In Lawn Areas: (See detail on Drawings)
 - 1. Cleanout Ferrule: Cast iron construction, bronze countersunk threaded cleanout plug with recessed socket, size to match shaft construction below. JOSAM 58190-22 Series (2" to 8" pipe size).
 - 2. Shaft Construction: Pipe type and size shall match horizontal run of pipe indicated on Drawings (minimum 4" to maximum 8" shaft). Bell end at top of shaft shall be adjusted to set finished grade of final product.
 - 3. Base/Collar Pad: Cast-in-place VDOT Class A3 concrete.
- B. In Concrete Paved Areas (non-traffic bearing): (See detail on Drawings)
 - 1. Cleanout Ferrule: Cast iron construction, bronze countersunk threaded cleanout plug with recessed socket, 58190-22 Series as manufactured by Josam, size to match shaft construction below.
 - 2. Shaft Construction: Pipe type and size shall match horizontal run of pipe indicated on Drawings (minimum 4" to maximum 8" shaft). Bell end at top of shaft shall be adjusted to set finished grade of final product.
 - 3. Base/Collar Pad: Concrete pavement (sidewalk, etc.) shall act as collar. Scoring and finishing shall be that specified for the sidewalk. Do not strike or score dimensions of collar around cleanout unless the sidewalk scoring

or jointing fall within that area. If so obtain Architects input on orientation of collar.

- C. In Paved Areas (traffic bearing): (See detail on Drawings)
 - 1. Cleanout Lid and Frame: Cast iron construction, hinged lid, #R-1976 manufactured by Neenah:
 - a. Lid Design: Checkerboard grill.
 - b. Nominal Lid and Frame Size: 11-1/4 inch dia. lid, 10 inch clear opening, 20 inch dia. flange, and 8 inch height.
 - 2. Base/Collar Pad: Cast-in-place VDOT Std. Class A3 concrete.

2.7 BEDDING AND BACKFILL MATERIALS

- A. Bedding & Haunching: See Section 312317 - Utility Trenching & Backfilling. [Except dry-mix lean concrete shall be used for bedding (saddle) of pipe through detention basin berm.]
- B. Cover Bedding/Initial Backfill (Select Backfill): See Section 31 23 17 - Utility Trenching & Backfilling.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions.
- B. Verify that sizes, locations and elevations of any/all points of connection to existing or proposed work are as indicated on Drawings.
- C. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Excavate pipe trench and correct over excavation in accordance with Section 312317 - Utility Trenching & Backfilling for work of this section. See Drawings for trench detail.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated. Remove large stones or other hard matter, which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches (150 mm) compacted depth and compact to 95 percent. Continue until pipe springline is reached and hand excavate an accurate pipe shape to invert required. After setting pipe, where hand excavation is irregular against pipe, hand fill and tamp for an even fit tight to pipe at springline.

- B. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with VDOT Standards, applicable ASTM Standard for material and manufacturer's instructions, whichever is most stringent. Seal joints watertight.
- B. Concrete Pipe: Contractor shall use manufacturer's installation recommendations for installing the pipe. The Contractor shall be warned that bell-spigot confined o-ring gasket pipe requires a special installation technique to avoid cracking the bell-spigot connections. Cracks in the bell-spigot connections shall be rejected by the City.
 - 1. When connecting the concrete pipe to a concrete structure, the Contractor shall thoroughly wet, with clean water, the adjoining concrete material before applying the mortar. This will help achieve the bond at the joint and also prevent shrinkage cracking in the mortar. The City shall reject connections that are not bonded or connections that have shrinkage cracking.
- C. Lay pipe to slope gradients noted on Drawings with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m). See Drawings for storm sewer profiles.
- D. Install aggregate at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches (300 mm), compact to 95 percent.
- E. Refer to Section 312317 - Utility Trenching & Backfilling for backfilling requirements. Do not displace or damage pipe when compacting.
- F. Make connection to all storm water collectors and receiving channel or system to include, but are not necessarily limited to building rain leaders, downspouts, foundation drains, existing storm sewer to remain, etc.
- G. Install trace wire continuous over top of non-metallic pipe. Coordinate with Section 312317 - Utility Trenching & Backfilling.
- H. Install Utility Warning and Identification Tape continuous over pipe. Coordinate with Section 312317 - Utility Trenching & Backfilling. See Drawings for trench detail; ID tape location.

3.5 INSTALLATION - CLEANOUTS AND FLOOR DRAINS

- A. Establish elevations and pipe inverts as indicated in pipe installation above.
- B. Form bottom of excavation clean and smooth to correct elevation.
- C. Install wye per pipe installation above.
- D. Set vertical piping (adjusted to make ferrule or grate at proper finished grade),

backfill per Section 312317 - Utility Trenching & Backfilling, then set cleanout ferrule.

- E. Level top surface of backfill, form for the concrete collar pad (coordinating with adjacent work as necessary), and cast-in-place.
- F. Traffic Bearing Cleanout Only: Set adapter so that in the completed work the cleanout plug has 2 inches minimum to 6 inches maximum clearance beneath the lid but no deeper than flush with the concrete anchor pad. Fill from cleanout invert with VDOT Std. #26 coarse aggregate to beneath the concrete anchor pad. Wrap cleanout adapter with welder's cloth followed by aluminum flashing prior to placing concrete. See detail on drawings for other dimensions. Mount lid and frame on grout to slope and elevation of finished traffic surface. Anchor frame with 5/8" bolts to anchor pad.

3.6 INSTALLATION - DRAINAGE STRUCTURES

- A. Form bottom of excavation clean and smooth to correct subgrade elevation.
- B. Place and level a 4 inch (50 mm) base of Type A3 coarse aggregate.
- C. Set bottom riser section (doghouse or with precast base).
- D. Set pipe in and out of structure to line and grade.
- E. If not precast, form and place cast-in-place concrete base pad to pipe inverts per Drawings, providing for shaping.
- F. If precast, level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.
- G. Pipes shall be neatly and tightly mortared in place. Provide for required shaping.
- H. Set remaining risers and top segments to elevation indicated coordinating with adjacent work in line and grade.
- I. Mount manhole lid and frame in grout to elevation and slope of paved surface or level in lawn areas, secure top cone section to orientation (if eccentric) indicated.
- J. Contractor shall mortar all lifting lug locations.

3.7 FIELD QUALITY CONTROL

- A. Trench, Bedding & Backfilling Tests: Field trench inspection and compaction testing will be performed under provisions of Section 312213 – Rough Grading and Section 312317 - Utility Trenching & Backfilling.
- B. The Architect or other assigned Owner's representative will conduct field investigations and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished as set forth in Div. 1; Temporary Utilities. Be able to produce evidence, when

required, that each item of work has been constructed in accordance with the Drawings and Specifications.

- C. Request inspection of installed piping prior to placing cover bedding/initial backfill over pipe. Place initial backfill and reinspect.
- D. Tests for Non-Pressure Lines: Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the other end of the segment/run of pipe. When pressure piping is used in a non-pressure line for non-pressure use, test as specified for non-pressure line.
- E. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- F. Once completed, the City of Roanoke Planning and Stormwater Department will conduct a storm drain acceptance review. Part of that process includes the Stormwater Department televising the installed pipe for defective workmanship and substandard joint conditions using a robotic pipe camera. Any defective work discovered during this process shall be corrected by removing the pipe and installing a new section.

3.8 PROTECTION

- A. Protect finished Work under provisions of Section 311000 - Site Preparation & Clearing.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

3.9 SCHEDULE

- A. Refer to Drawings (Profiles) for additional pipe and structure types and sizes.
- B. Storm Sewer Branch Lines: Connect inlets at various site locations with intersection of main sewer line. Size and type as indicated on Drawings (profiles).
- C. Storm Sewer within VDOT Right-of-way and/or Easement: Size as indicated on Drawings (profiles).
- D. Rain Leaders (RL): From 5 feet (1.5 m) beyond building wall, to municipal storm sewer; PVC; size as indicated on Drawings.

END OF SECTION

SECTION 334600 SUBDRAINAGE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Complete system through outfall / terminus connection.
 - 2. Sub-surface weep-type drainage system for building perimeter, retaining walls, and slabs-on-grade as applicable.
 - 3. Filter aggregate and fabric.
 - 4. Bedding.
- B. Related Sections:
 - 1. Section 310516 - Aggregate Materials.
 - 2. Section 312316 - Excavating: Excavating for site subdrainage system piping and surrounding filter aggregate.
 - 3. Section 312323 - Backfilling: Backfilling over filter aggregate, up to subgrade elevation.
 - 4. Section 334100 - Storm Drainage: Connection to weep drainage system, sump, etc.

1.2 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM D3034 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 2. ASTM D3212 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe Bell and Spigot Type Joints.
 - 3. ASTM F477 – Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe Bell and Spigot Type Joint Gaskets.
 - 4. ASTM F758 – Standard Specification for Subdrainage Perforations.
- B. UNI-BELL
 - 1. UNI-B-1 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe Bell and Spigot Type Joints.
 - 2. UNI-B-4 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- C. American Association of State Highway & Transportation Officials (AASHTO):
 - 1. AASHTO M252 – Standard Specification for Corrugated Polyethylene Drainage Tubing.
 - 2. AASHTO M288 – Standard Specification for Geotextiles, latest edition.

1.3 SUBMITTALS FOR REVIEW

- A. Section 013300 - Submittal Procedures.

- B. Product Data for Information: Submit data on pipe drainage products, pipe accessories, and appurtenances. All products identified in PART 2 of this specification.

1.4 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution Requirements: Requirements for submittals.
- B. Section 017810 - Project Record Documents: Record location of pipe runs, connections, cleanouts and principal invert elevations (highs, bends, penetrations, and connections).

PART 2 PRODUCTS

2.1 PIPE MATERIALS

- A. Polyvinyl Chloride (PVC) Pipe: ASTM D3034 and/or UNI-BELL UNI-B-4, SDR 35 with bell and spigot joints per ASTM D3212 and/or UNI-BELL UNI-B-1 and ASTM F477 gaskets; size as indicated on Drawings (4 inch (100 mm) minimum inside diameter); with required fittings. Solid or perforated as required. Perforation pattern shall conform to ASTM F758. Perforations shall be circular, 3/16 to 1/2 inch diameter, on 3 to 3.5 inch centers, and arranged in four rows along the barrel where rows are 45 and 80 degrees either side from bottom centerline of the pipe.
- B. Corrugated Plastic Tubing: AASHTO M252; Single-wall flexible type corrugated HDPE pipe with soil-tight joints with required fittings; size as indicated on Drawings (4 inch (100 mm) minimum inside diameter). If connection to storm sewer system is indicated, supply appropriate connector for differing materials as recommended by manufacturers.
- C. Use perforated pipe at subdrainage system; unperforated through sleeved walls.

2.2 AGGREGATE AND BEDDING

- A. Filter Aggregate and Bedding Materials: Fill Type A2 as specified in Section 310516 – Aggregate Materials.

2.3 ACCESSORIES

- A. Filter Fabric: AASHTO M288 for subsurface drainage, Survivability Class 3, non-woven, as manufactured by TC Mirafi, Amoco Fabrics and Fibers Co., Typar Geotextiles (Reemay, Inc.). Products meeting this requirement are Mirafi 180N, Amoco ProPex 4553, or Typar 3401.
- B. Filter Cloth: (Encourages drainage) Woven geotextile fabric Manufactured by LINQ, Model #GTF 200 S.
- C. Geotextile Fabric: (Structural support) Non-woven geotextile fabric, Manufactured by LINQ Model #GTF 180 EX.

- D. Pipe Sleeve: Steel type for foundation wall penetrations, as applicable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 013100 – Administrative Requirements: Coordination: Verification of existing conditions before starting work.
- B. Verify trench cut or excavated base is ready to receive work and excavations, dimensions, and elevations are as indicated on shop drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation per excavation or trenching spec as applicable.
- B. Remove large stones or other hard matter, which could damage drainage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION

- A. Place filter fabric.
- B. Place drainage pipe on fabric. Use PVC pipe where depth of fill over pipe exceeds 10 feet. Use same pipe throughout a section or loop. Separate runs may be of other materials.
- C. Lay pipe to slope gradients of 1/8 inch per foot; with maximum variation from indicated slope of 1/8 inch (3 mm) in 10 feet (3 m).
- D. Place pipe with perforations facing down. Mechanically join pipe ends.
- E. Install Type A2 aggregate at sides and top of pipe. Install top cover compacted thickness of 12 inches (300 mm).
- F. Close filter fabric over leveled top surface of aggregate cover prior to subsequent backfilling operations.
- G. Place aggregate in maximum 6 inch (150 mm) lifts, consolidating each lift.
- H. Refer to applicable area or trench excavation and backfill section for compaction requirements. Do not displace or damage pipe when compacting.
- I. Connect to storm sewer system or sump pit or rout to surface discharge point per Drawings. Where the need for subdrainage is unnecessary use unperforated pipe (ie. extensions away from structure to sewer outlet or discharge).
- J. Coordinate the Work with connection to indicated outfall, and trenching.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Testing and inspection services.
- B. Request inspection prior to placing aggregate cover over pipe.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 017000 - Execution Requirements: Protecting installed construction.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION

SECTION 031000
CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Form-facing material for cast-in-place concrete.
 - 2. Shoring, bracing, and anchoring.

1.3 DEFINITIONS

- A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction, movement, contraction, and isolation joints
 - c. Forms and form-removal limitations.
 - d. Shoring and reshoring procedures.
 - e. Anchor rod and anchorage device installation tolerances.

1.5 ACTION SUBMITTALS

- A. Product Data: For each of the following:
 - 1. Exposed surface form-facing material.
 - 2. Form-release agent.

1.6 INFORMATIONAL SUBMITTALS

- A. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Mockups: Formed surfaces to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
 - 1. Build panel approximately 32 sq. ft. in the location indicated or, if not indicated, as directed by Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle forms in a manner to prevent damage to form surface.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 - 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 - 2. Limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).

2.2 FORM-FACING MATERIALS

- A. As-Cast Surface Form-Facing Material:
 - 1. Provide continuous, true, and smooth concrete surfaces.
 - 2. Furnish in largest practicable sizes to minimize number of joints.
 - 3. Acceptable Materials: As required to comply with Surface Finish designations, and as follows:
 - a. Plywood, metal, or other approved panel materials.
- B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
 - 1. Provide lumber dressed on at least two edges and one side for tight fit.

- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces not exceeding specified formwork surface class.
 - 1. Provide forms with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation, with end forms.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

2.3 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

2.4 RELATED MATERIALS

- A. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- C. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- D. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with ACI 301.

- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified..
- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips
 - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- L. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.

2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 3. Place joints perpendicular to main reinforcement.
 4. Space vertical joints in walls as indicated on Drawings.
- M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
 3. Install dowels for reinforced concrete masonry walls.
 4. Clean embedded items immediately prior to concrete placement.

3.3 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work.

1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
1. Align and secure joints to avoid offsets.
 2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORING AND RESHORING INSTALLATION

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
 2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION

SECTION 032000
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction contraction and isolation joints.
 - c. Steel-reinforcement installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of Architect.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates and Test Reports: For each of the following, signed by manufacturers:

1. Steel Reinforcement

B. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Mockups: Reinforcing for cast-concrete formed surfaces, to demonstrate tolerances and standard of workmanship.

1. Build panel approximately 32 sq. ft. in the location indicated on Drawings or, if not indicated, as directed by Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars to be lapped as indicated.
 - 2. Stagger splices in accordance with ACI 318.
- G. Install welded-wire reinforcement in longest practicable lengths.
 - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
 - a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches.
 - 2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire.
 - 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 - 4. Lace overlaps with wire.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.
- B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Steel-reinforcement placement.

END OF SECTION

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, finishes, and curing.

B. Related Requirements:

1. Section 03 10 00 "Concrete Forming and Accessories" for form-facing materials.
2. Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Ready-mix concrete manufacturer.
 - c. Concrete Subcontractor.
 - d. Special Inspector,
2. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction joints, control joints, isolation joints, and joint-filler strips.
 - c. Semirigid joint fillers.
 - d. Vapor-retarder installation.
 - e. Anchor rod and anchorage device installation tolerances.
 - f. Cold and hot weather concreting procedures.
 - g. Concrete finishes and finishing.
 - h. Curing procedures.
 - i. Forms and form-removal limitations.
 - j. Shoring and reshoring procedures.

- k. Methods for achieving specified floor and slab flatness and levelness.
- l. Floor and slab flatness and levelness measurements.
- m. Concrete repair procedures.
- n. Concrete protection.
- o. Initial curing of field test cylinders (ASTM C31/C31M.)

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

- 1. Portland cement.
- 2. Fly ash.
- 3. Blended hydraulic cement.
- 4. Aggregates.
- 5. Admixtures:
 - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
- 6. Vapor retarders.
- 7. Curing and sealing compounds.
- 8. Joint fillers.
- 9. Repair materials.
- 10. Floor sealers.

B. Design Mixtures: For each concrete mixture, include the following:

- 1. Mixture identification.
- 2. Minimum 28-day compressive strength.
- 3. Durability exposure class.
- 4. Maximum w/cm.
- 5. Slump limit.
- 6. Air content.
- 7. Nominal maximum aggregate size.
- 8. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
- 9. Intended placement method.
- 10. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

- 1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

Project: Refueling Centers Fire Station #6
 ITB# SOL1254

Cast-In-Place Concrete
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1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Bonding agents.
5. Adhesives.
6. Vapor retarders.
7. Semirigid joint filler.
8. Joint-filler strips.
9. Repair materials.

C. Preconstruction Test Reports: For each mix design.

D. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor to be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Mockups: Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.

1. Formed Surfaces: Build panel approximately 32 sq. ft. Insert area in the location indicated or, if not indicated, as directed by Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

Project: Refueling Centers Fire Station #6
ITB# SOL1254

Cast-In-Place Concrete
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1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I, gray.
2. Fly Ash: ASTM C618, Class C or F.
3. Blended Hydraulic Cement: ASTM C595/C595M, Type IL, portland-limestone cement.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
 - c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
2. Maximum Coarse-Aggregate Size: 1 inch nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.4 CURING AND SEALING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Water: Potable or complying with ASTM C1602/C1602M.
- C. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.5 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.
- C. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.6 ONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
 - 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent by mass for footings and walls, 15 percent by mass for slabs.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
 - 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, and concrete with a w/cm below 0.50.

2.7 CONCRETE MIXTURES

- A. Class A: Normal-weight concrete used for footings, piers, and walls.
 - 1. Exposure Class: ACI 318 F0, S0, W0, C0.
 - 2. Minimum Compressive Strength: 4000 psi at 28 days.
 - 3. Maximum w/cm: 0.50.
 - 4. Slump Limit: 4 inches , plus or minus 1 inch.
 - 5. Air Content: No air-entraining admixture required.
 - 6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

- B. Class C: Normal-weight concrete used for interior slabs-on-grade and slabs on steel deck.
1. Exposure Class: ACI 318 F0, S0, W0, C0.
 2. Minimum Compressive Strength: 4000 psi at 28 days.
 3. Maximum w/cm: 0.50.
 4. Minimum Cementitious Materials Content: 540 lb/cu. yd.
 5. Slump Limit: 5 inches plus or minus 1 inch, 8 inches plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
 6. Air Content:
 - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
 7. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.
- C. Class D: Normal-weight concrete used for exterior concrete walls, piers and slabs-on-grade.
1. Exposure Class: ACI 318 F2, S0, W1, C1.
 2. Minimum Compressive Strength: 4500 psi at 28 days.
 3. Maximum w/cm: 0.45.
 4. Slump Limit: 5 inches , plus or minus 1 inch.
 5. Air Content:
 - a. 6 percent, plus or minus 1.5 percent at point of delivery for concrete.
 6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
 2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
 - 1. Daily access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
 - 4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.4 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
 - 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
 - 2. Face laps away from exposed direction of concrete pour.
 - 3. Lap joints 6 inches and seal with manufacturer's recommended tape.
 - 4. Terminate vapor retarder at the top of floor slabs, sealing entire perimeter to existing floor slabs and foundation walls.
 - 5. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
 - 6. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.5 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
 - 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
 - 2. Place joints perpendicular to main reinforcement.

- a. Continue reinforcement across construction joints unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
- 3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
- 4. Space vertical joints in walls as indicated on Drawings.
- C. Control Joints in Slabs-on-Grade: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
 - 1. Install dowel bars and support assemblies at joints where indicated on Drawings.
 - 2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
 - 1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 - 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
1. If a section cannot be placed continuously, provide construction joints as indicated.
 2. Deposit concrete to avoid segregation.
 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Do not place concrete floors and slabs in a checkerboard sequence.
 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 3. Maintain reinforcement in position on chairs during concrete placement.
 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 5. Level concrete, cut high areas, and fill low areas.
 6. Slope surfaces uniformly to drains where required.
 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-3.0:
 - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
 - b. Remove projections larger than 1/8 inch.
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 Class A.
 - e. Locations: Apply to exposed concrete surfaces.

- B. Rubbed Finish: Apply the one of the following to exposed wall, beam, and column surfaces. Finish shall be consistent throughout the Project.

1. Smooth-Rubbed Finish:
 - a. Perform no later than one day after form removal.
 - b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
 - c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
 - d. Maintain required patterns or variances to match approved mockups.
2. Grout-Cleaned Rubbed Finish:
 - a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
 - b. Do not clean concrete surfaces as Work progresses.
 - c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
 - d. Wet concrete surfaces.
 - e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.
 - f. Maintain required patterns or variances to match approved mockups.

C. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish:
 1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
 2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
 3. Apply float finish to surfaces to receive trowel finish.
- C. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighthen until surface is free of trowel marks and uniform in texture and appearance.
3. Do not add water to concrete surface.
4. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
5. Apply a trowel finish to surfaces to vault base slab, slabs-on-grade, and vault suspended slab.
6. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
 - a. Slabs-on-Ground:
 - 1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and also no more than 1/16 inch in 2 feet.
 - b. Suspended Slabs:
 - 1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and also no more than 1/16 inch in 2 feet.

D. Broom Finish: Apply a broom finish to exterior concrete flat work.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.
4. Curing: Comply with ACI 308.1.

B. Curing Slab-on-Grade Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Apply two coats of curing and sealing compound in accordance with manufacturer's written instructions.

3.11 TOLERANCES

A. Conform to ACI 117.

3.12 JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
1. Defer joint filling until concrete has aged the minimum time period specified by the joint filler manufacturer or at least one month, whichever is greater.
 2. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
1. Repair and patch defective areas when approved by Architect.
 2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.
 - a. Limit cut depth to 3/4 inch.
 - b. Make edges of cuts perpendicular to concrete surface.
 - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.

- d. Fill and compact with patching mortar before bonding agent has dried.
- e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
- 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
 - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
 - b. Compact mortar in place and strike off slightly higher than surrounding surface.
- 3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

- 1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
 - a. Correct low and high areas.
 - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
- 2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
- 3. After concrete has cured at least 14 days, correct high areas by grinding.
- 4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.
 - b. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - c. Feather edges to match adjacent floor elevations.
- 5. Correct other low areas scheduled to remain exposed with repair topping.
 - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
 - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
- 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
 - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
 - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
 - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
 - d. Place, compact, and finish to blend with adjacent finished concrete.
 - e. Cure in same manner as adjacent concrete.
- 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

- a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
 - b. Dampen cleaned concrete surfaces and apply bonding agent.
 - c. Place patching mortar before bonding agent has dried.
 - d. Compact patching mortar and finish to match adjacent concrete.
 - e. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- C. Inspections:
 - 1. Headed bolts and studs.
 - 2. Verification of use of required design mixture.
 - 3. Concrete placement, including conveying and depositing.
 - 4. Curing procedures and maintenance of curing temperature.
 - 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 - 6. Batch Plant Inspections: On a random basis, as determined by Architect.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C143/C143M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure five 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one laboratory-cured specimens at seven days.
 - b. Test three laboratory-cured specimens at 28 days.
 - c. Hold one laboratory-cured specimen to test at 56 days if required.
 - d. A compressive-strength test to be the average compressive strength from a set of three specimens obtained from same composite sample and tested at 28 days.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
9. Additional Tests:
 - a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.
10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.15 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION

SECTION 077140
GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes pre-finished aluminum gutters and downspouts.

1.2 REFERENCES

- A. AAMA 603.8 (American Architectural Manufacturers Association) - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
- B. AAMA 605.2 (American Architectural Manufacturers Association) - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
- C. ASTM B32 - Specification for Solder Metal.
- D. ASTM B209/B209M - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- E. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.
- F. SMACNA (Sheet Metal and Air Conditioning Contractors National Association) - Architectural Sheet Metal Manual.

1.3 DESIGN REQUIREMENTS

- A. When size is not indicated, conform to SMACNA Manual for sizing components for rainfall intensity determined by a storm occurrence of 1 in 10 years.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.
- B. Product Data: Submit data on manufactured components, materials, and finishes.
- C. Samples: Submit two samples, 4 inch x 4 inch, for each type of metal illustrating finish, color, and configuration.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA Manual.
- B. Maintain one copy of each document on site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Products and Substitutions: Product storage and handling requirements.
- B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope to drain.
- C. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.7 COORDINATION

- A. Coordinate Work with installation of metal flashings and roofing shingles.

1.8 WARRANTY

- A. Special Warranty on Metal Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal gutters and downspouts roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 GUTTERS AND DOWNSPOUTS

- A. Product Description:
 - 1. Gutter: SMACNA "A" Profile, .032" prefinished aluminum, maximum lengths.
 - 2. Downspouts: 4" x 4", .032" prefinished aluminum, maximum lengths.
- B. Gutter Guard: prefinished aluminum mesh strainer, continuous along entire length of top of gutter:
 - 1. Subject to compliance with requirements, provide products by one of the following manufacturers or approval equal:
 - 1) Englert
 - 2) Amerimax
 - 3) Leaf Filter

2.2 COMPONENTS

- A. Pre-Finished Aluminum Sheet: ASTM B209/B209M, manufacturer's standard alloy and temper for specified finish; minimum 0.040 inch thick; mill finish shop Fluoropolymer coating; color as selected by Architect from full range of standard colors.

2.3 ACCESSORIES

- A. Anchors and Supports: Profiled to suit gutters and downspouts.
 - 1. Anchoring Devices: Where not indicated provide in accordance with SMACNA requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Brackets.
- B. Fasteners: Same material and finish as gutters and downspouts.
- C. Protective Backing Paint: FS TT-C-494, bituminous.

2.4 FABRICATION

- A. Form gutters and downspouts of profiles and sizes indicated.
- B. Fabricate with required connection pieces.
- C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- D. Hem exposed edges of metal.
- E. Fabricate gutter and downspout accessories; seal watertight.

2.5 FACTORY FINISHING

- A. PVDF (polyvinylidene fluoride) coating: Multiple coat, thermally cured, fluoropolymer system conforming to AAMA 605.2.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify surfaces are ready to receive gutters and downspouts.

3.2 PREPARATION

- A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil.

3.3 INSTALLATION

- A. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.
- B. Slope gutters 1/8 inch per foot minimum.
- C. Anchor downspouts to walls per SMACNA requirements.
- D. Terminate downspouts in cast iron boots.

END OF SECTION

SECTION 107300
PROTECTIVE COVERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, General Requirements, of these Specifications, apply to work specified in this section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Protective Cover system; including frames, drainage system and roof deck assembly.
 - 2. Pitched roof with roll-formed aluminum roof panels.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 03, "Cast-in-Place Concrete," for concrete for post footings.
 - 2. Division 26, Electrical, for lighting mounted to soffit of protective cover system.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design, engineer, fabricate, and install Protective Cover system to withstand the structural loads required under the State Building Code without exceeding the allowable design working stresses of the materials involved, including anchors and connections.

1.4 SUBMITTALS

- A. Product Data: Submit for each type of protective cover and accessory indicated. Indicate roof panel type, fascia profile, framing components and accessories.
- B. Shop Drawings: Submit shop drawings indicating layout of Protective Cover coordinated with field measurements and including frame heights, roof slopes, overall dimensions, connections and relationship to adjoining work, accessories, types of materials, and finishes. Indicate work by others required for complete installation.
- C. Certification: Submit design calculations prepared and sealed by registered (structural) Professional Engineer licensed in the State of Virginia indicating structure complies with wind criteria of ANSI/ASCE 7-88, stability and loading requirements of building code and all other governing criteria.
- D. Color Samples: Submit printed or coated metal samples of complete color range offered for Architects selection.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer to perform unit of work of this section who has specialized in the installation of types of protective covers similar to that required for this project and who is acceptable to, or certified by, manufacturer of protective covers.
- B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel" and D1.3 "Structural Welding Code - Sheet Steel."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Check actual dimensions of construction affecting protective covers by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work. Provide approved layout drawings and column base inserts or form-outs for installation of concrete foundations.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Peachtree Protective Covers, Inc.
 - 2. Dittmer Architectural Aluminum
 - 3. Avadek Walkway Cover Systems

2.2 MATERIALS

- A. Aluminum Sheet: ASTM B 209
- B. Aluminum Tubing: ASTM B 429, 6063 - T6, schedule 40.
- C. Aluminum Extrusions: ASTM B 429, 6063 - T6.
- D. Cast Aluminum (end caps): 319 alloy.
- E. Fasteners: Vibration-proof, of size and material standard with manufacturer.

2.3 CONSTRUCTION

- A. Smoothly round corners, edges, and exposed fasteners to eliminate snagging and pinching hazards. Form exposed sheet metal with flat, flush surfaces, true to line and level, and without cracking and grain separation. Perform welding by operators and processes complying with AWS requirements.

2.4 PROTECTIVE COVER

- A. General: Provide manufacturer's standard prefinished metal roofing Protective Cover system fabricated to comply with requirements indicated. Provide all roof deck, fascia, and frames ("bents") consisting of beams and columns with integral

(internal) rainwater drainage system. Include all accessories, closure and trim pieces, anchors and connection devices required for complete assembly.

- B. Frame Height: Sloped roof deck, heights as indicated on drawings.
- C. Support Structure: All structural fabrication shall be extruded anodized aluminum sections made of 6063-T6 aluminum alloy, and having a minimum wall thickness of 0.125 inches. Provide frames ("bents") fabricated from anodized beams and columns as either all-welded rigid frames or mechanically joined sections as determined by manufacturer (fabricator) and in accordance with final shop drawings. Provide column sleeves for presetting into concrete foundation structure.
 - 1. Finish: Provide factory applied 2-coat, thermocured coating system ("Kynar") composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70% polyvinylidene fluoride resin by weight; conforming to AAMA 2605 (formerly 605.2). Finish color will be selected from manufacturer's full range of color offerings.
 - 2. Provide frame configuration indicated for installation, including those required for angled or corner conditions.
 - 3. Provide extruded aluminum wall angle for wall supported applications as indicated.
- D. Extruded Aluminum Roof Deck: Provide interlocking structural deck system fabricated of anodized 6063-T6 aluminum alloy and having a minimum wall thickness of 0.065 inches. All splices shall occur at supports; splices in other locations will not be permitted.
 - 1. Provide manufacturer's standard 3-1/2" deep flat bottom deck section for flat soffit.
 - 2. Provide manufacturer's standard 3" deep corrugated deck section for vertical screen wall.
 - 3. Provide manufacturer's standard anodized extruded aluminum fascia of profile indicated.
 - 4. Metal Roofing Finish: Provide factory applied 2-coat, thermocured coating system ("Kynar") composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70% polyvinylidene fluoride resin by weight; conforming to AAMA 2605 (formerly 605.2). Finish color will be selected from manufacturer's full range of color offerings.
 - 5. Hardware: All connections shall be made with standard corrosion resistive fasteners.
 - 6. Drainage: Internal drainage in column shall connect to site drainage below grade. Provide 3" diameter aluminum pipe extension welded to column.

2.5 FOUNDATIONS FOR PROTECTIVE COVER

- A. Provide concrete foundations complying with criteria specified in Section 03 30 00, "Cast-in-Place Concrete." Footings for the bent frame assembly shall provide sufficient bearing area at the bottom to support all loads of the Protective Cover. Footing design is based on 3,000 PSF allowable soil pressure unless otherwise instructed in the soil data, such as, but not limited to, adverse soil conditions, high water table, underground obstructions and other conditions, to permit bidders reasonable evaluation of the site conditions. Foundation concrete shall attain minimum working strength of 3,000 pounds per square inch at 28 days.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install protective covers to comply with manufacturer's instructions and final shop drawings. Provide accessories indicated and anchors, fasteners, inserts, and other items required for installation of units and permanent attachment of units to adjoining construction.
- B. Adjust frames prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and wall angles to building construction as follows:
 - 1. Anchor posts in concrete by means of column sleeves preset and anchored into concrete. Insert posts into sleeves, and fill annular space between post and sleeve solid with non-shrink nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's directions. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8 inch build-up, sloped away from post. For installations exposed on exterior, or to flow of water, seal anchoring material to comply with grout manufacturer's directions.
 - 2. Anchor wall angles into wall construction with lead expansion shields and bolts or alternate expansion devices sufficient to support loading.

3.2 CLEANING AND PROTECTION

- A. Clean installed protective covers on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensures that protective covers are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Connectors and splices.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Copper building wire.
2. Connectors and splices.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

D. Conductor Insulation:

1. Type THHN and Type THWN-2. Comply with UL 83.
2. Type XHHW-2. Comply with UL 44.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as

defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
2. Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors must be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

1. Copper:
 - a. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
 - b. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

C. ASD Output Circuits Cable: Extra-flexible stranded for all sizes.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway Type XHHW-2, single conductors in raceway.
- B. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION, GENERAL

- A. Complete raceway installation between conductor and cable termination points in accordance with Section 26 05 33.13 "Conduits for Electrical Systems" prior to pulling conductors and cables.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

- E. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inch of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of *assembly*.

END OF SECTION

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grounding and bonding conductors.
2. Grounding and bonding clamps.
3. Grounding and bonding connectors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment Grounding Conductor:

1. General Characteristics: 600 V, wire or cable, green color, in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

2.2 GROUNDING AND BONDING CLAMPS

- A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications.

B. Performance Criteria:

1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2.3 GROUNDING AND BONDING CONNECTORS

A. Performance Criteria:

1. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

3.2 INSTALLATION OF GROUNDING AND BONDING

- A. Comply with manufacturer's published instructions.

3.3 PROTECTION

- A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Support, anchorage, and attachment components.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Sockets.
 - e. Eye nuts.
 - f. Fasteners.
 - g. Anchors.
 - h. Brackets.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch diameter holes at a maximum of 8 inch on center in at least one surface.

PART 3 - EXECUTION

3.1 SELECTION

- A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 1. NECA NEIS 101
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERM as required by NFPA 70.

3.2 INSTALLATION OF SUPPORTS

- A. Comply with NECA NEIS 101

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 05 50 00 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M. Submit welding certificates.
- D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION

SECTION 260533
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 ACTION SUBMITTALS

A. Product Data: For the following:

1. Wireways and auxiliary gutters.
2. Surface metal raceways.
3. Surface nonmetallic raceways.
4. Cabinets, cutout boxes, and miscellaneous enclosures.

PART 2 - PRODUCTS

2.1 TYPE EMT-S RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 797 and UL Category Control Number FJMX.

2.2 TYPE LFMC RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 360 and UL Category Control Number DXHR.

2.3 TYPE LFNC RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 1660 and UL Category Control Number DXOQ.

2.4 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and

marked for intended location and use.

2.5 SURFACE METAL RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 5 and UL Category Control Number RJBT.

2.6 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 514A and UL Category Control Number QCIT.

B. Metallic Outlet Boxes:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Description: Box with provisions for mounting wiring device directly to box.

2.7 CABINETS, CUTOUT BOXES, JUNCTION BOXES, PULL BOXES, AND MISCELLANEOUS ENCLOSURES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics:
 - a. Non-Environmental Characteristics: UL 50.
 - b. Environmental Characteristics: UL 50E.

B. Indoor Sheet Metal Cabinets:

1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.

C. Indoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

D. Indoor Cast-Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2.8 COVER PLATES FOR DEVICES BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

PART 3 - EXECUTION

3.1 SELECTION OF RACEWAYS

3.2 Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements. SELECTION OF BOXES AND ENCLOSURES

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:

1. Outdoors:
 - a. Type 3R unless otherwise indicated.
2. Indoors:
 - a. Type 1 unless otherwise indicated.

3.3 INSTALLATION OF RACEWAYS

A. Installation Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
3. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
4. Comply with NECA NEIS 101 for installation of steel raceways.
5. Comply with NECA NEIS 102 for installation of aluminum raceways.

B. Raceways Penetrating Rooms or Walls with Acoustical Requirements:

1. Seal raceway openings on both sides of rooms or walls with acoustically rated putty.

3.4 INSTALLATION OF SURFACE RACEWAYS

- A. Install surface raceways only where indicated on Drawings.

3.5 INSTALLATION OF BOXES AND ENCLOSURES

- A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
- B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements.
- C. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- D. Locate boxes so that cover or plate will not span different building finishes.
- E. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
- F. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
- G. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
- H. Set metal floor boxes level and flush with finished floor surface.
- I. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- J. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
 1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
 2. Provide gaskets for wallplates and covers.

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating

recommended by manufacturer.

3.8 CLEANING

- A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION

SECTION 260533.13
CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type ERM-C-S duct raceways, elbows, couplings, and nipples.
2. Type FMC-S and Type FMC-A duct raceways.
3. Type LFMC duct raceways.
4. Type PVC duct raceways and fittings.
5. Fittings for conduit, tubing, and cable.
6. Electrically conductive corrosion-resistant compounds for threaded conduit.
7. Solvent cements.

1.2 DEFINITIONS

- A. Conduit: A structure containing one or more duct raceways.
- B. Duct Raceway: A single enclosed raceway for conductors or cable.
- C. Duct Bank: An arrangement of conduit providing one or more continuous duct raceways between two points.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Type ERM-C-S duct raceways, elbows, couplings, and nipples.
2. Type FMC-duct raceways.
3. Type PVC duct raceways and fittings.
4. Fittings for conduit, tubing, and cable.
5. Electrically conductive corrosion-resistant compounds for threaded conduit.
6. Solvent cements.

B. Sustainable design submittals.

1. Solvent cements.

PART 2 - PRODUCTS

2.1 TYPE EMT-S DUCT RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN FJMX; including UL 797.

B. Raceway Color Codes:

Red- Fire Alarm

Orange- Telcom

Blue- 208/120V Power

Purple- Security

2.2 TYPE LFMC DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DXHR; including UL 360.

2.3 TYPE PVC DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DZYR; including UL 651.

2.4 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- 2.

2.5 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 2. Listing Criteria: UL CCN DWTT; including UL 514B.
- B. Source Quality Control:
1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
 2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
- C. UL DWTT - Solvent Cements for Type PVC Duct Raceways and Fittings:

PART 3 - EXECUTION

3.1 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.

3.2 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
1. Type ERM-C-S: Article 344 of NFPA 70 and NECA NEIS 101.
 2. Type FMC-S: Article 348 of NFPA 70 and NECA NEIS 101.
 3. Type LFMC: Article 350 of NFPA 70 and NECA NEIS 101.
 4. Type PVC: Article 356 of NFPA 70 and NECA NEIS 111.
 5. Expansion Fittings: NEMA FB 2.40.
 6. Consult Architect for resolution of conflicting requirements.
- C. Interfaces with Other Work:
1. Coordinate installation of new products for with existing conditions.

END OF SECTION

SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Labels.
2. Extruded insulating tubing.
3. Bands.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 LABELS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN PGDQ2 for components; including UL 969.

- B. UL PGDQ2 - Self-Adhesive Labels: thermal, transfer-printed.

2.2 BANDS

- A. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

2.3 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.4 CABLE TIES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN ZODZ; including UL 1565 or UL 62275.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 SELECTION OF COLORS AND IDENTIFICATION MARKINGS

- A. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded conductors.
1. Colors for 208Y/120 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 2. Colors for 480Y/277 V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 3. Color for Neutral (Grounded Conductor): White.
 4. Color for Equipment Ground: Green.
- B. Color-Coding Instructional Signs: Self-adhesive labels, including color code for grounded and ungrounded conductors.
- C. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage.
- D. Cover Plates: Label individual cover plates with self-adhesive labels. Place label at top of cover plate. Label cover plate with the following information, in the order listed:
1. Panelboard designation.
 2. Colon or dash.
 3. Branch circuit number.
- E. Equipment Identification Labels:

1. Black letters on white field.
2. Indoor Equipment: Self-adhesive label
3. Outdoor Equipment: Laminated acrylic or melamine sign

F. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 SELECTION OF SIGNS AND HAZARD MARKINGS

- A. Comply with 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs.
- B. Electrical Hazard Warnings:
 1. Arc-Flash Hazard Warning: Self-adhesive labels. Comply with NFPA 70E

3.4 INSTALLATION

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
- D. Verify identity of item before installing identification products.
- E. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- F. Apply identification devices to surfaces that require finish after completing finish work.
- G. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- H. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.
- I. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.
- J. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

- K. Laminated Acrylic or Melamine Plastic Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

END OF SECTION

SECTION 262416 PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. New and existing panelboards.
2. Disconnecting and overcurrent protective devices.

1.2 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Disconnecting and overcurrent protective devices.

B. Shop Drawings: For each panelboard and related equipment.

1. Detail bus configuration, current, and voltage ratings.
2. Short-circuit current rating of panelboards and overcurrent protective devices.

1.4 CLOSEOUT SUBMITTALS

A. Warranty documentation.

PART 2 - PRODUCTS

2.1 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with interrupting capacity matching existing breaker type and AIC ratings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering breakers for existing panelboards.

3.2 INSTALLATION

- A. Comply with manufacturer's published instructions.

3.3 IDENTIFICATION

- A. Breaker Labels: Faceplate must list current rating, UL and IEC certification standards, and AIC rating.
- B. Circuit Directory:
 - 1. Provide computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
 - a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.

3.4 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Nonconforming Work:
 - 1. Panelboards will be considered defective if they do not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- C. Collect, assemble, and submit test and inspection reports, including certified report that identifies panelboards included and that describes scanning results, with comparisons of two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 262726
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General-use switches.
2. General-grade duplex straight-blade receptacles.
3. Receptacles with ground-fault protective devices.

1.2 ACTION SUBMITTALS

A. Product Data:

1. General-use switches.
2. General-grade duplex straight-blade receptacles.
3. Receptacles with ground-fault protective devices.

PART 2 - PRODUCTS

2.1 GENERAL-USE SWITCHES, DIMMER SWITCHES, AND FAN-SPEED CONTROLLER SWITCHES

A. Toggle Switch:

1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Options:
 - a. Device Color: As indicated on architectural Drawings.
3. Accessories:
 - a. Cover Plate high-impact thermoplastic (nylon) with smooth finish and color: matching wiring device; from same manufacturer as wiring device.
 - b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.2 GENERAL-GRADE SINGLE STRAIGHT-BLADE RECEPTACLES

A. Single Straight-Blade Receptacle

1. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- 2. General Characteristics:
 - a. NEMA 5-20R.

PART 3 - EXECUTION

3.1 INSTALLATION OF SWITCHES

- A. Comply with manufacturer's instructions.

3.2 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

- A. Comply with manufacturer's instructions.
- B. Identification:
 - 1. Identify cover or cover plate for device with panelboard identification and circuit number

END OF SECTION

SECTION 265119
LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaires.
 - 4. Include emergency lighting units, including batteries and chargers.
 - 5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
- B. Product Schedule: For luminaires and lamps.
- C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 LUMINAIRE SUPPORT

- A. Comply with manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Supports:
 - 1. Sized and rated for luminaire weight.

2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.

END OF SECTION

SECTION 270528
PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings.
 - 2. Nonmetallic conduits and fittings.
 - 3. Optical-fiber-cable pathways and fittings.
 - 4. Metallic surface pathways.
 - 5. Tele-power poles.
 - 6. Hooks.
 - 7. Boxes, enclosures, and cabinets.
 - 8. Polymer-concrete handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid conduit.
- C. IMC: Intermediate metal conduit.
- D. RTRC: Reinforced thermosetting resin conduit.

1.4 ACTION SUBMITTALS

- A. Product data for the following:
 - 1. Surface pathways
 - 2. Wireways and fittings.
 - 3. Tele-power poles.
 - 4. Boxes, enclosures, and cabinets.
 - 5. Underground handholes and boxes.
- B. Shop Drawings: For custom enclosures and cabinets and custom underground handholes and boxes. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of pathway groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
 - 3. Underground ducts, piping, and structures in location of underground enclosures and handholes.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Data: Seismic rating Provide seismic bracing for all pathway racks, enclosures, cabinets, equipment racks, and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
 - 2. Alpha Wire.
 - 3. Southwire Company.
 - 4. Thomas & Betts Corporation; A Member of the ABB Group.
- C. General Requirements for Metal Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
 - 2. Comply with TIA-569-D.
- D. GRC: Comply with ANSI C80.1 and UL 6.

- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: die cast.
 - b. Type: compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- H. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Description: Nonmetallic raceway of circular section with manufacturer-fabricated fittings.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
 - 2. Carlon; a brand of Thomas & Betts Corporation.
 - 3. RACO; Hubbell.
 - 4. Thomas & Betts Corporation; A Member of the ABB Group.
- C. General Requirements for Nonmetallic Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 - 2. Comply with TIA-569-D.
- D. RNC: Type EPC-40-PVC Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material.
- F. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Description: Comply with UL 2024; flexible-type pathway with a circular cross section, approved for plenum riser or general-use installation unless otherwise indicated.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Alpha Wire.
 - 2. Carlton; a brand of Thomas & Betts Corporation.
 - 3. Endot Industries Inc.
 - 4. IPEX USA LLC.
- C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with TIA-569-D.

2.4 SURFACE METAL PATHWAYS

- A. Description: Galvanized steel with snap-on covers, complying with UL 5.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. MonoSystems, Inc.
 - 2. Niedax Inc.
 - 3. Panduit Corp.
 - 4. Wiremold / Legrand.
- C. Finish: Manufacturer's standard enamel finish in color selected by Architect.
- D. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- E. Comply with TIA-569-D.

2.5 TELE-POWER POLES:

- A. Description: Prefabricated, finished metal pole with prewired power and communications outlets.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. MonoSystems, Inc.
 - 2. Panduit Corp.
 - 3. Wiremold / Legrand.
- C. Material: Galvanized steel with ivory baked-enamel finish.

- D. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.
- E. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- F. Comply with TIA-569-D.

2.6 HOOKS

- A. Description: Prefabricated sheet metal cable supports for telecommunications cable.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. MonoSystems, Inc.
 - 2. Panduit Corp.
 - 3. Wiremold / Legrand.
- C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with TIA-569-D.
- E. Galvanized steel.
- F. J shape.

2.7 BOXES, ENCLOSURES, AND CABINETS

- A. Description: Enclosures for communications.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Erickson Electrical Equipment Company.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. RACO; Hubbell.
 - 4. Thomas & Betts Corporation; A Member of the ABB Group.
 - 5. Wiremold / Legrand.
- C. General Requirements for Boxes, Enclosures, and Cabinets:
 - 1. Comply with TIA-569-D.
 - 2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
 - 3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
 - 4. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

- 5. Gangable boxes are allowed.
- D. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- E. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- F. Metal Floor Boxes:
 - 1. Material: Cast metal.
 - 2. Type: Fully adjustable.
 - 3. Shape: Rectangular.
 - 4. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum galvanized, cast iron with gasketed cover.
- I. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4, with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures:
 - a. Material: Plastic.
 - b. Finished inside with radio-frequency-resistant paint.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- J. Cabinets:
 - 1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.8 POLYMER-CONCRETE HANDHOLES

- A. Description: Molded of sand and aggregate; bound together with polymer resin; and reinforced with steel, fiberglass, or a combination of the two.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. [Armorcast Products Company.](#)
2. [NewBasis.](#)
3. [Oldcastle Enclosure Solutions.](#)
4. [Quazite: Hubbell Power Systems, Inc.](#)

C. General Requirements for Polymer Concrete Handholes:

1. Boxes and handholes for use in underground systems shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
3. Comply with TIA-569-D and SCTE 77.

D. Configuration: Designed for flush burial with integral closed bottom unless otherwise indicated.

E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.

1. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
2. Cover Legend: Molded lettering, "COMMUNICATIONS" "FIBER" "PHONE" "CABLE".

F. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

G. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.9 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed Conduit: RNC, Type EPC-80-PVC.
2. Concealed Conduit, Aboveground: IMC.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried concrete encased.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums
3. Concealed in Ceilings and Interior Walls and Partitions: EMT or innerduct.
4. Damp or Wet Locations: GRC.
5. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, communications-cable pathway.
6. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: Riser-type, communications-cable pathway.
7. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: EMT.
8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel units in institutional and commercial kitchens and damp or wet locations.

C. Minimum Pathway Size: 3/4-inch trade size for copper and aluminum cables, and 1 inch for optical-fiber cables.

D. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use set-screw or compression, steel fittings. Comply with NEMA FB 2.10.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:
 - 1. NECA 1.
 - 2. NECA/BICSI 568.
 - 3. TIA-569-D.
 - 4. NECA 101
 - 5. NECA 102.
 - 6. NECA 105.
 - 7. NECA 111.
- B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- C. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- D. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems" for hangers and supports.
- E. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling" for sleeves and sleeve seals for communications.
- F. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- G. Complete pathway installation before starting conductor installation.
- H. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- I. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.
- J. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within 12 inches of enclosures to which attached.
- L. Pathways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
 - 3. Arrange pathways to keep a minimum of 2 inches of concrete cover in all directions.

4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 5. Change from nonmetallic conduit and fittings to GRC or IMC and fittings before rising above floor.
- M. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for pathways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- O. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- Q. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.
- R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.
- S. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- T. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.
- U. Surface Pathways:
1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
 2. Install surface pathway with a minimum 2-inch radius control at bend points.
 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- V. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
 2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.

3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- W. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.
- X. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service pathway enters a building or structure.
 3. Where otherwise required by NFPA 70.
- Y. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- Z. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT that is located where environmental temperature change may exceed 100 deg F, and that has straight-run length that exceeds 100 feet.
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

AA. Hooks:

1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.
2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
3. Hook spacing shall allow no more than 6 inches of slack. The lowest point of the cables shall be no less than 6 inches adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
4. Space hooks no more than 5 feet o.c.
5. Provide a hook at each change in direction.

BB. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.

CC. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

DD. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

EE. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

GG. Set metal floor boxes level and flush with finished floor surface.

HH. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe of less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end

- of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
 5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete around conduit for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
 6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, but a minimum of 6 inches below grade. Align planks along centerline of conduit.
 7. Underground Warning Tape: Comply with requirements in Section 270553 "Identification for Communications Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line, 24 inches below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- F. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 310513
SOIL MATERIALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Subsoil materials.
- B. Topsoil materials.

1.2 RELATED SECTIONS (include but are not limited to)

- A. Appendix:
 - 1. Subsurface Investigation (Geotechnical) report; bore hole locations and findings of subsurface materials.
- B. Section 013300 – Submittal Procedures.
- C. Section 014000 – Quality Requirements: Testing soil fill materials.
- D. Section 310516 – Aggregate Materials.
- E. Section 312216 – Rough Grading.
- F. Section 312513 – Erosion and Sediment Control: Slope protection and erosion control.
- G. Section 312323 – Backfill.
- H. Section 312317 –Trenching.
- I. Section 329119 – Landscape Grading.

1.3 REFERENCES

VIRGINIA DEPARTMENT OF TRANSPORTATION

- A. VDOT, “Road & Bridge Standards & Specifications,” latest edition.

AMERICAN SOCIETY OF TESTING AND MATERIALS

- B. ASTM D698 – Std. Test Method for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ASTM D2487 – Classification of Soils for Engineering Purposes.

- D. ASTM D2922 – Std. Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- E. ASTM D3017 – Std. Test Method for Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- F. ASTM D4318 – Std. Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits).

1.4 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures.
- B. Materials Source: Submit name of imported materials source, to Geotechnical Engineer.
- C. Samples: Submit, in air-tight containers, 10 lb (4.5 kg) sample of each type of fill to appropriate testing laboratory.

1.5 QUALITY ASSURANCE

- A. Furnish each individual soil material from single source throughout the work.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

- A. Subsoil Type S1:
 - 1. Excavated and re-used material, imported borrow, or select or local borrow.
 - 2. Graded.
 - 3. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris; Less than 1% (by weight) of organic matter or other deleterious material.
 - 4. Conforming to ASTM D2487 Group Symbol CL or better.

2.2 TOPSOIL MATERIALS (See Section 329119 – Landscape Grading for Schedule)

- A. Topsoil Type T1:
 - 1. On-site topsoil, excavated and reused material, conforming to Virginia Stormwater Management Handbook Standard & Spec. C-SSM-02 TOPSOILING.
 - 2. Graded.
- B. Topsoil Type T2:
 - 1. Imported borrow.
 - 2. Natural, fertile, friable loamy soil (loam, sandy loam, silty loam, sandy clay loam, or clay loam), of 20-70% sand, 10-60% silt, and 5-30% clay.

3. Characteristic of productive soils in the vicinity which produce desirable vegetation and obtained from naturally well-drained areas.
4. Reasonably free of roots, rocks larger than 1 inch (25 mm) in longest dimension, subsoil, debris, large weeds, and foreign matter.
5. Free of toxic substances or any other material or substance which might be harmful to plant growth or a hindrance to grading maintenance operations.
6. Acidity range (adjusted pH) of 6.0 to 7.0.
7. Containing a minimum of 2 percent organic matter.
8. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.
9. With additives as recommended in soil analysis report.

2.3 SOURCE QUALITY CONTROL

- A. Section 014000 – Quality Requirements: Testing and analysis of soil material.
- B. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698 (Standard Proctor) and D2487 (Classification of Soils).
- C. Testing and Analysis of Topsoil Material: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of, inorganic matter (sand, silt, & clay), deleterious material, pH, and mineral and plant nutrient content of topsoil. Report suitability of topsoil for growth of applicable planted material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil.
- D. If tests indicate materials do not meet specified requirements, change material and retest.
- E. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

- A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth.
- B. Remove lumped soil, boulders, and rock.
- C. Stockpile excavated material, suitable for reuse, in area designated on site.
- D. Remove excess material not being used from site.
- E. Remove excavated materials not meeting requirements for reuse from site.

3.2 STOCKPILING

- A. Stockpile materials on site at locations indicated on Drawings.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Prevent intermixing of soil types or contamination.
- E. Direct surface waters away from stockpile site to prevent erosion or deterioration of materials.
- F. Stockpile topsoil 8 feet (2.5 m) high maximum.
- G. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.
- B. If a borrow area is utilized, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.

END OF SECTION

SECTION 310516
AGGREGATE MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Course Aggregate Materials.
 - 2. Fine Aggregate Materials.
- B. RELATED SECTIONS (including but not limited to:)
 - 1. Appendix: Subsurface Investigation (Geotechnical) report; recommended needs for aggregate materials.
 - 2. Section 013300 – Submittal Procedures.
 - 3. Section 014000 – Quality Requirements: Testing aggregate fill materials.
 - 4. Section 312213 – Rough Grading.
 - 5. Section 312513 – Erosion and Sediment Control: Slope protection and erosion control.
 - 6. Section 312323 – Backfilling.
 - 7. Section 312317 – Trenching.
 - 8. Section 321216 – Asphalt Paving.
 - 9. Section 321313 – Concrete Paving.
 - 10. Section 331116 – Water Distribution System.
 - 11. Section 334600 – Subdrainage: Filter aggregate.
 - 12. Section 334100 – Storm Drainage.
 - 13. Section 333100 – Sanitary Sewer System.

1.2 REFERENCES

AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS

- A. AASHTO - M147 - Materials for Aggregate and Soil-Aggregate.

AMERICAN SOCIETY OF TESTING AND MATERIALS

- A. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- D. ASTM D3017 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

VIRGINIA DEPARTMENT OF TRANSPORTATION

- E. VDOT "Road & Bridge Standards & Specifications," latest edition.
- F. VDOT "Special Provision for Flowable Backfill" dated March 11, 2010.

1.3 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures.
- B. Manufacturer's Certificate: Submit name of imported materials suppliers to Geotechnical Engineer.

1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from a single source throughout the work.

PART 2 PRODUCTS

2.1 AGGREGATE MATERIALS

- A. Coarse Aggregate Type A1 (Utility Bedding, Haunching, & Initial Cover): Conforming to VDOT Std. #68, 7, or 78.
- B. Coarse Aggregate Type A2 (Drainage Fill): Conforming to VDOT Std. #57.
- C. Coarse Aggregate Type A3 (Base for Concrete Flatwork): Conforming to VDOT Std. #5, 56, or 57.
- D. Coarse Aggregate Type A4 (Aggregate Base under Bituminous Pavement): Conforming to VDOT Std. #21A or B, Type II (A or B as indicated in pavement sections on the Drawings).
- E. Fine Aggregate Type A5 (Sand for Bedding): Conforming to VDOT Std. Grade "C" Fine Aggregate, VDOT Std. #10 Course Aggregate, or equivalent. A minimum of 100% (by weight) must pass a 3/8" laboratory square opening sieve, 94-100% passing a No. 4 sieve, and a maximum of 25% (by weight) may pass a No. 50 sieve.
- F. Course Aggregate "Rip-Rap" (as referenced on plans by d50 value): A well graded rip-rap, in accordance with DCR and VDOT standards, consisting of field stone of approximately rectangular shape. Specific gravity of individual stones shall be 2.5 minimum. Mean stone diameter shall be as denoted by the "d50" value. The diameter of the largest stone size shall not be larger than 1.5 times the d50 size. The diameter of the smallest stone size shall not be smaller than 0.3 times the d50 size. Small fines will not be permitted.

2.2 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Source testing and analysis of aggregate material.
- B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698.
- C. If tests indicate materials do not meet specified requirements, change material or material source and retest.
- D. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 STOCKPILING

- A. Stockpile in sufficient quantities to meet Project schedule and requirements.
- B. Separate differing materials with dividers or stockpile apart to prevent mixing.
- C. Direct surface water away from stockpile site so as to prevent deterioration of materials.

3.2 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.
- B. If a borrow area is utilized, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.

END OF SECTION

SECTION 310900
GEOTECHNICAL ENGINEERING, INSPECTION AND TESTING

PART 1 GENERAL

1.1 DESCRIPTION

- A. Geotechnical investigation report.
- B. Earthwork quality assurance.
- C. Underground utility quality assurance.

1.2 RELATED SECTIONS (including but not limited to:)

- A. Section 312213 – Rough Grading.
- B. Section 312316 – Excavation.
- C. Section 312323 – Backfill.
- D. Section 312317 – Trenching.
- E. Division 33 Underground Utility Sections.
- F. Appendix: Subsurface Exploration Report.

1.3 GEOTECHNICAL INVESTIGATION REPORT

- A. A geotechnical investigation report has been prepared for the site of this work by an independent geotechnical engineer.
- B. A copy of the full geotechnical investigation report for this project is bound at the end of the Project Manual in the Appendix.
- C. This geotechnical investigation report was obtained only for the Architect's/ Engineer's use in design and is not a part of the Contract Documents.
- D. The report is provided for bidder's information, but is not a warranty of subsurface conditions. Owner assumes no responsibility for conditions of site or continuation of those conditions existing at the time of report generation.
- E. Bidders should visit the site and acquaint themselves with existing conditions.
- F. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but such investigations may be performed only under time schedules and arrangements approved in advance by the Architect.

1.4 EARTHWORK QUALITY ASSURANCE

- A. A qualified independent Soils Testing Laboratory, which staffs a Professional Geotechnical Engineer, registered in Virginia (herein after Geotechnical Engineer), will be retained by the Owner to observe and report performance or work in connection with Rough Grading, Excavating, Backfill, & Trenching , and any other earthwork related concern.
- B. The Geotechnical Engineer shall perform the following:
 - 1. Make a site inspection, review governing requirements for this work and the test results and make recommendations on applicable portions of the Work (traffic bearing areas, building foundation, , etc., as may be applicable to this project),
 - 2. All required tests to determine bearing capacity of soil (subgrade suitability) prior to placement of all footings, slabs, tanks, utilities, etc.
 - 3. Inspections,
 - 4. Testing of all proof-rolling and filling operations,
 - 5. Determination of materials (suitable, unsuitable, rock, etc., as may be applicable to this project),
 - 6. Quantify materials involving unit price payments as applicable,
 - 7. Submit certifications of all such tests and inspections as may be herein required, with a proper description of tested or inspected locations, to the Architect/Engineer with a copy to the Contractor. Location maps shall be submitted with each report identifying areas where testing occurred.
- C. All testing performed by the Geotechnical Engineer is solely in the interest of and for the protection of the Owner.
- D. The density of all finally placed or excavated material shall be as specified herein and as determined suitable by the Geotechnical Engineer.
- E. The Contractor shall be responsible for notifying the Geotechnical Engineer of his readiness for all tests in a timely manner and for providing access to the site so as to cause no delay to the project.
- F. All instructions and directions provided by the Geotechnical Engineer to the Contractor shall be in writing and immediately communicated to the Owner and Architect.
- G. When a soils test requested by the Contractor fails to meet the requirements of these specifications, the cost of all re-testing required shall be borne by the Contractor.
- H. Notwithstanding any tests, instructions, or decisions made by the Geotechnical Engineer, the Contractor shall not be relieved of his obligation to perform all grading and compaction work in accordance with the Contract Documents.
- I. The Contractor may, at his option, hire his own Soils Testing Service to assure himself that his work is in accordance with the Contract Documents.

1.5 UNDERGROUND UTILITY QUALITY ASSURANCE

- A. The Architect or a representative retained by the Owner, will observe and report performance on work in connection with Underground Utility installation and testing.
- B. The following shall be performed:
 - 1. Review governing requirements for installation of this work,
 - 2. Upon accepting condition of trench for pipe installation, observe placement of bedding, haunching, pipe, any anchorage or thrust blocking required, and initial cover to assure that pipe is installed in accordance with those requirements,
 - 3. Verification of appropriate pipe, joint, and fitting materials,
 - 4. Observation of all required tests to determine suitability of said pipe installation, and
 - 5. Submit certifications of all such inspections and observations as may be herein required, with a proper description of tested locations, to the Architect/Engineer with a copy to the Contractor.
- C. All utility inspection related work performed by the Architect or Owner's Representative is solely in the interest of and for the protection of the Owner.
- D. The Contractor shall be responsible for notifying the Architect of his readiness for all inspections and observations in a timely manner and for providing access to the site so as to cause no delay to the project.
- E. Approvals and Disapprovals provided by the during inspection to the Contractor shall be in writing and immediately communicated to the Owner and Architect/Engineer.
- F. When an inspection/observation requested by the Contractor fails to meet the requirements of these specifications, the cost of all re-inspection/observation required shall be borne by the Contractor.
- G. Notwithstanding any tests, instructions, or decisions made during inspections, the Contractor shall not be relieved of his obligation to perform all utility work in accordance with the Contract Documents.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 311000
SITE PREPARATION AND CLEARING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparation.
- B. Protection: Protect improvements and vegetation to remain within and beyond/outside limits of disturbance.
 - 1. Barriers, warnings, shoring, etc.
 - 2. Adjacent properties, waterways and the air
 - 3. Reference points,
 - 4. Existing improvements,
 - 5. Existing utilities, and
 - 6. Trees and vegetation.
- C. Demolition, Clearing & Grubbing:
 - 1. Remove surface debris.
 - 2. Demolish and remove existing site improvements. Designated paving and curbs.
 - 3. Clear site of plant life and grass.
 - 4. Remove trees and shrubs, including root systems, unless designated to remain.
- D. Topsoil Stripping: Excavate and stockpile topsoil.
- E. Removal: Clean up, remove and dispose of undesirable material off-site.
- F. Restoration: Restore existing finished surfaces disturbed to that of proposed finishes (preconstruction condition as a minimum).
- G. Utility Adjustments: Adjust new and existing utility tops to meet proposed finish grades.
- H. Definitions.
- I. Project Record Documents.

1.2 RELATED SECTIONS (including but not necessarily limited to)

- A. Appendix:
 - 1. Subsurface Investigation Report.
- B. Division 01: Permits, Fees, & Notices: Land Disturbing Permit.
- C. Division 01: Temporary Utilities: Water Service.

- D. Division 01: Temporary Controls: Surface Water and Dewatering. Dust. Noise. Air pollution.
- E. Section 310900 – Geotechnical Engineering, Inspection, & Testing. Geotechnical Engineer.
- F. Section 310513 – Soil Materials: Definitions of subsoil and topsoil materials.
- G. Section 31 15 00 – Work Area Protection, MOT, Access.
- H. Section 31 22 13 – Rough Grading: Site subgrade contouring. References this section for Preparation, Protection, and Clean up, Removal and Disposal.
- I. Section 31 25 13 - Erosion and Sediment Control: Requirements for land disturbance, protection of stockpiles topsoil.
- J. Section 32 91 19 - Landscape Grading: Coordination of soil materials stockpile removal for finish grading and preparation for landscaping/seeding.

1.3 REFERENCES

- A. Virginia ~~Erosion & Sediment Control (ESC) Manual~~ Stormwater Management Handbook, latest edition: Temporary seeding, construction entrances and other measures or practices which may apply.
- B. Virginia Department of Health (VDH) "Waterworks Regulations", latest edition: Well or Monitoring Well abandonment.
- C. Virginia Department of Transportation (VDOT) "Road & Bridge Standards & Specifications", latest edition: Safety Items.
- D. Manual on Uniform Traffic Control Devices (MUTCD), latest edition (including the Virginia Supplement): Pavement Marking and Signage within right-of-way.

1.4 REGULATORY REQUIREMENTS

- A. Conform to all applicable codes. These include but shall not be limited to those pertaining to erosion and sediment control and disposal of debris.
- B. Obtain all required permits from authorities having jurisdiction.
- C. Erosion & Sediment Control (ESC): See Section 312513 - Erosion & Sediment Control for plan preparation, review, approvals, regulatory requirements, etc.
- D. Utility Companies: Administrative Requirements: Coordination & Meetings: Coordinate clearing Work with utility companies. Verify locations of existing utilities. Notify them prior to starting and comply with their requirements.
- E. Existing Signage within Right-of-Way: Any existing signs shall be relocated as necessary meeting all state and local ordinances including conformance in design

and placement with the Virginia Supplement to the Manual on Uniform Traffic Control Devices (MUTCD), latest edition. Edge of signs shall be 12 feet off edge of pavement or 6 feet off shoulder or 2 feet behind face of curb. Clear height shall be 7 feet above grade. Reference document shall take precedence.

1.5 DEFINITIONS

- A. Limit of Disturbance or Construction Limits: The extent that proposed contours, erosion and sedimentation control measures, subsurface utility work and surface improvements are indicated on the Drawings or as delineated as limits on Drawings plus Contractor trailer, storage and parking as defined in the Contract Documents.

1.6 PROJECT RECORD DOCUMENTS

- A. Accurately record on Project Record Documents the actual locations of utilities to remain, by horizontal dimensions from landmarks to remain, depth or elevations of inverts, and slope gradients while preparing for land disturbance and in providing protection of utilities.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Erosion and Sediment Control Materials: See Section 312513 - Erosion and Sediment Control for approved materials and products.
- B. See Section 310513 – Soil Materials: Definitions of subsoil and topsoil materials.

PART 3 EXECUTION

3.1 PREPARATION

- A. Accept premises as found. Owner assumes no responsibility for conditions of site or continuation of conditions existing at time of advertisement.
- B. Assure that all pertinent required permits have been obtained.
- C. Verify all site conditions pertinent to this work.
- D. Locate, identify and flag/mark for protection all bench marks, property corners and reference points. Verify that survey bench mark and intended elevations for the Work are as indicated.
- E. Contractor shall lay out all work and be responsible for all lines, elevations and measurements.
- F. Verify that existing trees/plant life designated to remain, are conspicuously marked as such.

- G. Drawings do not purport to show all objects existing on the site. Before commencing work, verify with the Architect all improvements to be protected, salvaged, relocated, removed or demolished. Existing utilities are indicated on the Drawings in accordance with available records.
- H. Before any work is started, the Contractor shall contact all corporations, companies, individuals and local authorities owning, maintaining or regulating utilities, conduits, wires and pipes running to or on the property to make suitable arrangements for locating, protection, handling, relocation, adjusting, and/or removal and disposal/salvage of such lines or structures. Verify locations and elevations.
- I. Contact MISS UTILITY at least 48 hours in advance of land disturbing activities.
- J. Before any work is started, the Contractor shall contact all state and local authorities owning, maintaining or regulating adjacent rights-of-way to make suitable arrangements for protection, handling, relocation, and/or removal and disposal/salvage of such improvements involved in this Work (signs, structures, etc.). Verify locations, elevations and applicable codes.

3.2 PROTECTION

- A. General: Erect and maintain temporary bracing, shoring, lights, barricades, warning signs, etc., all in accordance with applicable rules and regulations.
- B. Protection of adjacent properties, waterways and the air:
 - 1. Prior to any land disturbance activity install Erosion and Sediment Control measures conforming to Section 312513 - Erosion and Sediment Control (ESC). See Site Drawings for specific practices required to prevent soil from washing from areas disturbed during clearing operations. Maintain all ESC measures required.
 - 2. Clearing shall be restricted to the area within the right-of-way, easements, and Construction Limits indicated on the Drawings.
 - 3. Any material which will result in dust shall be wet down during removal.
- C. Protection of Reference Points: Protect and maintain all bench marks, property corners, monuments and other reference points from damage or displacement. Do not cover. Obtain accurate replacement of any that is disturbed, destroyed or moved due to the work and furnish a certificate by a professional civil engineer or land surveyor that all such items have been relocated accurately.
- D. Protection of Existing Improvements:
 - 1. Conduct site clearing operations to ensure minimum interference with roads, streets, walks, utilities, and other adjacent improvements to remain. Do not close or obstruct streets, walks or other facilities without written permission from authorities having jurisdiction and prior approval by the Owner.
 - 2. Use all means necessary to protect existing improvements designated to remain. In the event of damage, immediately make all necessary repairs

and replacements as directed by the Architect.

E. Protection of Existing Utilities:

1. Existing utilities, encompassing all water systems, storm and sanitary sewer systems, gas lines, electric systems, telephone and communication systems, underground storage tanks, etc., and all accessories thereto, underground, on the surface or overhead, located in or affected by the construction of the work shall be relocated as required
2. Protect existing utilities noted to remain.
3. Coordinate the timing of utility adjustments to ensure that all new and existing utility tops are adjusted to proposed finish grades prior to stone base applications in paved areas, and prior to topsoil applications within lawn spaces.
4. Give advance notice to the Utility Owner of work to be removed or relocated. The work shall be performed by the Contractor or Utility Owner with arrangements and payment for this work being made by the Contractor.
5. If existing concealed utilities not shown or correctly indicated by the Contract Documents are encountered, the Contractor shall stop work in that area and notify the Architect and Utility Owner. Do not proceed until written instructions are received from the Architect.
6. The Contractor shall excavate with care to determine the exact location of existing utilities, including sizes and inverts. Also, stake and flag at this time for protection. This work shall precede pipe laying, grading, excavation and other construction as far as practicable, to permit adjustments where required.

F. Protection of Existing Trees and Vegetation:

1. Contractor shall assume that all existing vegetation on the premises is intended to remain unless specifically noted otherwise.
2. Protect existing trees, plant growth, and features against compacting the root zone, unnecessary cutting, breaking, skinning of roots, or bruising of bark, or damage from dust, debris, or chemicals. Conform to details and specifications of the ~~Virginia Erosion & Sediment Control~~ Stormwater Management Handbook for methods of protection.
3. Disposal of any adhesives, concrete, plaster, paints, thinners, or other volatile liquids or substances detrimental to vegetation shall be done in proper locations away from existing or new plant materials.
4. Repair or replace trees and vegetation damaged by construction operations, but not intended for demolition, in a manner acceptable to the Architect

3.3 DEMOLITION, CLEARING AND GRUBBING

- A. Removal of utilities may cause excavations beneath proposed buildings and improvements. All excavations performed for demolition purposes shall be backfilled and tested in accordance with the specifications.
- B. Clear areas required for access to site and execution of Work. Honor described or

indicated Limits of Construction and Disturbance.

- C. Remove existing walks, pavement, fencing, curbs, minor buildings and structures where required for excavation or new construction or as indicated on the Site Drawings. Existing pavement to be removed or connected to shall be neatly cut in straight lines at necessary locations required to accomplish required work. Existing pavement to be trenched through by the open cut method shall be neatly cut in straight lines at minimum width required to accomplish required work.
- D. Where asphalt or concrete walks or pavement are removed in locations proposed as lawn or planting beds, all existing bedding stone shall be removed. Underlying subsoil shall be loosened and prepared to receive fill, topsoil, or mulch as applicable.
- E. Upon encountering and well within limits of disturbance, verify first with A/E that well is not in use and that Owner desires it to be formally abandoned. If so desired Contract price will be adjusted by Change Order. Abandon well in accordance with Virginia Department of Health "Waterworks Regulations", Section 3.8 - Observation, Monitoring and Remediation Wells and Section 3.11 - Well Abandonment. Adjust top elevation of casing as required to maintain three (3) feet of cover from finished grade.
- F. Abandon in place, in accordance with applicable codes, all utility lines, septic tanks, drain fields, septic pits, dry wells, etc., not intended to remain, if it poses no conflict with the Work, will have three (3) feet of cover at finished grade and, in the opinion of the Architect, remaining in place does not have an adverse impact upon the project or intended use.
- G. Remove utility lines & structures, septic tanks, drain fields, septic pits, dry wells, etc., which conflict with the work or do not meet the preceding conditions. Provide for the relocation, raising or lowering of existing electric and telephone poles where required.
- H. Remove grass, trees, stumps, shrubs, roots, vines, weeds, brush, surface rocks, debris and all other extraneous material or objects from areas to be built upon or graded. Remove all vegetation to a sufficient depth to prevent regrowth.
- I. Conduct demolition, clearing and grubbing operations in such a manner as to minimize disturbance to subsoil and creation of dust. Remove existing foundation walls, floor slabs and footings in such a manner as to avoid disturbing underlying subgrade.
- J. Where trees are indicated to be left standing, stop topsoil stripping at drip line to prevent damage to main root system. Use only hand grubbing inside the driplines of trees to remain.
- K. Fill depressions caused by demolition, clearing and grubbing operations with controlled fill unless further excavation or grading is indicated and immediately follows.

- L. Do not allow water to pond in any excavation or depression. See Dewatering in Division 01: Temporary Controls.

3.4 STRIPPING TOPSOIL

- A. Excavate topsoil from areas to be further excavated, re-landscaped, or re-graded as indicated on the Drawings. Excavate to whatever depths encountered in a manner to prevent intermingling with underlying sub-soil or other objectionable material. Comply with the following:
 - 1. Do not excavate wet topsoil.
 - 2. Avoid including debris, stones and other extraneous matter in topsoil which will make it "unsuitable" under Section 31 05 13 – Soil Materials: Topsoil Materials.
 - 3. Leave subsoil surface free of trash, debris and foreign materials.
- B. Stockpile on site in an area approved by the Architect/Engineer. Comply with Section 31 25 13 - Erosion & Sediment Control; Topsoil Stockpile.

3.5 CLEANUP, REMOVAL & DISPOSAL

- A. Clean up debris resulting from site clearing and grading operations (earthwork related) continuously with the progress of the Work.
- B. Remove debris, rock, extracted plant life, unsatisfactory, and/or surplus (not being reused) soil materials, etc. from site.
- C. Any debris, rock, extracted plant life, etc. designated to be removed from the site shall become the property of the Contractor and shall be disposed at the Contractor's expense.
- D. Dispose of all material in accordance with all local, state and federal regulations governing same.

END OF SECTION

SECTION 311500
WORK AREA PROTECTION, MAINTENANCE OF TRAFFIC (MOT), AND ACCESS

1. General

- 1.1. Traffic Maintenance - All traffic control shall be subject to approval by the City Traffic Engineer (Transportation Department 540-853-2385). The City Traffic Engineer is not the City Project Manager or City Engineer. Changes to the traffic control plan, as directed by the City Traffic Engineer, shall not be a basis for additional compensation. The Contractor shall submit a traffic control plan sealed by a Professional Engineer registered in Virginia for review and approval prior to mobilization. All lane and street closures and detours shall be coordinated with the Transportation Department. Note that the Engineering and Transportation Departments are separate departments. Traffic control plans shall be submitted within the specified number of days outlined in the Submittals (Section 01 30 00) portion of this specification.
- 1.2. Any sign, to be posted on the job site/work zone for more than 72 hours, must be anchored into the ground with a steel/wooden post. Placing signs on trees, existing road sign posts, or mailbox posts, etc. shall not be allowed.
- 1.3. Work Area Protection – The Contractor shall maintain the work area in accordance with the Virginia Work Area Protection Manual, latest edition. The City shall not be responsible for any portion of work area protection or safety.
- 1.4. If a temporary road closure is required on the project, a traffic control plan conforming to the Virginia Work Area Protection Manual shall be submitted to the City of Roanoke for approval prior to starting construction. Contractor shall be required to provide all signage and devices in accordance with the Virginia Work Area Protection manual. In addition, the Contractor shall provide and maintain all signs for road/alley detours. **The City of Roanoke shall not provide any signs.**
- 1.5. Access - Coordinate citizens' access to driveways as much as possible. Access to properties along the project route shall be maintained during construction.
- 1.6. Contractor shall be responsible for providing all signage for the project. The Contractor shall not rely on City personnel to provide or maintain any signage.
- 1.7. There may be other Contractors in the adjoining areas. Incidental coordination with the Contractors may be required.

2. Products – Not Used

3. Execution – Not Used

END OF SECTION

SECTION 312213
ROUGH GRADING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Site Subgrade Contouring. General cutting, grading, filling, and rough contouring of the site for access drives, parking, site structures, building pads, landscaping features, etc., as applicable.
- B. Furnish all labor, materials, equipment, and incidentals necessary for earthmoving, grading, cutting, filling, and compaction to provide subgrade elevations as specified herein from finish grades indicated on the Drawings.
- C. Unauthorized excavation defined.

1.2 RELATED SECTIONS

- A. Appendix: Geotechnical Report, Subsurface Investigation.
- B. Section 310513 - Soil Materials.
- C. Section 310516 - Aggregate Materials.
- D. Section 311000 - Site Preparation and Clearing.
- E. Section 312316 - Excavating: Building excavation.
- F. Section 312323 - Backfilling: General building area backfilling.
- G. Section 312317 - Utility Trenching & Backfilling: Trenching and backfilling for utilities.
- H. Section 329119 - Landscape Grading: Finish grading with topsoil to contours.

1.3 REFERENCES

AMERICAN SOCIETY OF TESTING & MATERIALS

- A. ASTM C136 - Method For Sieve Analysis of Fine and Coarse Aggregates.
- B. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

- D. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- E. ASTM D2419 - Test Method For Sand Equivalent Value of Soils and Fine Aggregate.
- F. ASTM D2434 - Test Method For Permeability of Granular Soils (Constant Head).
- G. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- H. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.4 DEFINITIONS

- A. "Finish grade" refers to contours and spot grades indicated on the Drawings.
- B. "Subgrade" or "rough grade" refers to bottom of footings at foundation walls and columns, bottom of aggregate fill within trenches or under slabs-on-grade and paving, and finish grade less specified topsoil depth elsewhere. Refer to applicable Drawings and Schedules for distances below finish grade. "Subgrade" may also refer to the subsoil base upon which fill is to be placed
- C. "Unsuitable material" refers to any material beneath proposed subgrade in cut conditions and existing subgrade in fill conditions which in the opinion of the Geotechnical Engineer, after observing proof-rolling or other testing/observation, will not be a satisfactory base for supporting the proposed work above.

1.5 CLASSIFICATION OF EXCAVATION

- A. All cutting, filling, excavating and backfilling to the limits of rough grade as defined herein is "unclassified" except for Rock and Unsuitable Soils and it shall be the Contractor's responsibility to determine the subsurface character. Bidders are expected to examine the site and then decide for themselves the character of materials to be encountered. Claims for extra compensation arising from latent, subsurface conditions within the area defined will not be considered.
- B. Excavation beyond the indicated subgrade elevations or excavation side dimensions shall be replaced at Contractor's expense with material per schedule this section.

1.6 SUBGRADE SUITABILITY

- A. The Geotechnical Engineer shall inspect all subgrades below footings and below slabs on grade and the results of such inspections shall be reported to the Architect and Owner.
- B. As determined by the Geotechnical Engineer, any unsuitable material below limits of subgrade elevations shall be removed and replaced per schedule this section.

Contract Price will be adjusted as identified on the Bid Form except as indicated in "C" below.

- C. Once any subgrade has been approved by the Geotechnical Engineer for pouring of footings, slabs, etc., if the pouring of concrete is delayed by the Contractor, for any reason, resulting in subsequent disapproval of said subgrade by the Geotechnical Engineer, any additional excavation required as a result of such subsequent disapproval shall be provided by the Contractor at no additional cost to the Owner.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Topsoil: Type T1 or T2 as specified in Section 310513.
- B. Subsoil Fill: Type S1 as specified in Section 310513.
- C. Structural Fill: Type S1 as specified in Section 310513.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 013000 – Administrative Requirements: Coordination.
- B. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 PREPARATION, PROTECTION, & CLEANUP

- A. Control water in accordance with Division 01 – Temporary Controls. Ponding water will not be permitted.
- B. Comply with Section 311000 - Site Preparation & Clearing: Preparation, Protection, Field Measurements, Cleanup.
- C. The Contractor shall be responsible for controlling on-site construction traffic to prevent softening or rutting of completed controlled fill work. Additional work required due to improper traffic control will be at the Contractor's expense.
- D. Identify required lines, levels, contours, and datum.
- E. Locate, identify, and protect above and below grade utilities that remain, from damage.

- F. Notify utility company to remove and/or relocate utilities, as applicable.
- G. Protect plant life, lawns, and other features remaining as a portion of final landscaping.
- H. Protect bench marks, survey control points, any existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 PROOF-ROLLING

- A. After all demolition, clearing, grubbing, and topsoil and organics stripping the exposed subgrade shall be proof-rolled. Proof-rolling shall be with a tandem axle dump truck or similar pneumatic tired equipment weighing at least 10 tons (20 tons max) to locate soft or other unsuitable areas. The number and direction of passes shall be as required by the Geotechnical Engineer.
- B. Any soft or compressible areas or unsuitable material encountered shall be removed and replaced per schedule this section. The Geotechnical Engineer shall observe the removal, document the volume, observe and test the replacement and immediately forward copies of documentation to the Architect/Engineer.
- C. Unless approved by the Geotechnical Engineer proof-rolling shall be a continuous operation until the entire site is complete.
- D. When extensive excavation is required to bring the site to rough grade, proof-rolling shall occur simultaneously with the excavation work, if possible.
- E. The Contractor shall provide assistance to the Geotechnical Engineer or his representative as required to accomplish this work and to accurately track the progress of proof-rolling.
- F. After proof-rolling the subgrade, areas to receive fill shall be uniformly scarified to a depth of 2". Water shall be added to the loosened material or it shall be allowed to dry as required so that the moisture content is within necessary limits of the optimum as judged or tested by the Geotechnical Engineer.

3.4 SUBSOIL EXCAVATION (Cutting)

- A. Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded.
- B. Work within 15 feet of any structure to remain shall be handled under Section 312316 – Excavating & Filling. Should the Architect or Geotechnical Engineer determine the structure to be in jeopardy by grading operations this distance may be increased.
- C. Do not excavate wet subsoil unless determined to be "unsuitable material".

- D. When excavating through roots of trees to remain, perform work by hand and cut roots with sharp ax.
- E. If rock is encountered, it shall be excavated to 12" below rough grade and replaced per schedule this section.
- F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.5 STOCKPILING

- A. Stockpile suitable excavated material per Section 312513 - Erosion & Sediment Control: Topsoil/Soil Materials Stockpile.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements. Stockpile materials on site at locations acceptable to Architect/Engineer. Avoid drainage ways and drip areas of trees. Remove excess material and material unsuitable for reuse as fill from site.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Prevent intermixing of soil types or contamination.

3.6 FILLING

- A. Before fill is placed, existing grade shall be prepared as specified in Section 311000, shall be dry and clean of all debris, and shall be proof-rolled in accordance with this section.
- B. Scarify proof-rolled, existing subgrade to a depth of 2" prior to placing fill.
- C. All fill materials shall be tested and approved by the Geotechnical Engineer prior to placement and shall meet or exceed the requirements as specified in schedule this section.
- D. Place fill to subgrade contours and elevations allowing for later placement of topsoil and pavements.
- E. Furnish additional fill material from off site if required to complete the work. Fill material from off-site is subject to approval of the Architect and Geotechnical Engineer.
- F. Filling operations for embankments having a slope greater than 1' vertically to 4' horizontally or other similar areas noted on the site plan shall be stepped or benched in 8" vertical lifts. Carry fill slope at least three feet horizontally beyond design rough grade, then cut back to well compacted material at subgrade elevations indicated on the Drawings.
- G. Do not place fill in water or mud or on frozen or frosty ground.

- H. Surfaces of new grades shall be left clean and ready to receive applicable finished surface. Remove all ruts and depressions to give a smooth and uniform subgrade.
- I. To avoid delay of the project, when wet weather will not permit placement of soil fill material under the building area, Contractor will be permitted the option of using structural fill type A3 or as acceptable to the Geotechnical Engineer, as the fill material at no additional cost to the Owner.
- J. Fill areas to contours and elevations with unfrozen materials.
- K. Place fill material on continuous layers and compact in accordance with the schedule at end of this section.
- L. Maintain optimum moisture content of fill materials to attain required compaction density.
- M. Slope grade away from building minimum 2 inches in 10 ft (1.5:100), unless noted otherwise. This is also the minimum for grassed areas.
- N. Make grade changes gradual. Blend slope into level areas.
- O. Remove surplus fill materials from site.

3.7 RESTORATION OF GRADES

- A. Restore to original grades and conditions all properties damaged by any activity related to this work and take adequate precautions to avoid settlements or cave-ins of properties higher than site, and settling, eroding or other damage to properties lower than site.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

3.8 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 0.1 foot (30 mm) within 100 feet of buildings, under all pavement and site improvements (such as athletic/play fields); and 0.25 foot (75 mm) on surrounding fields and slopes.

3.9 COMPACTION OF FILLS

- A. Required compaction tests shall be carried out according to ASTM D698 Standard Proctor Test by the Geotechnical Engineer.
- B. Field testing methods shall be as determined by the Geotechnical Engineer.
- C. Contractor shall be responsible for notifying Geotechnical Engineer as each lift is installed. Contractor shall not place additional lifts until tests indicate the fill is

compacted to specified densities. Should any lifts be placed prior to approval of lower lifts, the work shall be removed at no additional cost to the Owner.

- D. Materials and densities shall be in accordance with schedule this section.
- E. The moisture content of the fill material shall be within 3% of the optimum range for maximum compaction during compaction. Add water as required. If excess water exists, it shall be reduced by harrowing, dicing and natural evaporating.

3.10 FIELD QUALITY CONTROL

- A. Testing: In accordance with ASTM D698.
- B. Work performed which does not meet technical or design requirements as determined by the Geotechnical Engineer will be removed, replaced and retested at no additional cost to the Owner. No deviations from the Contract Documents shall be permitted without specific and written approval from the Architect/Engineer.
- C. Thickness of lifts prior to compaction and distribution of tests, unless otherwise required by the Geotechnical Engineer, shall be accordance with the following table:

	MAX. LIFT	TEST DISTRIBUTION
AREA	THICKNESS	(PER LIFT)
Lawn & unpaved areas	8"	1 per 10,000 s.f.
Backfills (Exterior)	8"	1 per 2,500 s.f.
Embankments (3H:1V & >)	8"	1 per 2,500 s.f.
Under Paving, Curbs, Walks, Footings, and Slabs on Grade	8"	1 per 1,000 s.f.

- D. Lift thickness given are for heavy compaction equipment. If hand operated equipment is used then lift thickness shall be one-half of those given above.
- E. Test distributions are minimum requirements with more required if deemed necessary by the Geotechnical Engineer. If fill area is linear in shape and less than 50' wide, provide one (1) test per 50 linear feet of the fill areas.
- F. Density requirements under slabs, footings and pavement shall be carried ten feet (10') beyond exterior edges.

3.11 STOCKPILE CLEANUP

- A. Comply with Section 329119 - Landscape Grading for finish grading and preparation of stockpile areas for landscaping/seeding.
- B. Comply with state and local erosion and sediment control ordinances by having stabilized all disturbed areas at completion of work.

3.12 SCHEDULES

- A. Fill Under Slab-On-Grade Building to 10 Feet Outside:
 - 1. Fill Type S1, to subgrade elevation, compacted to 95 percent,
 - 2. Inside foundation wall cover with Fill Type A3 (Base for Concrete Flatwork), 4 inches (100 mm) thick (unless detailed otherwise), compacted to 95 percent.
- B. Fill Under Grass Areas:
 - 1. Fill Type S1, to specified depth of topsoil below finish grade, compacted to 90 percent. See Section 329119 - Landscape Grading for topsoil depth.
- C. Fill Under Landscaped Areas:
 - 1. Fill Type S1, to specified depth of topsoil below finish grade, compacted to 90 percent.
- D. Fill For Landscape Berms:
 - 1. Fill Type S1, to specified depth of topsoil below finish grade, compacted to 85 percent.
- E. Fill Under Vehicular Asphalt or Concrete Paving, Pavers, Curbs and Concrete Dumpster Pad:
 - 1. Compact subsoil to 95 percent of its maximum dry density.
 - 2. Fill Type S1, to within two (2) feet of pavement subgrade, compacted to 95 percent.
 - 3. Fill Type S1, to pavement subgrade as indicated in applicable pavement section or schedule description, compacted to 98 percent.
- F. Fill Under Non-Vehicular Concrete Paving or Pavers (Walks):
 - 1. Compact subsoil to 95 percent of its maximum dry density.
 - 2. Fill Type S1, to pavement subgrade as indicated in applicable pavement section or schedule description, compacted to 95 percent.
- G. Fill to Correct Over-excavation:
 - 1. Fill Type A1, flush to subgrade elevation, compacted to 95 percent.
- H. Fill Over-Excavation of Demolished or Grubbed Material:
 - 1. Under Grassed Areas: Fill Type S1, to specified depth of topsoil below finish grade, compacted to 90 percent. See Section 329119 - Landscape Grading for topsoil depth.

2. Under other improvements: Same as fill to Correct Over-Excavation or for specified surface.
- I. Topsoil Fill: See Section 329119 - Landscape Grading.

END OF SECTION

SECTION 312316 EXCAVATING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Excavating for building foundations.
- B. Excavating for slabs-on-grade, curbing, walks, landscaping, etc.
- C. Excavating for site structures.

1.2 RELATED SECTIONS

- A. Appendix: Geotechnical report; bore hole locations and findings of subsurface materials.
- B. Section 310900 - Geotechnical Engineering, Inspection, and Testing
- C. Section 312213 - Rough Grading: Classification of excavation. Topsoil and subsoil removal from site surface.
- D. Section 312323 - Backfilling.
- E. Section 312317 - Utility Trenching & Backfilling: Excavating for utility trenches.
- F. Section 312513 - Erosion & Sediment Control: Slope protection and erosion control.

1.3 DEFINITIONS

- A. Finish grade refers to contours and spot grades indicated on the Drawings.
- B. Subgrade or rough grade refers to bottom of footings at foundation walls and columns, bottom of crushed stone fill within trenches or under slabs-on-grade and paving, and finish grade less specified topsoil depth elsewhere. Refer to applicable Drawings and Schedules for distances below finish grade. Subgrade may also refer to the subsoil base upon which fill is to be placed.
- C. Where rock is encountered, Contractor shall over-excavate 12 inches below defined subgrade.
- D. Unsuitable material refers to any material beneath proposed subgrade in cut conditions and existing subgrade in fill conditions, which in the opinion of the Geotechnical Engineer, after observing proof-rolling or other testing/observation, will not be a satisfactory base for supporting the proposed work above.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that survey bench mark and intended elevations for the Work are as indicated. Identify required lines, levels, contours, and datum locations.

3.2 EXCAVATING

- A. Underpin adjacent structures which may be damaged by excavating work.
- B. Work within 15 feet of any structure to remain shall be handled under Excavation. Should the Architect or Geotechnical Engineer determine the structure to be in jeopardy by grading operations this distance may be increased.
- C. Excavate subsoil to accommodate building foundations, slabs-on-grade, curbing, and site structures, construction operations, etc.
- D. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 312323.
- E. Slope banks with machine to angle of repose or less until shored.
- F. Do not interfere with 45 degree bearing splay of foundations.
- G. Grade top perimeter of excavation to prevent surface water from draining into excavation. Hand trim excavation. Remove loose matter.
- H. Notify Architect/Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- I. Do not excavate wet subsoil unless authorized as "unsuitable material".
- J. When excavating through roots, perform work by hand and cut roots with sharp ax.

3.3 TOLERANCES

- A. Bottom of Footings: Excavate in excess of required dimension on detail from true line and grade.
- B. Sides of Footings: Excavate in excess of required dimension on detail from centerline of true alignment.

- C. Excavation for Misc. Structures: Plus or minus 0.04 foot (0.5 in) (13 mm) from true line and grade.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Assurance: Field inspection and testing. Geotechnical Engineer.
- B. Prevent soil in excavated areas previously considered suitable from becoming "unsuitable" due to rainfall or surface runoff and ponding. Measures to protect subgrade shall include, but not be limited to, delaying final excavation of bottom 8" of material to just prior to finished product placement, or installing a protective layer of lean concrete.
- C. Provide for visual inspection of bearing surfaces. Place no footing until soil bearing capacity has been verified by the Geotechnical Engineer.

3.3 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

SECTION 312317
UTILITY TRENCHING AND BACKFILLING

PART 1 GENERAL

1.1 SECTION INCLUDES (But is not limited to)

- A. Excavating trenches for utilities from inlets to indicated points of connection to municipal utilities, source, outfall, etc., as applicable.
- B. Compacted backfill from top of utility cover bedding/initial backfill to subgrade elevations.

1.2 RELATED SECTIONS

- A. Section 310900 - Geotechnical Engineering, Inspections, and Testing.
- B. Section 310513 - Soil Materials.
- C. Section 310516 - Aggregate Materials.
- D. Section 311000 - Site Preparation and Clearing: Preparation for land disturbance. Protection of the work. Demolishing structures. Clearing and grubbing. Stripping and stockpiling topsoil.
- E. Section 312213 - Rough Grading: Subgrade Suitability, Correction of Over-excavation.
- F. Section 329119 - Landscape Grading: Depth of topsoil.
- G. Division 33 - Water, Sanitary Sewer, Storm Drainage, Foundation Drainage Sections, as applicable.
- H. Division 23 - Underground Steam, Condensate, Chilled Water, Refrigerant, Fuel System Sections, etc., as applicable
- I. Division 26 - Underground Electrical and Communication Conduits

1.3 REFERENCES

- A. VDOT "Special Provision for Flowable Backfill" dated March 11, 2010.
- B. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.
- C. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- D. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm)

Drop.

- E. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.4 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.
- B. Bedding: Fill placed under pipe to provide support.
- C. Haunching: Fill placed from bedding to spring line of the pipe, also considered bedding, which further supports pipe in both the horizontal and vertical.
- D. Cover Bedding/Initial Backfill: Fill placed above haunching to protect pipe prior to further backfill.

1.5 FIELD MEASUREMENTS

- A. Verify that survey bench mark, control point, and intended elevations for the Work are as shown on the Drawings.

1.6 COORDINATION

- A. Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

1.7 PROJECT RECORD DOCUMENTS

- A. Accurately record on Project Record Documents the actual locations of existing utilities encountered, by horizontal dimensions, elevations or inverts, and general direction.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Backfill: Type S1 as specified in Section 310513 – Soil Materials.
- B. Coarse Aggregate (Utility Bedding): Type A1 as specified in Section 310516 - Aggregate Materials.
- C. Flowable Backfill: As specified in VDOT "Special Provision for Flowable Backfill" dated March 11, 2010.
- D. Concrete: Lean concrete with a compressive strength of 1,000 psi (7 MPa).

2.2 ACCESSORIES

- A. Buried Utility Warning and Identification Tape: Provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape or manufactured

specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved, with warning and identification imprinted in bold black letters continuously over entire tape length. Warning and identification shall be "CAUTION BURIED WATER LINE/SANITARY SEWER/STORM SEWER BELOW" or similar, as applicable. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

- B. Should Local Governing Authority require separate Detection Wire and Warning/Identification Tape, meet the local requirements regarding materials, function, and placement.

PART 3 EXECUTION

3.1 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Verify that all prerequisite work has been completed. Verify location and elevation of points of connection. Notify Miss Utility.
- C. Protect plant life, lawns and other features remaining as a portion of final landscaping.
- D. Protect bench marks, and any existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Maintain and protect above and below grade utilities which are to remain.

3.2 EXCAVATING

- A. Excavate subsoil required for utilities from origin to destination as indicated.
- B. Cut trenches sufficiently wide to enable safe installation and allow inspection. Remove water or materials that interfere with Work.
- C. Install trench forms of sufficient height and minimum width to reduce the amount of lateral excavation. Portions of excavations may approach adjacent property lines, pins, landscaping and tree root systems which shall be protected.
- D. Do not interfere with 45 degree bearing splay of foundations or as otherwise indicated by Geotechnical Engineer in Soils Report or from their field inspection.
- E. Hand trim excavation, including joints, as necessary. Remove loose matter.
- F. Remove any lumped subsoil, large stones, or other hard matter which could damage pipe or impede consistent backfilling or compaction.
- G. Cut out soft areas of subgrade not capable of compaction in place. See Section 312213 – Rough Grading for Subgrade Suitability. Backfill per schedule this

section.

- H. Correct areas over-excavated in accordance with Section 312213 – Rough Grading.
- I. Stockpile excavated material, if suitable for use and required for rough grading, in area designated on site, and remove excess material from site.

3.3 BEDDING & HAUNCHING

- A. Place Geotextile fabric, if applicable, as indicated in details in coordination with appropriate lifts of fill.
- B. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place bedding and haunching to spring line of pipe and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.

3.4 BACKFILLING

- A. Backfill trenches with unfrozen fill materials per applicable utility trench section to proposed subgrade per finished contours and elevations allowing for topsoil or pavement as applicable.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Backfill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.
- D. Employ a placement method that does not disturb or damage utilities in trench or any adjacent work.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Place Buried Utility Warning and Identification Tape continuous over each separate run of piping. Bury tape with printed side up and at the location indicated in the trench sections on the Drawings.
- G. Remove surplus fill materials from site.
- H. Leave fill material stockpile areas completely free of excess fill materials and restore to applicable proposed finished surface condition.

3.5 COMPACTING

- A. Percentage of maximum density requirements:
 - 1. Compact virgin subsoil (bottom of excavated trench) and each layer of backfill due to over-excavation to 95 percent of maximum dry density at +/-3% optimum moisture content as determined by ASTM D698

(Standard Proctor).

2. Compact each layer of backfill to not less than the scheduled percentages of maximum dry density at +/-3% optimum moisture content as determined by ASTM D698 (Standard Proctor).

- B. Equipment: Use power-driven hand tampers for compacting materials adjacent to structures and in trenches. Provide equipment capable of adding moisture to the soil material or for aerating the soil as determined necessary by moisture-density tests.
- C. Moisture Conditioning: Uniformly apply water in such a manner as to prevent free water appearing on the surface, either during or subsequent to compaction operations. Compaction by flooding is prohibited.
- D. Re-fill, re-grade and re-finish any area that becomes unsatisfactory due to freeze-thaw, erosion or settling. All areas or portions thereof that do not meet minimum density requirements shall be reworked and compacted until they meet the project density requirements.

3.6 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1-1/2 inches (0.12 ft) (37 mm) from required elevations.
- B. This tolerance shall not relieve the Contractor from providing minimum sections of finish surfaces or meeting critical spot grades shown on drawings.

3.7 FIELD QUALITY CONTROL

- A. Compaction testing will be performed in accordance with ASTM D698 (Standard Proctor) and ASTM D3017 (Moisture Content).
- B. Field testing methods shall be as deemed appropriate by the Project Geotechnical Engineer.
- C. Request inspection prior to and immediately after placing bedding.
- D. Frequency of Compaction Tests: One per lift per 200 LF of trench or fraction thereof.
- E. If tests indicate Work does not meet specified requirements, remove unacceptable Work, replace, compact, and retest.

3.8 PROTECTION OF FINISHED WORK

- A. Re-fill, re-grade and re-stabilize any area that becomes unsatisfactory due to freeze-thaw, erosion or settling, or vehicular traffic during construction.

3.9 SCHEDULE: See applicable trench sections on Drawings.

- A. Backfill Under Asphalt Pavement, Concrete Flatwork, and Road Shoulders:

1. To pavement subgrade, compacted to 100 percent.
- B. Backfill Through Embankments Under Grass Areas:
 1. To specified depth of topsoil below finish grade, compacted to 90 percent.
See Section 329119 - Landscape Grading.
- C. Backfill Under Grass:
 1. To specified depth of topsoil below finish grade, compacted to 90 percent.
See Section 329119 - Landscape Grading.
- D. Backfill Under Landscaped Areas:
 1. To 12 inches (300 mm) below finish grade, compacted to 90 percent.
- E. Backfill to Correct Over-excavation:
 1. Flush to required subgrade elevation, compacted to 95 percent. On a case by case basis, as approved by the Engineer, lean concrete to minimum compressive strength of 1000 psi (7 MPa) may be allowed.

END OF SECTION

SECTION 312318 ROCK REMOVAL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Removal of identified and discovered rock during excavation.
- B. Expansive tools to assist rock removal.
- C. Blasting is prohibited.

1.2 RELATED SECTIONS

- A. Appendix: Subsurface Investigation Report: Rock and weathered rock locations and depths.
- B. Section 312213 - Rough Grading: Subsoil materials. Backfilling.
- C. Section 312316 - Excavating: Building component excavation.
- D. Section 312323 - Backfilling: Backfill materials.
- E. Section 312513 - Utility Trenching & Backfilling: Utility excavation, backfill and compaction.

1.3 UNIT PRICE –PAYMENT

- A. Excavation and replacement of Rock shall be performed in accordance with the Bid Form. Identification and in situ measurement by the project Geotechnical Engineer shall be prerequisites for payment.

1.4 DEFINITIONS

- A. Definitions of Rip Rock, Blast Rock, and for Blast Rock for Trench Excavations shall be as defined within the Subsurface Geotechnical Report found with the Appendix. "Blast Rock" definitions shall refer to rock to be removed by mechanical means. Blasting onsite shall not be permitted.

1.5 SCHEDULING

- A. Schedule Work to avoid disruption to work in occupied buildings nearby.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Division 01.
- B. Verify site conditions and note subsurface irregularities affecting work of this section.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Deliver materials to job-site in their original, unopened containers, with all labels intact and legible at the time of use and bearing the manufacturer's warnings to be observed in the handling and use of chemicals.
- C. Provide adequate protection of all materials and equipment before, during and after execution of the Work.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

- A. Excavate and remove rock by the mechanical method.
- B. Drill holes and utilize expansive tools, wedges, or mechanical disintegration compound to fracture rock.
- C. Cut away rock at bottom of excavation to form level bearing.
- D. Remove shaled layers to provide sound and unshattered base for foundations.
- E. In utility trenches, excavate to 12 inches (300 mm) below invert elevation of pipe and 24 inches (600 mm) wider than pipe diameter.
- F. Remove excavated materials from site.
- G. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 312323 - Backfilling.

3.4 FIELD QUALITY CONTROL

- A. Provide for visual inspection of foundation bearing surfaces and cavities formed by removed rock

END OF SECTION

SECTION 312323 BACKFILLING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Building perimeter and site structure backfilling to subgrade elevations.
- B. Site backfilling.
- C. Fill under slabs-on-grade.
- D. Fill in landscaped beds/areas.
- E. Fill for over-excavation.
- F. Consolidation and compaction as scheduled.

1.2 RELATED SECTIONS

- A. Appendix: Geotechnical report; bore hole locations and findings of subsurface materials.
- B. Section 310900 - Geotechnical Engineering, Inspection, and Testing: Geotechnical Engineer.
- C. Section 310513 - Soil Materials.
- D. Section 310516 - Aggregate Materials.
- E. Section 312316 - Excavating.
- F. Section 312317 - Utility Trenching & Backfilling: Backfilling of utility trenches.
- G. Section 334600 - Subdrainage: Filter aggregate and filter fabric.
- H. Section 329119 - Landscape Grading: Filling of topsoil to finish grade elevation.
- I. Section 033000 - Cast-in-Place Concrete: Concrete materials.

1.3 REFERENCES

- A. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

- C. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- D. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- E. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.4 SUBMITTALS FOR REVIEW

- A. Samples: Submit to testing laboratory, in air-tight containers, 10 lb (4.5 kg) sample of each type of subsoil fill from each source to be used.
- B. Samples: Submit to testing laboratory, in air-tight containers, 10 lb (4.5 kg) sample of each type of aggregate fill from each source to be used.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Refer to specific trench sections on the Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify sub-drainage, damp proofing, or waterproofing installation has been inspected.
- B. Verify structural ability of unsupported walls to support loads imposed by the fill. Allow necessary time for curing and provide adequate bracing prior to backfilling.

3.2 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Type A4 fill and compact to density equal to or greater than requirements for subsequent fill material.
- C. Scarify and proof roll subgrade surface to a depth of 1 inch (13 mm) to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

- A. Backfill areas to contours and elevations with unfrozen materials.

- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Place geotextile fabric over Type A2 fill prior to placing next lift of fill.
- D. Soil Fill Type S1: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.
- E. Employ a placement method that does not disturb or damage other work.
- F. Maintain optimum moisture content of backfill materials to attain required compaction density.
- G. Backfill against supported foundation walls and retaining walls. Do not backfill against unsupported walls.
- H. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- I. Maintain minimum grade away from building per Section 312213 – Rough Grading.
- J. Make gradual grade changes. Blend slope into level areas.
- K. Stockpile in sufficient quantities to meet Project schedule and requirements where specified in Section 312213 – Rough Grading. Remove excess material and material unsuitable for reuse as fill from site.

3.4 TOLERANCES

- A. Top Surface of Backfill (Subgrade): Plus or minus 0.1 foot (30 mm) within 100 feet of buildings, under all pavement and site improvements (such as athletic/play fields); and 0.25 foot (75 mm) on surrounding fields and slopes.

3.5 FIELD QUALITY CONTROL

- A. Section 310900 - Geotechnical Engineering, Inspection, and Testing.
- B. Compaction testing will be performed in accordance with ASTM D698.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

- D. Frequency of Tests: Meeting requirements listed in Section 312213 – Rough Grading

	<u>Max. Lift Thickness</u>	<u>Tests (per Lift)</u>
Backfills (Exterior)	8"	1 per 2,500 s.f.
Under Paving, Curbs, Walks, Footings, and Slabs on Grade	8"	1 per 1,000 s.f.

3.6 PROTECTION OF FINISHED WORK

- A. Reshape and re-compact fills subjected to vehicular traffic.

3.7 SCHEDULE

- A. Interior Crawl Spaces:
1. Fill Type S1, sufficient to equalize load on wall exterior, compacted to 90 percent.
- B. Interior Slab-On-Grade:
1. Fill Type S1, per section on Drawings, compacted to 95 percent,
 2. Cover with Fill Type A3, per section on Drawings, compacted to 95 percent.
- C. Exterior Side of Foundation Walls, Retaining Walls and Over (geotextile protected) Granular Filter Material and Foundation Perimeter Drainage Stone:
1. Fill Type S1, per structural details to subgrade elevation, each lift, compacted to 90 percent.
- D. Fill Under Grass Areas:
1. Fill Type S1, to rough grade, compacted to 90 percent.
- E. Fill Under Landscaped Areas:
1. Fill Type S1, to rough grade, compacted to 90 percent.
- F. Fill For Berming:
1. Fill Type S1, to rough grade, compacted to 95 percent.
- G. Fill Under Asphalt or Concrete Paving:
1. Compact subsoil to 100 percent of its maximum dry density.
 2. Fill Type A4, to depth of pavement below finish paving elevation per pavements sections, compacted to 100 percent.
- H. Fill to Correct Over-excavation:
1. Lean concrete to minimum compressive strength of 1000 psi (7 MPa), OR
 2. Fill Type A4, flush to required elevation, compacted to 100 percent.

END OF SECTION

SECTION 312513
EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 WORK INCLUDED (But is not limited to)

- A. Furnish all labor, equipment and materials to complete and maintain Erosion and Sediment Control (ESC) measures necessary to prepare for and control proposed land disturbance per local and state regulations.
- B. Responsible Land Disturber defined.
- C. Install ESC Structures and Measures.
- D. Maintain Effectiveness of Structures and Measures.
- E. Control Water Run-off.
- F. Control Dust Accumulation.
- G. Control Amount of Disturbed/Unstabilized Area.
- H. Temporary and Permanent Stabilization of Disturbed Areas.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 00 & 01: Permits, Fees, & Notices: Land Disturbing Permit.
- B. Section 311000 – Site Preparation & Clearing: Topsoil Stripping and Stockpiling.
- C. Section 312213 – Rough Grading: Site subgrade contouring.
- D. Section 312316 – Excavating and Filling: Excavating for other than linear utility work.
- E. Section 312323 – Backfilling: Backfilling for other than linear utility work.
- F. Section 312317 – Utility Trenching & Backfilling.
- G. Section 334100 – Site Storm Drainage System.
- H. Section 329119 – Landscape Grading: Topsoiling.
- I. Section 329219 – Seeding: Temporary Seeding. Permanent Seeding. Dry-Seeding Mulch. Hydroseeding Mulch. Liquid Mulch Binder. Erosion Control/Revegetation Mats. Staples. Hydroseeding. Soil Supplements.
- J. Section 329223 – Sodding.

1.3 REFERENCES

- A. Virginia ~~Erosion & Sediment Control (ESC)~~ Stormwater Management (VSM) Handbook: Temporary seeding, construction entrances and other measures or practices which may apply.
- B. Virginia Department of Transportation (VDOT) "Road & Bridge Standards & Specifications": Outlet Protection, Channel Sections, Materials, Installation of Measures, etc. (but excluding references to measurement and payment).

1.4 DEFINITIONS

- A. Local Governing Authority (LGA) - The state agency, plan approving authority, municipal department or other entity which legally has jurisdiction over the referenced work or activity. This usually means the field official who makes or controls onsite inspections of the Work.

1.5 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all requirements of the Virginia Erosion & Sediment Control Law pertaining to this project as presented in the ~~Virginia Erosion & Sediment Control~~ VSM Handbook.
- B. Erosion & Sediment Control (ESC):
 - 1. The Contractor shall employ a Responsible Land Disturber who is certified by the Department of Conservation and Recreation. The name of this person is to be designated in writing by the Contractor to the State ESC plan approving authority (LGA) and the Owner along with copies of their certification prior to any land disturbance. The Responsible Land Disturber for this project shall be in charge of and is responsible for carrying out the land-disturbing activities on this project. The certified Responsible Land Disturber may change at any time during the life of this project, as long as the State ESC plan approving authority is notified in advance and in writing.
 - 2. Obtain and pay for such land disturbing permits as required by the plan approving authorities, including fees and bonds, per Division 0 & 1.
 - 3. The Contractor shall not begin land disturbance until all required permits have been obtained and, if required, posted at the site. Permits may include, but are not limited to, the following:
 - a) Local (or State) Land Disturbance Permit.
 - b) Virginia Stormwater Management Program (VSMP) Permit.
 - 4. The plans have been drawn according to specifications of the ~~Virginia Erosion and Sediment Control~~ VSM Handbook (Latest Edition) and pertinent state regulations. The ESC Narrative shall be considered part of these Contract Documents as required by the State ESC plan approving authority (LGA).

1.6 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures: Submittals.
- B. All products identified in PART 2 of this specification.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All Erosion and Sediment Control materials shall conform to the standards set forth in the ESC VSM Handbook unless indicated as VDOT Std. in which case they shall conform to the "Road & Bridge Stds. & Specs."
- B. Construction Entrance Stone: Provide in accordance with the ESC VSM Handbook Std. & Spec. 3-02 C-SCM-03.
- C. Construction Road Stabilization Stone: Provide in accordance with ESC VSM Handbook Std. & Spec. 3-03 C-SCM-02. Within areas to be paved and once rough grade has been obtained, the Contractor may use pavement base material as specified and/or indicated in the pavement section on Drawings.
- D. Outlet Protection or Storm Water Conveyance Channel Stone: Provide in accordance with VDOT Std. EC-1 Erosion Control Stone and Spec. 414.03(e) Erosion Control Stone. Stone shall be sound, durable, non-erodible shot rock or rock excavation free from seams, cracks, and other structural defects. Also see sized indicated on the Drawings.
- E. Outlet Protection Stone Geotextile Fabric for bedding shall conform to VDOT Std. & Spec. Section 245, which includes but is not limited to meeting the following requirements: apparent size opening equal to or greater than No. 50 sieve as tested per ASTM D4751, tensile strength @ 20% maximum elongation of 30 lbs/linear inch minimum as tested per VTM-52, puncture strength of 80 lbs minimum as tested per ASTM D4833, and have seams equal in strength to the basic material. Submit written documentation of test results from an independent commercial lab verifying that material meets specified requirements.
- F. Silt Fence: Woven fabric for use as silt fence around inlets or to protect slopes.
 - 1. Manufacturer - Product:
 - a) Amoco - Propex Silt Stop
 - b) Mirafi, Inc. - Mirafi 100X, Envirofence
 - c) Exxon - GTF 101-S
 - 2. Posts for staking silt fence shall be 1" x 2" wood with a minimum length of 48".

- G. Filter Fabric: Non-woven fabric for use in foundation drain systems, dry wells, lining beneath EC Stone, etc..
 - 1. Manufacturer - Product:
 - a) TC Mirafi – Mirafi 180N
 - b) Amoco Fabrics and Fibers Co. – ProPex 4547
 - c) Reemay, Inc. – Typar 3401
- H. Temporary & Permanent Seeding and Related Items: Provide in accordance with Section 329219 – Seeding.
- I. Water: Water shall be potable and provided in accordance with Section 015100 – Temporary Utilities: Temporary Water.

PART 3 EXECUTION

3.1 GENERAL

- A. Accept premises as found. Owner assumes no responsibility for conditions of the site or continuation of conditions existing at the time of advertisement.
- B. Temporary erosion and sediment control measures are required during construction and shall be installed prior to any clearing, grading or other construction, and to the minimum standards and specifications of the ~~ESC~~ VSM Handbook. Comply with all minimum standards of the Virginia Erosion and ~~Sediment Control~~ Stormwater Management Regulations, ~~4VAC50-30-40~~ 9VAC25-875 of the Code of Virginia.
- C. Permanent storm water management measures are required for the project and shall be installed to the minimum standards and specifications of the ~~ESC~~ VSM Handbook. Comply with all minimum standards of the Virginia Erosion and Stormwater Management Regulations, ~~4VAC3-20~~ 9VAC25-875 et seq.
- D. The erosion control and storm water management plans as approved by the LGA shall be made part of these Contract Documents. This includes the ESC Narrative.
- E. Prior to initial disturbance of earth, comply with all applicable standards and ordinances to prevent soil erosion and siltation. Install, construct and maintain such measures as shown on Drawings and all others as required by the inspecting authorities having jurisdiction.
- F. Be responsible for satisfying any and all erosion control and storm water management requirements for any land disturbing activities, including but not limited to on-site or off-site borrow, on-site or off-site stockpiling or disposal of waste materials. Before undertaking any land disturbing activity for which the Contract Documents do not specifically address erosion control and storm water management (such as off-site borrow and waste areas), contact the Regional Office of the Division of Soil and Water Conservation (SWC) or other LGA to determine what Erosion Control and storm water management measures are necessary. Completely satisfy all requirements of the LGA, including payment of design, review, and permit expenses, before continuing with the concerned activity.

- G. Dust Control: Any material which will result in dust shall be wet down during the work.
- H. Use whatever means necessary to prevent mud and dirt from being carried onto public streets.
- I. Should mud and dirt accumulate on streets execute immediate cleaning methods to remove accumulation.

3.2 PREPARATION

- A. Assure that all pertinent required permits have been obtained.
- B. Notify LGA of intent to begin work.
- C. Verify that existing trees/plant life designated to remain, are conspicuously marked as such.

3.3 PROTECTION

- A. Protection of adjacent properties and waterways: Prior to any land disturbance activity install Erosion and Sediment Control measures. See Site Drawings for specific practices required to prevent soil from washing from areas disturbed during clearing operations. Maintain all ESC measures required.
- B. Protection of Existing Trees and Vegetation:
 - 1. Provide protection for existing trees, plant growth, and features designated to remain against compacting the root zone, unnecessary cutting, breaking, skinning of roots, or bruising of bark. Conform to details and specifications of the ~~ESC~~ VSM Handbook for methods of protection.
 - 2. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to the Architect.

3.4 EROSION & SEDIMENT CONTROL MEASURES

- A. General:
 - 1. The LGA reserves the right to require more ESC measures if field observation of in place measures shows they are inadequate for the task.
 - 2. Maintain erosion control during construction until permanent pavement, plantings and restoration of natural areas is effective in controlling erosion.
 - 3. Plan and execute construction by methods to control surface drainage from cut, fill, borrow and grading areas.
 - 4. Minimize amount of bare soil exposed at one time.
 - 5. Schedule operations so ground surface will be disturbed for shortest possible time before permanent construction is installed.
 - 6. Maintain large areas as flat as practicable to minimize soil transfer through surface flow.
 - 7. Storm Drainage System: Install as much of permanent system as soon as practicable and divert surface water into system, with remainder of system

installed as soon as conditions allow. Coordinate with Section 334100 - Site Storm Drainage System.

8. Repair washed and eroded areas. Re-establish required grades, densities, elevations, profiles and contours. Re-seed as required.

B. Temporary Construction Entrance:

1. A construction entrance is required at all locations where construction vehicles enter a public right-of-way. During wet weather conditions, clean the wheels of construction vehicles prior to their accessing public streets.
2. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.02~~ C-SCM-03, to the extent shown on Drawings.
3. No point of vehicular access onto the disturbed earthen portion of the site shall be utilized other than the Construction Entrance (CE) shown on Drawings. Access is allowed from pavement directly onto Construction Road Stabilization (CRS) but not from CRS onto disturbed earth.
4. Place stone to the dimensions shown on Drawings (default: 12' width x 70' length, minimum) and at a depth of 6 inches minimum. A wash rack and temporary water service may be required by the LGA at their discretion.
5. In addition to periodically adding clean stone to the construction entrance and maintaining the edges, the Contractor is required to clean all mud, soil and debris from public roadways which originates from the project site on a daily basis.

C. Construction Road Stabilization:

1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.03~~ C-CSM-02, as required for the job trailer, construction parking, building access, and storage.
2. Additionally 6-inch depth of roadway base stone shall be placed immediately after final subgrade elevations are established in the portions of the site indicated on Drawings. Should additional portions of the site require stabilizing, such as parking areas, the Contractor shall utilize the same stone size and depth as required herein for roads. See pavement sections on Drawings.

D. Silt Fence:

1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.05~~ C-PCM-04 to the extent shown on Drawings.
2. Drive posts a minimum of 12 inches into the ground at a maximum spacing of 10 feet. Maximum height above grade shall be 36 inches.
3. At the base of the posts on the up hill side, excavate a continuous shallow trench.
4. Staple, wire or attach filter fabric to the post according to the manufacturer's instructions, leaving 8 inches of fabric along the bottom.
5. Extend bottom surplus of fabric into the trench. Backfill and compact the soil over the trench providing a secure anchor.

E. Storm Drain Inlet Protection for Drop Inlets:

1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.07~~ C-SCM-04, using filter fabric as herein specified.
2. Space posts around the perimeter of the inlet at 3 feet on center and drive

- 12 inches into the ground. The height above-grade of the posts shall be between 15 and 18 inches.
 3. Excavate a shallow trench around the perimeter of the posts.
 4. Staple, wire or attach fabric to the posts according to the manufacturer's recommendations, leaving 8 inches of surplus fabric along the bottom.
 5. Extend bottom of fabric into the trench, backfill and compact over the trench.
- F. Storm Drain Inlet Protection for Curb Drop Inlets:
1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. ~~3.07~~ C-SCM-04, using filter fabric as herein specified.
 2. Place fabric over throat of inlet such that at least 12 inches extends across the top surface of the structure and 12 inches extends across the flow line or gutter line.
 3. Place VDOT #1 stone along the top and gutter line edges of the fabric to anchor the edges, then place stone along throat area of inlet.
- G. Storm Drain Inlet Protection for Culverts:
1. Install and maintain in accordance with ~~ESC Std.~~ & VSM Handbook Spec. ~~3.08~~ C-SCM-05, using material as herein specified.
 2. Space posts around the perimeter of the culvert inlet placed approximately 6 feet up stream from the culvert at a maximum of 3 feet on center and drive 12 inches into the ground. The height above-grade of the posts shall be between 16 and 36 inches.
 3. Excavate a shallow trench around the perimeter of the posts.
 4. Staple, wire or attach fabric to the posts according to the manufacturer's recommendations, leaving 8 inches of surplus fabric along the bottom.
 5. Extend bottom of fabric into the trench, backfill and compact over the trench.
 6. If the above proves of insufficient to provide protection from silt entering the culvert, replace with the Optional Stone Combination as detailed in ~~ESC~~ VSM Handbook ~~Plate 3.08-4~~ Figure C-SCM-05-1.
- H. Outlet Protection or Storm Water Conveyance Channel:
1. After surrounding area has been brought to subgrade, excavate to subgrade elevations for OP or SCC as indicated from finish grade on plans less EC Stone depth in detail.
 2. Compact subgrade to requirements for surrounding subgrade under applicable earthwork section.
 3. Install bedding geotextile fabric in accordance with detail, overlapping joints 6 inches minimum and stapling per manufacturer's recommendations and entrenching entire perimeter of fabric 9 inches. Compact fabric entrenchment to requirements of surrounding subgrade.
 4. Place, do not dump, Erosion Control Stone to the dimensions and configuration indicated on the applicable detail.
- I. Erosion Control/Re-vegetation Mat:
1. Install Erosion Control Mat in accordance with VDOT Std. EC-2 or EC-3 in the locations shown on Drawings or as otherwise indicated.
 2. Install Re-vegetation Mat in the locations shown on Drawings or otherwise indicated. Mat shall conform to Part 2 of Section 329219 - Seeding.
 3. Shape and grade the channel or slope; remove all rock and debris.

4. Place and compact topsoil to the depth previously specified.
 5. Apply fertilizer, lime and seed at the rates specified for seeded lawn areas in Section 329219 – Seeding.
 6. Place and secure the mat as described in Part 3 of Section 329219 – Seeding.
- J. Temporary Check Dams in Swales:
1. Install and maintain in accordance with ~~VEC Std. & VSM Handbook Spec. 3.20~~ C-SCM-07.
 2. Place VDOT #1 stone in locations as necessary to control erosion such that the entire width of the swale is guarded. The maximum height of the dam shall not exceed 24 inches. The center portion shall be 6 inches lower than the outer edges.
 3. Upstream and downstream faces of the dam shall be sloped 2 feet horizontally for every one foot of height.
- K. Temporary Right-of-Way Diversion
1. Install and maintain in accordance with ~~VEC Std. & VSM Handbook Spec. 3.14~~ C-SCM-07.
 2. Place VDOT #1 stone or compacted earth at a maximum of 18 inches in height.
 3. Spacing shall be as specified in Table ~~3.14.A~~ C-ECM-07-2 at a maximum and as shown on the Drawings.
 4. All diversions shall be directed to an adequate receiving channel, pipe, or system.
 5. Adjust locations based upon field observations and changing site conditions.
- L. Temporary Sediment Trap
1. Install and maintain in accordance with ~~VEC Std. & VSM Handbook Spec. 3.13~~ C-SCM-11.
 2. Coordinate locations with other diversion measures.
 3. Contributing drainage areas shall not exceed 3.0 acres. Field adjust measures and diversions during construction where conditions cause drainage areas to approach the maximum 3.0 acres of drainage area.
 4. Perform maintenance inspections regularly along with cleanout procedures when measures approach 50% of the accumulated sediment depth.
- M. Sediment Basin (temporary) / Detention Basin (permanent):
1. Install sediment basin in accordance with and at the location shown on the Drawings. This shall be part of the first work accomplished since it is the primary measure to control sediment from leaving the site from further land disturbance.
 2. Basin shall double as the permanent detention basin and as such shall be carefully constructed to assure the long-term water restraining integrity of the earthen berm. Berm construction shall be performed in accordance with Virginia Stormwater Management Handbook (Latest Edition), Section ~~3.04~~ P-SUP-01, Earthen Embankments.
 3. Extreme care shall be taken when closing the berm across the existing drainage channel since it drains a large, developed area.
 4. As a sediment basin, the primary outlets shall be modified as detailed on the

plans to act as dewatering devices.

5. Upon stabilization of the site, the sediment basin shall be converted to the detention basin by cleaning out any sediment, dressing to rough grade, topsoiling to finished grade, seeding, and landscaping. The dewatering device shall be removed and all orifices cleanly trimmed (square, sharp, without burrs, and removing any bends, tees or caps used for the dewatering device installation both inside and outside the outlet structure. Any concrete channel lining or pads proposed within the basin shall also be placed at this time.

N. Temporary Seeding:

1. Temporary seeding shall be applied to denuded areas within seven (7) days after final grade has been established and to portions of the site which may not be at final grade but which will remain inactive for more than 30 14 days and less than one year. Lawn areas and slopes may be topsoiled and permanently seeded only if this can be accomplished during the correct time of year for the permanent seed mixture specified in Section 329219 – Seeding. Permanent Seeding is required for areas which will remain dormant for more than one year.
2. Where the area is compacted, crusted or hardened, the soil surface shall be loosened by disking, raking, harrowing or other means.
3. Apply lime at a rate of 50 pounds per 1000 sq. ft. and 5-40-40 10-20-10 fertilizer at 40 14 pounds per 1000 sq. ft. Thoroughly mix into loosened soil.
4. Seed shall be evenly applied at a rate of 1-2 lbs. per 1000 sq. ft. to the prepared ground and mulched.
5. Slopes greater than 3:1 shall be hydroseeded. Other areas may be hydroseeded or dry seeded at the Contractor's option.
6. Hydroseeding operations shall include seed, fertilizer, mulch and binder in one operation. Areas which are hydroseeded from 6/1 to 9/1 or 12/1 to 3/1 shall be mulched with straw. Wood fiber mulch shall not be used during these times.
7. After mulching of dry seeded areas, mulch shall be stabilized using a liquid binder. Portions which continue to lose mulch due to wind or runoff shall be further stabilized with mulch stabilization netting. Install netting according to Section 329219 – Seeding.
8. Areas which fail to establish initial vegetative cover adequate in checking erosion shall be re-seeded as soon as such areas are recognized. Matting and blankets shall be installed on areas which fail to establish subsequent vegetative efforts.

- O. Topsoil/Soil Materials Stockpile: Do not stockpile in drainage ways or within the drip line of trees. Stockpile to a depth not exceeding 8 feet (2.5 m) and with side slopes not exceeding 2H:1V. Protect from wind and water erosion and from admixture of debris.

P. Tree Protection:

1. Install and maintain in accordance with ~~VEC Std.~~ & VSM Handbook Spec. 3.38 C-SSM-01 to the extent shown on the Drawings, unless detailed otherwise. Also refer to Section 311000 – Site Clearing and Preparation and Section 312323 – Backfilling for filling within drip lines of vegetation to

- remain.
2. The limits of clearing shall be beyond the drip line of existing trees to remain.
 3. Prior to clearing the site, protected trees shall be clearly identified with a bright colored surveyor's ribbon applied in a band circling the tree at heights of 4 and 8 feet.
 4. No equipment, building materials or topsoil shall be placed within the drip line of protected trees.
 5. 40 inch high snow fence shall be placed at the limits of clearing (drip line). Fence shall be maintained at all times.

3.5 REMOVAL OF TEMPORARY EROSION AND SEDIMENT CONTROLS

- A. Remove temporary erosion and sediment control measures within 30 days after permanent lawn areas have become substantially established as defined in Section 329219 - Seeding or after the temporary measures are no longer required as determined and authorized by the local program administrator. Permanently stabilize disturbed soil areas resulting from the disposition of temporary measures to prevent further erosion.

END OF SECTION

SECTION 313116
TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Soil treatment with termiticide.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of termite control product.
 - 1. Include the EPA-Registered Label for termiticide products.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For termite control products, from manufacturer.
- B. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Termiticide brand name and manufacturer.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes used, and rates of application.
 - 6. Areas of application.
 - 7. Water source for application.
- C. Warranties: Sample of special warranties.

1.5 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures: Submittals.
- B. All products identified in PART 2 of this specification.

- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- B. Source Limitations: Obtain termite control products from single manufacturer.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.8 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

- 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. BASF Corporation, Agricultural Products; Termidor.
 - b. Bayer Environmental Science; Premise 75.
 - c. FMC Corporation, Agricultural Products Group; Dragnet FT, Talstar, Prevail.
 - d. Syngenta; Demon TC, Prelude, Probuild TC.
2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified

concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

SECTION 321216
ASPHALT PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Asphaltic Concrete Paving; surface/wearing course and base/binder course.
- B. Surface sealer, primer/tack coat.
- C. Aggregate Base Course; depth and compaction.

1.2 RELATED SECTIONS

- A. Appendix: Subsurface Investigation/Geotechnical Report (for Contractor's use).
Geotechnical Engineer.
- B. Section 310900 - Geotechnical Engineering, Inspection, and Testing.
- C. Section 310513 - Soil Materials: Testing aggregate materials.
- D. Section 310516 - Aggregate Materials: Aggregate Base Course. Testing
aggregate materials.
- E. Section 312213 - Rough Grading: Site subgrade contouring. Preparation of site
for paving and base. Compaction testing.
- F. Section 312316 - Excavating: Excavating for other than linear utility work.
- G. Section 312323 - Backfilling: Backfilling for other than linear utility work.
- H. Section 312317 - Utility Trenching & Backfilling.
- I. Section 334100 - Site Storm Drainage Systems.
- J. Section 321723 - Pavement Marking & Signage.
- K. Section 329119 - Landscape Grading: Topsoil depth. Adjacent surface rough
grade.

1.3 DEFINITIONS

- A. Local Governing Authority (LGA) - The state agency, municipal department or
other entity which legally has jurisdiction over the referenced work or activity. This
usually means the field official who makes or controls onsite inspections of the
work.

1.4 REFERENCE STANDARDS

- A. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.
- B. Manual of Uniform Traffic Control Devices (MUTCD, including Virginia supplement), latest edition.
- C. Americans With Disabilities Act (ADA): 28 CFR Part 36, Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities; Final Rule dated July 26, 1991.
- D. Local Governing Authority Regulations pertaining to work of this section (i.e. handicapped parking marking and signage requirements, fire lane marking and signage requirements, etc.).

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with requirements of Reference Standards above. Refer to ACI 304 for any concrete related item not covered in Reference Standard.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with industry standards, the specified requirements and the methods for proper performance of the work of this section.
- C. Asphalt Mixing Plant: VDOT Certified.
- D. Obtain materials from same source throughout.

1.6 SUBMITTALS FOR REVIEW

- A. Submit certification from Asphalt batch plant for proposed mix design of each class of mix for information prior to beginning of work.
- B. All products identified in PART 2 of this specification.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not produce or place asphalt when the weather is rainy or foggy, when the base course is frozen or has excess moisture, or when the ambient temperature is less than 40 degrees F in the shade away from artificial heat.
- B. Other materials shall be placed or installed per manufacturer's recommendations.

1.8 BARRICADES AND SIGNALS

- A. Within public right-of-way, provide and maintain temporary signs, signals, lighting devices, markings, barricades, and channelizing and hand signaling devices in

accordance with DOT D-6.1 to protect personnel and new construction from damage by equipment and vehicles until the surface is approved by the VDOT Inspector, LGA, or Architect/Engineer, as applicable.

- B. On-site, provide and maintain temporary signs, signals, lighting devices, markings, and barricades to protect personnel and new construction from damage by equipment and vehicles until the surface is approved by the Architect/Engineer.

1.9 REGULATORY REQUIREMENTS

- A. VDOT review, approval and inspections per VDOT Stds.

PART 2 PRODUCTS

2.1 AGGREGATE BASE COURSE

- A. Aggregate Base under Asphalt Pavement: Coarse Aggregate Type A4 in accordance with Section 310516 - Aggregate Materials (see Pavement Sections on Drawings).

2.2 ASPHALTIC CONCRETE PAVING

- A. Primer, Tack & Seal Coats: In accordance with VDOT Section 210, Asphalt Materials.
- B. Asphalt Base Course: In accordance with VDOT Section 212.20, Type BM-25.0 bituminous concrete.
- C. Asphalt Surface Course: In accordance with VDOT Section 212.17, Type SM-12.5D bituminous concrete.

2.3 SOURCE QUALITY CONTROL AND TESTS

- A. Section 310900 – Geotechnical Engineering, Inspection, and Testing: Aggregate and asphalt testing. Compaction testing. Geotechnical Engineer.
- B. Have required tests made by Geotechnical Engineer (in lieu of VDOT) per Reference Standard. Submit all required information and results to Owner. Test asphalt samples for depth and density.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate the Work and verify base conditions. Verify that all pre-requisite work (subsurface utilities, etc.) has been completed and is ready to receive the work of this section. Verify that compacted subgrade is dry and ready to support paving/surfacing and imposed loads. Verify that gradients and elevations of base are correct.
- B. Ensure that all existing utility structures, new or existing, have been adjusted to

meet proposed finished grades prior to paving.

3.2 PLACING AGGREGATE BASE COURSE

- A. For Asphalt Pavement: Begin spreading base material at the point nearest the source of supply. Permit traffic and hauling over the base. Fill ruts formed by traffic and reroll. After base course placement, continue machining and rolling until surface is smooth, compacted, well bonded, and true to the designed cross section. Compact to 100 percent ASTM D-698 maximum dry density. Maintain the base smooth and true to grade and cross section until asphaltic concrete placement.

3.3 PREPARATION

- A. Protect finished surfaces adjacent to asphalt work from overspray, damage by equipment, etc.
- B. For repair work, cut existing surface back to undisturbed material to provide uniform division lines between existing and new work.
- C. Butt new work to existing surfaces to result in smooth transitions and uniform sections.
- D. Before placing surface, inspect the subgrade and base for conformity with the specified section. If necessary, remove or add material to bring all portions of the subgrade and base to proper section and correct elevation. Thoroughly compact and inspect the adjusted section after correcting.
- E. Asphalt Pavement - Primer:
 - 1. Apply a prime coat on the finished stone base course at a rate of 0.25 gallon residual asphalt per square yard. Allow prime coat to cure for a minimum of 48 hours prior to placing asphaltic concrete. Apply cutback asphalts when the stone base course is dry. Lightly spray stone base with water immediately prior to application of emulsified asphalts. During prime coat placement, minimum ambient temperature shall be 50 degrees F and rising. Maintain and protect primed surfaces from damage until asphaltic concrete placement.
 - 2. Apply primer in accordance with VDOT Section 311 - Prime Coat.
 - 3. Apply primer to contact surfaces of curbs and gutters.
 - 4. Use clean sand to blot excess primer.
- F. Asphalt Pavement - Tack Coat:
 - 1. Apply tack coat on existing pavement to be overlaid at a rate of 0.10 gallon residual asphalt per square yard. Thoroughly clean surfaces to receive the tack coat immediately prior to application of tack coat. Tack coat shall be tacky at the time of asphaltic concrete placement.
 - 2. Apply tack coat in accordance with VDOT Standards.
 - 3. Apply tack coat to contact surfaces of curbs and gutters.
 - 4. Coat surfaces of manhole and drainage structure frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

- G. Asphalt Pavement - Seal Coats:
 - 1. Apply asphalt and cover material in accordance with VDOT Section 312 - Seal Coat.

3.4 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Install Work in accordance with VDOT standards.
- B. Place to compacted thickness identified in details on Drawings.
- C. Install drainage tops/frames in correct position and elevation.
- D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- E. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.5 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Place base/binder course to compacted thickness identified in details on Drawings.
- B. Place surface/wearing course within two (2) hours of placing and compacting binder course.
- C. Place surface/wearing course to compacted thickness identified in details on Drawings.
- D. Install drainage tops/frames in correct position and elevation.
- E. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- F. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.6 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch (6 mm) measured with 10 foot (3 m) straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch (6 mm).
- C. Variation from True Elevation: Within 1/2 inch (12 mm).
- D. Assure that drainage swales over pavement function as designed.

3.7 FIELD QUALITY CONTROL

- A. Field testing methods shall be as determined by the Geotechnical Engineer.

3.8 PROTECTION OF ASPHALT

- A. Immediately after placement, protect pavement from premature drying and excessive hot or cold temperatures. Also, protect pavement from mechanical injury for one (1) day or until surface temperature is less than 140 degrees F (60 degrees C).
- B. Do not permit pedestrian traffic over pavement for 7 days minimum after finishing.

3.9 SCHEDULES

- A. Refer to details on the Drawings.

END OF SECTION

SECTION 321313
PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete sidewalks, stairs, integral curbs, curb &/or gutters, median barriers, parking areas, and roads.
- B. Aggregate base course.

1.2 RELATED SECTIONS (including but not limited to)

- A. Section 013300 - Submittals.
- B. Section 014000 - Quality Requirements: Quality Assurance, Mock-ups
- C. Section 014110 - Inspection and Testing.
- D. Section 015700 - Traffic Regulation.
- E. Section 017000 - Execution Requirements: Protection of Completed Work.
- F. Section 310900 - Geotechnical Engineering, Inspections, and Testing.
- G. Section 310516 - Aggregate Materials: Aggregate base course.
- H. Section 312213 - Rough Grading: Preparation of site for paving and base.
- I. Section 312323 - Backfilling: Compacted subbase for paving.
- J. Section 321216 - Asphalt Pavement.
- K. Section 321723 - Pavement Markings & Signage: Pavement markings.
- L. Section 329119 - Landscape Grading: Preparation of subsoil at pavement perimeter.
- M. Section 033000 - Cast-in-place Concrete: Reinforcing, Joints, Curing.
- N. Section 055000 - Misc. Metals: Stair safety nosing and handrails.
- O. Section 079200 - Joint Sealers: Sealant for joints.

1.3 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings.
- B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

- C. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
- D. ASTM C33 - Concrete Aggregates.
- E. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- F. ASTM C698 - Test Methods for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- G. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.

1.4 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures.
- B. Product Data: Provide data on joint filler, admixtures, curing compounds and ADA tactile warning mats.
- C. All products identified in PART 2 of this specification.
- D. Submit certification from Concrete batch plant for proposed mix design of each class of mix for information prior to beginning of work.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with requirements of Reference Standards above. Refer to ACI 304 for any concrete related item not covered in Reference Standard. Maintain one copy of the reference utilized onsite with Contract Documents.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with industry standards, the specified requirements and the methods for proper performance of the work of this section.
- C. Concrete Mixing Plant: VDOT Certified.
- D. Obtain materials from same source throughout.

1.6 REGULATORY REQUIREMENTS

- A. Conform to VDOT review, approval and inspections per VDOT Stds.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Materials, other than concrete, shall be placed or installed per manufacturer's recommendations.

PART 2 PRODUCTS

2.1 AGGREGATE BASE

- A. Aggregate for Base Course: Type A3 per Section 310516 - Aggregate Materials.

2.2 FORM MATERIALS

- A. Steel form material, profiled to suit conditions.
- B. Joint Filler (General Pavement): Asphalt impregnated fiberboard, 1/2 inch thick by full depth of concrete pavement less 1/2 inch allowance for joint sealant.
- C. Joint Filler (Curbing): Asphalt impregnated fiberboard, 1/2 inch thick by full depth of VDOT Std. CG-2 (curb only) or CG-6 (curb & gutter) as indicated less 1/2 inch allowance for joint sealant. See Drawings for delineation.
- D. Joint Filler (Petroleum locations): Refer to Section 033000 Cast In Place Concrete.

2.3 REINFORCEMENT

- A. Reinforcing Steel and Welded Steel Wire Fabric: Type specified in Section 033000 - Cast-in-Place Concrete.
- B. Dowels: ASTM A615; 40 ksi (276 MPa) yield grade, plain steel, galvanized finish.

2.4 CONCRETE MATERIALS

- A. Concrete shall be VDOT Std. Class A3 for walks and stairs and Class A4 within traffic bearing areas. See Drawings for delineations.
- B. VDOT Specification Modifications:
 - 1. Slump: Admixtures shall be added to adjust slump to 5.5 inches. Further adjustments shall be made to address workability during hot or cold weather conditions. Adhere to VDOT Specifications for slump when slip forms are used.
 - 2. Curing compounds shall dry clear (no pigment).
- C. Fine and Coarse Mix Aggregates: ASTM C33.
- D. Detectable Warning Surface: Per VDOT Std. CG-12.
- E. Water: Potable, not detrimental to concrete.

2.5 ACCESSORIES

- A. Method of Curing: Membrane Curing Compound meeting requirements of Section 033000 - Cast In Place Concrete.
- B. Joint Sealers: Specified in Section 079200.
- C. Safety Nosing and Handrails: In accordance with Section 055000 - Misc. Metals.
- D. ADA Tactile Warning:
 - 1. Cast Iron Plates: ADA Compliant, Gray Cast Iron Detectable Warning Surface Plates
 - a. Color: Brick Red
 - b. Slip resistant textured iron surface, minimum 0.8 coefficient of friction.
 - c. Purchase the number and size of panels required to create a continuous 2' wide tactile warning strip for the full width of the walkway, as indicated on the plans. Panel sizes should be the largest size available that will fit within the walkway width without requiring cutting or modification of panels. Provide pre-tapered plates to match curves as necessary.
 - d. Install using the "wet-set" method in freshly placed concrete and in strict accordance with manufacturer's installation instructions.
 - e. Erect units without damage to shape or finish, install in locations indicated on the plans. Install flush with surrounding concrete and fully supported by substrate. A variance in grade of any more than 1/4" will not be accepted. Apply slight vibration to fully set panels in fresh concrete.
 - f. Hand tool control joints at edges of panels and in locations shown on drawings. Control joints shall not exceed 6' in spacing.

2.6 FINISH

- A. Finish for exterior flatwork shall be per schedule at the end of this Section.
- B. Edges of exterior flatwork shall be quarter round tooled after broom finish and left with steel troweled appearance and slightest depression below the interior surface.
- C. Crack control joints for exterior flatwork shall be quarter round tooled after broom finish and left with steel troweled appearance and slightest depression below the interior surface.

2.7 SOURCE QUALITY CONTROL AND TESTS

- A. Section 014000 - Quality Requirements: Quality assurance testing.
- B. Section 310900 - Geotechnical Engineering, Inspections, and Testing.
- C. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of work.

- D. Tests on cement and aggregates will be performed to ensure conformance with specified requirements.
- E. Test samples in accordance with ACI 301.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate the Work and verify base conditions under provisions of Div. 1. Verify that all pre-requisite work (subsurface utilities, etc.) has been completed and is ready to receive the work of this section. Verify that compacted subgrade is dry and ready to support paving/surfacing and imposed loads. Verify that gradients and elevations of base are correct.

3.2 PLACING AGGREGATE BASE COURSE

- A. For Concrete Pavement: Place base material of sufficient width to support formed work. Compact to 100 percent ASTM D-698 maximum dry density. Maintain the base smooth, compacted, well bonded, and true to the designed cross section until concrete placement.

3.3 PREPARATION

- A. For repair work, cut existing surface back to undisturbed material to provide uniform division lines between existing and new work.
- B. Butt new work to existing surfaces to result in smooth transitions and uniform sections.
- C. Before placing surface, inspect the subgrade and base for conformity with the specified section. If necessary, remove or add material to bring all portions of the subgrade and base to proper section and correct elevation. Thoroughly compact and inspect the adjusted section after correcting.
- D. Moisten base to minimize absorption of water from fresh concrete.
- E. Coat surfaces of manhole and drainage structure frames with oil to prevent bond with concrete pavement.
- F. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.4 FORMING

- A. Steel forms are preferred. Wood forms with appropriate bracing may be allowed with prior approval of form installations by the Architect. Slip forms shall be used for all curb and gutter applications (with noted adjustment for slump).
- B. Place and secure forms to correct location, dimension, profile, and gradient.

- C. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- D. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.5 REINFORCEMENT

- A. Place reinforcement as indicated in details on Drawings.
- B. Interrupt reinforcement at expansion joints.
- C. Place dowels to achieve pavement and curb alignment as necessary to prevent differential settlement of adjacent work. One end of dowel shall be set in capped sleeve to allow longitudinal movement (typical of all installations).
- D. Provide dowels at expansion joints. Place dowels at 12 feet (3.66 m) OC maximum with two (2) per connection min.
- E. Provide keyed and doweled, longitudinal construction joints at maximum of 12 feet (3.66 m) OC where slabs exceed 500 SF and are not otherwise segmented by expansion joints.

3.6 PLACING CONCRETE

- A. Measure, mix, transport, and place concrete in accordance with ACI 304 unless superseded by VDOT Section 217.10. Curing (clear, no pigment) shall adhere to product manufacturer's recommended instructions. Use of admixtures shall be approved in advance by the Architect.
- B. Do not produce or place concrete when the weather is rainy or foggy, when the subgrade is frozen or has excess moisture, or when the ambient temperature is less than 40 degrees F in the shade away from artificial heat.
- C. Place concrete for curbs and gutters using the slip form technique.
- D. Ensure reinforcement, inserts, embedded parts, formed joints, etc. are not disturbed during concrete placement.
- E. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- F. Place concrete to pattern indicated. Default to VDOT Spec. if none indicated.

3.7 JOINTS

- A. Place joint filler in pavement pattern placement sequence as indicated on the Drawings. Place joint filler between paving components and building or other

appurtenances. Place joint filler where new concrete work meets existing concrete.

- B. For linear work place expansion joints at 30 foot (9 m) intervals unless otherwise indicated. Align curb, gutter, and sidewalk joints where adjacent.
- C. Set top to required elevations. Secure to resist movement by wet concrete.
- D. Recess top of filler ½ inch (13 mm) for joint sealant placement.
- E. Use joint sealant for caulking all joints in concrete pavements and walks.
- F. Provide tooled control joints per VDOT specs to pattern indicated (with 6' OC as default value). Verify pattern with Architect prior to concrete placement.
- G. Provide keyed joints as indicated.

3.8 EXPOSED AGGREGATE

- A. Wash exposed aggregate surface with clean water and scrub with stiff bristle brush exposing aggregate to match sample panel.

3.9 FINISHING & CURING

- A. Finish per schedule at the end of this section. Avoid over-finishing!
- B. Direction of Texturing: Transverse to pavement direction, unless otherwise indicated in schedule.
- C. Tactile Warning: Provide ADA required finish where indicated on Drawings. Finished product shall match sample panel.
- D. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with Manufacturer's instructions.

3.10 JOINT SEALING

- A. Separate pavement from vertical surfaces with ½ inch (13 mm) thick joint filler.
- B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- C. Extend joint filler from bottom of pavement to within ½ inch (13 mm) of finished surface. Conform to Section 079200 for finish joint sealer requirements.

3.11 CURBS

- A. Install VDOT Std. CG-2 (curb only) and/or VDOT Std. CG-6 (curb & gutter) as delineated on the Drawings. Typically upslope curbing may be curb only. Provide also for dry-pan or reverse gutters at locations required to prevent

ponded water. This shall be verified and coordinated in advance with the Architect.

- B. Wiped down or submerged curbs (see details) shall have machined finish matching typical CG-2 finish.

3.12 CONCRETE STAIRS

- A. Place stairs at locations indicated on the Drawings.
- B. Construct per details on the Drawings.

3.13 TOLERANCES

- A. Section 014000 - Quality Requirements: Quality Assurance. Tolerances.
- B. Maximum Variation of Surface Flatness: $\frac{1}{4}$ inch (6 mm) in 10 ft. (3 m).
- C. Maximum Variation From True Position: $\frac{1}{4}$ inch (6 mm).

3.14 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection and testing.
- B. Section 310900 – Geotechnical Engineering, Inspections, and Testing.
- C. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.
- D. Three concrete test cylinders will be taken for every 75 or less cu. yds. (57 or less cu m) of each class of concrete placed each day.
- E. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.
- F. One slump test will be taken for each set of test cylinders taken.
- G. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.15 PROTECTION

- A. Section 017000 – Execution Requirements: Protection of Completed Work.
- B. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- C. Do not permit pedestrian or vehicular traffic over pavement for 7 days minimum after finishing.

3.16 SCHEDULE

- A. Area Paving: As detailed on Drawings with Light broom finish as default. Verify with Architect prior to placement of concrete.
- B. Sidewalk Paving: Light broom, radius to ¼ inch (6 mm) radius, and trowel joint edges.
- C. Curbs and Gutters: Light broom.
- D. Inclined Vehicular Ramps: Broomed perpendicular to slope.

END OF SECTION

SECTION 321723
PAVEMENT MARKING AND SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pavement Marking & Related Signage.

1.2 RELATED SECTIONS

- A. Section 013300 - Submittal Procedures.
- B. Section 016000 - Product Requirements: Product delivery and Product Storage and Handling.
- C. Section 017000 - Execution Requirements: Spare Parts and Maintenance Products. Final Cleaning.

1.3 DEFINITIONS

- A. Local Governing Authority (LGA) - The state agency, municipal department, or other entity, which legally has jurisdiction over the referenced work or activity. This usually means the field official who makes or controls onsite inspections of the work.

1.4 REFERENCE STANDARD

- A. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.
- B. Manual of Uniform Traffic Control Devices (MUTCD, including Virginia supplement), latest edition.
- C. Americans With Disabilities Act (ADA): 28 CFR Part 36, Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities; Final Rule dated July 26, 1991.
- D. Local Governing Authority Regulations pertaining to work of this section (i.e. handicapped parking marking and signage requirements, fire lane marking and signage requirements, etc.).

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with requirements of Reference Standards above. Refer to ACI 304 for any concrete related item not covered in Reference Standard. Maintain one copy of the reference utilized onsite with Contract Documents.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and

experienced in the necessary crafts and who are completely familiar with industry standards, the specified requirements and the methods for proper performance of the work of this section.

- C. Obtain materials from same source throughout.

1.6 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures.
- B. Product Data: Provide data on paint materials.
- C. Submit certification from sign supplier for all signage provided that they meet applicable standards above.
- D. All products identified in PART 2 of this specification.

1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Section 016000 – Product Requirements: Product delivery and Product storage and handling.
- B. Deliver products to site in Manufacturer's sealed and labeled containers; inspect to verify acceptability.
- C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- D. Paint Materials: Store all paint materials in a single location at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by Manufacturer's instructions. Protect from danger of combustion.

1.8 REGULATORY REQUIREMENTS

- A. VDOT review, approval and inspections per VDOT Stds.

1.9 QUALIFICATIONS

- A. Applicator: Company specializing in performing work of this section with minimum three years documented experience.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

1.11 WARRANTY

- A. Section 017000 - Execution Requirements: Requirements for warranties.
- B. Furnish one-year manufacturer's warranty for traffic paints.

1.12 EXTRA MATERIALS

- A. Section 017000 – Execution Requirements: Spare Parts and Maintenance Products.
- B. Supply Owner with 1-gallon (4 L) of each color, type, and surface texture of paint material used in the work; store where directed.
- C. Label each container with color, type, texture, and locations where used, in addition to the manufacturer's label.

PART 2 PRODUCTS

2.1 EXISTING SIGNAGE

- A. Existing traffic signage may be reused if not damaged and meeting current specifications.
- B. Existing specialty signage shall be salvaged and relocated to new positions as directed by the Owner.

2.2 PAVEMENT MARKING AND SIGNAGE

- A. Provide all identification, fire lane, traffic control and ADA signage indicated on Drawings and per schedule this section. Signs shall meet minimum standards of local fire department/marshal, ADA and Manual of Uniform Traffic Control Devices (MUTCD, including Virginia supplement) for all components. Sign posts shall meet VDOT Stds. & Specs.
- B. Plans have been reviewed and approved by the local governing authority (LGA). If, upon construction compliance inspection by LGA building inspector, any signage is lacking per requirements of VDOT, ADA or local code, the Contractor shall provide and place such signs as necessary for compliance at no additional cost to the Owner.
- C. For work within public right-of-way, provide pavement marking in accordance with VDOT requirements.
- D. Provide pavement markings in accordance with VDOT Section 704. For travel lane marking on-site use same with omission of glass beads. For parking lot striping use "Ultra Hide" water reducible acrylic latex traffic paint as manufactured by Glidden, Benjamin Moore, Devoe, PPG or Sherwin-Williams or approved equal. Use white for pavement markings, and direction arrows on asphalt (OSHA yellow on concrete) unless otherwise required by reference standards.

- E. Provide temporary markings within the VDOT right-of-way in accordance with VDOT requirements.
- F. Reference ADA requirements and local regulations for handicapped space marking configuration and colors.
- G. Recommended Pavement Marking Manufacturer: Pavement Stencil Company, Roanoke, VA or equal.
- H. Do not hand-finish bollard tops. Where bollards are installed use bollard caps manufactured by Top Gard Construction Products, Noblesville, IN or equal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate the Work and verify pavement conditions. Verify that all pre-requisite work (subsurface utilities, etc.) has been completed and is ready to receive the work of this section. Verify that pavement is ready to support paving/surfacing and imposed loads. Verify that finish grade of lawn areas are correct.
- B. Verify that surfaces or substrate conditions, as applicable, are ready to receive Work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Do not apply paint to concrete surfaces until concrete has cured for 28 days
- E. Verify locations, requirements, and extent of work.

3.2 PREPARATION

- A. Surface Appurtenances: Remove or mask any adjacent or attached items which are not to receive applied material prior to preparing surfaces or finishing.
- B. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

3.3 APPLICATION

- A. Protection: Protect work of other trades, whether being painted or not, against damage by painting. Provide "Wet Paint" signs to protect newly painted surfaces.
- B. Procedure: Apply products in accordance with manufacturer's instructions.
- C. Dry Receiving Surface: Do not apply finishes to surfaces that are not dry. Allow applied coats to dry thoroughly before next coat is applied.

- D. Minimum Coating Thickness: Apply no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Appearance: Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- I. Prime concealed surfaces of woodwork with primer paint.
- J. Acceptance: Owner's representative shall determine quality and consistency of coverage, color and finishes. Remove, refinish or repaint work not complying with requirements.

3.4 PAVEMENT MARKINGS

- A. Unless indicated otherwise, provide lane and edge lines four inches (4") in width. Apply paint after asphaltic concrete has cured for a minimum of seven (7) days, and minimum ambient temperature is 40 degrees F. Apply lane and edge markings per manufacturer's recommendation. Apply paint and markings to clean, dry surfaces, protect adjacent surfaces from damage and protect surfaces from traffic until dry. Provide uniform paint film of sufficient thickness to completely conceal base material.
- B. On-site travel lanes and, excluding within parking lots, shall be marked in accordance with VDOT Spec. Section 704 - Pavement Markings & Markers. Requirements for markers and glass beads will not be required on-site. On-site shall mean not within public right-of-way. Note that the public right-of-way includes the bus loop and access thereto. See Schedule this section.
- C. Roadway improvements within public right-of-way shall be marked in accordance with VDOT Spec. Section 704 - Pavement Markings & Markers. Replace any markings damaged by construction. Pavement markings within public right-of-way shall be Type B.
- D. Place required pavement marking and signage in accordance with ADA or Manual of Uniform Traffic Control Devices (MUTCD including Virginia Supplement), as applicable. See Schedule this section. Provide 36 inch deep by 12" square VDOT Std. Class A3 concrete base for signs. See pavement marking and Exterior Handicap Sign detail on the Drawings.
- E. Travel lane stop bars shall be painted, white lines, twenty-four (24) inches in width and across the entire indicated lane width.

- F. Cross-walks, painted traffic islands, and no parking areas (as shown on plan) shall consist of a six (6) inch wide painted yellow line border, entirely on the asphalt (not spilling over onto concrete gutter, etc.), of the width indicated on the plans, with four (4) inch wide yellow lines painted eighteen (18) inches apart and at forty-five (45) degrees to the border throughout the enclosed area. Verify orientation with Architect prior to painting.

3.5 FIELD QUALITY CONTROL

- A. The Owner reserves the right to engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the project may be taken, identified, sealed and certified in the presence of the contractor. The testing agency will perform appropriate tests as required by the Owner. If tests show material being used does not comply with specified requirements, the contractor shall remove non-complying paint from the site, pay for the testing, and repaint surfaces previously coated with the rejected paint. If necessary, the contractor may be required to remove rejected paint from those surfaces if, on repainting with specified paint, the two coatings are incompatible.
- C. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.
- D. Repair lines and markings, which after application and curing do not meet following criteria:
 - 1. Incorrect Location: Remove and replace incorrectly placed patterns.
 - 2. Insufficient Thickness, Line Width, Paint Coverage, Glass Bead Coverage or Retention: Prepare defective material by acceptably grinding or blast cleaning to remove substantial amount of beads and to roughen marking surface. Remove loose particles and debris. Apply new markings on cleaned surface in accordance with this Section.
 - 3. Uncured or Discolored Material, Insufficient Bonding: Remove defective markings in accordance with this Section and clean pavement surface one foot (300 mm) beyond affected area. Apply new markings on cleaned surface in accordance with this Section.
- E. Replace defective pavement markings as specified throughout warranted period. Replace markings damaged by anti-skid materials, studded tires, tire chains, chemical deicers, snow plowing or other loss of marking material regardless of cause. When markings are damaged by pavement failure or by Owner's painting, crack sealing, or pavement repair operations, Contractor is released from warranty requirements for damaged work.
- F. Prepare list of defective areas and areas requiring additional inspection and evaluation to decide where material may need to be replaced.
- G. Replace failed or defective markings in entire section of defective markings within 30 days after notification when any of the following exists during warranty period:
 - 1. Marking exhibits obvious discoloration or pigment loss.

2. More than 15 percent of area of continuous line within any line segment is missing.

3.6 CLEANING

- A. At the end of each workday, collect empty cans, rags, rubbish, and other discarded paint materials, place in closed metal containers, and remove daily from the site.
- B. After completing painting, clean all paint-splattered surfaces being careful not to cause harm to adjacent finished surfaces. Correct damage caused by painting to the satisfaction of the Owner's representative.
- C. At the completion of construction activities of all other trades, touch up and restore damaged or defaced painted surfaces.

3.7 SCHEDULES

- A. Pavement Marking:
 1. Stop Bar where indicated on Drawings measuring 24" deep by full width of asphalt in lane.
 2. "ONE WAY" as noted on the Drawings.
 3. "DO NOT ENTER" as noted on the Drawings.
 4. "STOP" at each stop bar where indicated (each lane as applicable).
 5. Traffic directional arrows where indicated on Drawings.
 6. LGA's Standard handicapped parking space and isle pavement marking in each handicapped space indicated by symbol on Drawings.
 7. Fire lane designation to LGA's Standards as indicated on the Drawings and as required by Fire Marshall.
 8. Pedestrian Crosswalk to MUTCD standards at location indicated on Drawings.
- B. Signage (locations as noted on the Drawings):
 1. "STOP" at each Stop Bar.
 2. "ONE WAY" with appropriate directional arrow
 3. "NO PARKING – FIRE LANE",
 4. "DO NOT ENTER",
 5. Right Turn Sign,
 6. LGA's Standard handicapped parking space signage at the head of each space and handicapped access signs,
 7. Fire lane designation to LGA's Standards as required by Fire Marshall,

END OF SECTION

SECTION 323113
CHAIN-LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Chain-Link Fences: Commercial.
 - 2. Swing, Sliding, and Automatic Gates.
- B. Related Section s include the following:
 - 1. Division 31 Section "Earthwork" for site excavation, fill, and backfill where chain-link fences and gates are located.
 - 2. Division 03 Section "Cast-in-Place Concrete" for concrete.

1.3 SUBMITTALS FOR REVIEW

- A. All products identified in PART 2 of this specification.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Height shall be 8'-0". Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with ASTM A 392 Class 1 zinc coated steel wire, CLFMI CLF 2445, and requirements indicated below:
 - a. Steel Wire Fabric: 2" No. 9 gauge vinyl coated, color black.

- 2. Selvage: Twisted top and knuckled bottom.
- B. Refer to Details on the Drawings.

2.2 COMMERCIAL FENCE AND GATE FRAMING

- A. Posts and Rails: Round cold-formed, electric-resistance-welded, steel pipe or tubing, with minimum yield strength of 45,000 psi and with outside dimension, minimum wall thickness, and weight complying with ASTM F 761 or ASTM F 654 for the following fence height and strength and stiffness requirements:
 - 1. Duty Rating: Medium.
 - 2. Tube or Pipe Diameter and Thickness: According to ASTM F 761.
 - 3. Tube Size and Thickness: According to ASTM F 654.
 - 4. Metallic-Coated Steel: Posts, rails, and frames protected with an external coating of not less than 0.6 oz. of zinc/sq. ft., a chromate conversion coating, and a clear, verifiable polymer film; with an internal protective coating of not less than 0.6 oz. of zinc/sq. ft. or 81 percent, not less than 0.3-mil- thick, zinc pigmented coating. Posts, rails, and frames shall be vinyl coated or powder coated black as noted on the Drawings.
 - 5. Post, rail, and frame diameters noted on the Drawings are intended as minimum sizes.

2.3 TENSION WIRE

- A. General: Provide horizontal tension wire at the following locations:
 - 1. Location: Extended along top and bottom of fence fabric.
- B. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire complying with ASTM A 817, ASTM A 824, and the following:
 - 1. Metallic Coating: Type II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:
 - a. Class 1: Not less than 0.8 oz./sq. ft. of uncoated wire surface.
 - b. Class 2: Not less than 1.2 oz./sq. ft. of uncoated wire surface.
 - c. Class 3: Not less than 2 oz./sq. ft. of uncoated wire surface.
 - d. Matching chain-link fabric coating weight.

2.4 FITTINGS & HARDWARE

- A. General: Comply with ASTM F 626.
- B. Gates: Center stop drop bar shall interlock with locking device or latch. Locking mechanism shall not require the use of a chain. Locks are not in contract. Provide gate keepers for double swing vehicular gates.
- C. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - a. Hot-Dip Galvanized Steel: 0.106-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

D. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

2.5 SECURITY FEATURES

- A. Barb Wire: ASTM A121 Coating Type Z, galvanized steel; 12.5 gage thick wire, 3-strand or double 3-strand where noted on the Drawings.
- B. Barbed Tape (Razor Wire): Galvanized steel, 0.98" gage, 1" pre-formed width, available in 18" and 24" loop diameter.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.
 1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.
 1. Install fencing on established boundary lines inside property line.

3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment as indicated on Drawings.
- D. Line Posts: Space line posts uniformly at 10 feet o.c.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.
1. Locate horizontal braces at midheight of fabric 6 feet or higher, on fences with top rail and at 2/3 fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric.
1. Bottom Tension Wire: Install tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- H. Chain-Link Fabric: Apply fabric to side facing the public. Leave 1 inch between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.
- J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at 1 end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

- K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

END OF SECTION

SECTION 329000
EXTERIOR PLANTING

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The extent of landscaping is shown on the drawings and shall include, but not be limited to:
 - 1. Supplying and installing trees, shrubs, groundcovers and other plant material.
 - 3. Finished grading of all planting areas.
 - 4. Staking and guying of plant materials.
 - 5. Fertilizing, spraying, pruning and mulching of all plant material.
 - 6. **Plant Guarantee and Maintenance Period.**

1.2 RELATED DOCUMENTS

- A. Section 329119: Landscape Grading.
- D. Section 310513: Soil Materials.

1.3 QUALITY ASSURANCE

- A. All plants shall meet or exceed the specifications as to quality and size as set forth by the plans or in the current edition of ANSI/Z60.1, "American Standard for Nursery Stock" for number one grade nursery stock as adopted by the American Association of Nurserymen, whichever is more stringent. No "park quality" materials will be acceptable. Any change in size shall first be approved by the A/E and Roanoke County. Substitutions will not be allowed unless adequate proof can be demonstrated that a specified plant cannot be found.
- B. Maintenance Instruction: Typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work. Meet with Owner, describe maintenance instruction at site prior to substantial completion.
- C. Chemical Application License: Application of herbicide, insecticides and other chemicals, shall be applied under the direction of a person licensed by the Commonwealth of Virginia to apply such chemicals. The License of the Applicator shall include certification for all plants indicated and be current.

1.4 PRODUCT HANDLING

- A. Deliver all materials to the Site in their original containers with all labels intact and legible at time of installation.
- B. Insofar as is practicable, plant materials shall be planted on the day of delivery. In the event this is not possible, the Contractor shall protect that stock not planted. Protect plants from sun or drying winds. Plants that cannot be planted immediately on delivery shall be kept in the shade, well watered and protected.

Plants shall not remain unplanted for longer than three days after delivery. ALL plants shall be lifted and handled from the bottom of the ball only. Plants moved with a ball will not be accepted if the ball is cracked or broken before or during plant operations. All foliage-bearing plants stored during summer months or winter months shall be treated with anti-dessiccants.

- C. In the event of damage or rejection, immediately make all replacements necessary to the approval of A/E and at no additional cost to the Owner.

1.5 UTILITIES

- A. The exact location of all existing and proposed underground and overhead utilities shall be verified by the Contractor and he shall conduct his work so as to prevent interruption of service and damage to any system. The Contractor shall protect existing structures and utility services and be responsible for their replacement if damaged by him or to make necessary adjustment in their location if required in order to complete the work of this contract.
- B. Should the Contractor damage any utility during his work, he shall replace and/or repair the utility as it existed prior to the damage at his own expense.

1.6 SEQUENCING AND SCHEDULING

- A. Planting time: Proceed with, and complete landscape work as rapidly as portions of site become available. Work within seasonal limitations for each kind of landscape work required.
- B. No planting shall be done in frozen ground, when snow covers the ground or when the site is muddy.
- C. If planting is done during the summer months special precautions will need to be taken to ensure that the plants do not dry out. If it is deemed necessary to plant during these months, plants will be treated with anti-desiccants, and be watered daily.

PART 2 PRODUCTS

2.1 FERTILIZER

- A. All Fertilizer shall be a commercial balanced formula with at least 25% organic material, and shall conform to applicable state fertilizer laws. Fertilizer will be "Briquettes" as manufactured by Wood Ace, or approved equal for trees. It shall be a slow release formula, and used as specified by manufacturer. Fertilizer shall be delivered mixed as specified, in standard size, unopened containers, showing weight, analysis, and name of manufacturer. If stored at the site, it shall be kept in a weatherproof place where its effectiveness will be unimpaired.
- B. Fertilizer for plant installations which occur in the Fall shall be a 5-10-10 analysis. Spring installations shall be 10-10-10 analysis.

2.2 TREE STAKING

- A. Tree Stakes: 2" x 2" wood posts, 8'-0" long.
- B. Rubber Hose: Two-ply, fabric-bearing hose having an inside diameter of not less than one-half inch, black in color.
- C. Guy Wire: Galvanized malleable iron wire No. 14 gauge.
- D. Turn Buckle: 1-5/16" diameter, with 4-1/2" lengthwise opening with threaded ends, and fitted with screw eyes. All parts are to be hot-dipped galvanized.
- E. Ground Anchors: Galv screw-in anchors, minimum 1/2 inch rod, 18 inch length.

2.3 PLANTING SOIL

- A. This shall be a fertile, friable soil typical of the locality. It shall be well drained without mixture of subsoil. It shall be clean and free of clay lumps, stones, roots, and deleterious substances two inches or more in diameter. It shall be a mixture of the following materials in quantities specified:
- B. For tree planting pits use Planting Soil "A". Planting Soil "A" shall be a mixture of the following materials in quantities specified: one part topsoil, and one part soil from the hole. Soil pH shall be maintained between 5.5 and 7.0. In holes which were in rock, replace rock with topsoil.
- C. Pit planted shrubs shall receive the same soil mix as trees. Use Planting Soil "A". In holes which were in rock, replace rock with topsoil.
- D. For shrub beds and flower beds, use Planting Soil "B". This soil shall be mixture of: one part humus, five parts topsoil. Soil pH shall be maintained between 6.0 and 7.0.

2.4 MULCH

- A. This shall be double shredded hardwood barkmulch used locally within the nursery trade for trees and shrubs or an approved equal. Color shall be selected by Architect.

2.5 PLANT MATERIALS

- A. This shall mean all trees and other plants required to be furnished for the project in accordance with plans and specifications.
- B. Refer to drawings for varieties and spacing of plant materials. Quantities shown on drawings shall take precedence over quantities shown on plant list.
- C. Substitutions will not be permitted unless adequate proof is submitted that the materials are not available. Substitutions must be approved by A/E prior to their installation.

PART 3 EXECUTION

- A. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify all such work is complete to the point where this installation may properly commence. If other work is not complete, do not begin work until it has been completed so as to allow for installation.
- B. Verify that planting may be completed in accordance with the original design and the referenced standards.

3.1 SOIL CONDITIONS

- A. Contractor shall inspect soil conditions and take notice of all soil or drainage conditions that may be detrimental to any plant material growth. Notify A/E in writing of all such conditions.

3.2 PREPARATION OF PLANTING SOIL

- A. Before planting, clean topsoil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.
- B. Place planting soil as follows:

Area	Volume of Planting Soil Mix
Shrubbery Plant Beds	12" Deep for entire bed.
Tree Pits and Shrub Pits	Equal to root ball in depth by 2.5 times ball diameter in width.

3.3 PLANTING AND SURFACE PREPARATION

- A. Tree Planting:
 - 1. Stake locations of all trees 5' and over in height and outlines of all tree masses.
 - 2. Rake surface clear of stones, debris, rubbish, and trash before pit excavation. Dispose of such material off site.
 - 3. Excavate pits as indicated on Drawings. Tree pits shall be excavated three times wider than the diameter of the root ball and only as deep as the root ball to be placed in the hole. If initially dug too deep, the soil added to bring it up to the correct level should be thoroughly tamped.
 - 4. The pit shall be cone-shaped, barely larger than the ball at the bottom and three times the ball diameter at the top as shown on drawing detail.
 - 5. Plants shall be set at the same relationship to finished grade as they were to the ground from which they were dug. Plants must be set plumb and braced in position until prepared topsoil has been placed around the ball and roots. Plants shall be set so that they will be the same depth one year later.
 - 6. The trunk of the tree is not to be used as a lever in positioning or moving the tree in the planting hole.

7. Because some nurseries practice tilling around trees the root flare may be buried several inches deep. In some cases the top of the root ball may be at ground level but the root flare actually is too deep. Proper planting depth requires the root flare to be at or slightly above the finished grade. It is important to determine how deeply the root flare is buried in the ball before it is placed in the planting hole. Sometimes the top of the ball may need to be removed until the root flare is at the proper planting depth. Remove the excess soil on the top of the root ball.
8. Ropes, strings, and wrapping from the top half of the root ball are to be removed after the plant has been set. All waterproof or water repellant wrappings shall be removed from the ball. Remove at least the top half of the wire basket before backfilling.
9. Mulch trees as shown on drawings. Remove any mulch from 1" of base of tree.

3.4 STAKING AND GUYING

- A. Trees shall be supported immediately after planting as shown on Drawings. The wire shall be encased in hose to prevent direct contact with bark of the tree and shall be placed around the trunk in a single loop. Wires shall be tightened and kept taut with turnbuckles.

3.5 PRUNING

- A. Each tree shall be pruned in accordance with standard horticultural practice to preserve natural character of plant. Prune only dead or excess material unless otherwise advised by A/E. Cuts over 3/4" in diameter shall be painted with an approved tree paint. Paint shall cover all exposed cambium as well as other exposed living tissue. Paint shall be waterproof, adhesive and elastic, antiseptic, free from kerosene, coal tar creosote or any other material injurious to the tree and shall be approved before it is used. Use "Woodtar" or an approved equal.
- B. All deciduous plants and trees shall be pruned immediately after planting, to the satisfaction of the A/E. Main leaders of trees shall not be cut back. Thin branches out and do not merely cut back. Long side branches, however, may be shortened.
- C. If the natural form of the plant is destroyed by careless pruning or thinning, the plant will be rejected.

3.6 SHRUB PLANTING AREAS

- A. Rake surface clear of stones, debris, rubbish and trash before pit excavation. Dispose of such material away from the Site. Rake and compact as above. Excavate holes as indicated and backfill with indicated soil mixture to depth shown.
- B. Place plants in holes as shown on Drawings. Plants placed in holes shall be placed in their pits so that after final settlement, they will stand at approximately the same depth as in the nursery or field. As the planting soil is backfilled around

the ball, it shall be placed in layers around the roots or ball. Each layer shall be carefully tamped in place in a manner to avoid injury to the roots or ball or disturbing the position of the plant. B&B plants shall have the burlap cut away or folded back from the top of the ball before applying water.

- C. After placing backfill and before final watering, apply fertilizer at a rate of 1/4 pound/foot of height for shrubs, or 1/8 pound/foot of height or spread for evergreens.

3.7 CLEAN-UP

- A. The Contractor shall, periodically or as directed during the progress of the work, remove and properly dispose of debris, rubbish, trash, clippings, prunings, and defective or unacceptable material. Keep clear of hazardous obstructions. Trash burning on the site will not be permitted.
- B. Except for the designated storage area, paved areas shall be kept clean of soil, fertilizer, mulch, trash and debris, and shall be maintained in a broom clean condition at all times.

3.8 PLANT GUARANTEE AND MAINTENANCE PERIOD

- A. **Contractor's Maintenance:**
 - 1. Contractor's responsibility to plant maintenance under this section shall commence when work is begun and continue until Substantial Completion Acceptance of the construction project. Maintenance shall include all necessary watering, cultivating, fertilizing, weeding, pruning, wound dressing, disease and insect control, protective spraying, replacement of unacceptable material, straightening plants which lean or sag, adjustment of any plants which settle or are planted too low, and other procedures consistent with good horticultural practices which are necessary to insure normal, vigorous and healthy growth of all work under this contract.
 - 2. In the event that treatment or replacement is made necessary as a result of damage caused by circumstances which are beyond the Contractor's control, and not wholly or partially as a result of an act or omission of the Contractor, such treatment or replacement will be authorized by the Owner by Change Order in accordance with the General Conditions.
 - 3. Contractor shall supply to Architect a comprehensive maintenance program for all plant materials on the site for the Owner's use. It should indicate such areas as, fertilizing, pruning, wound dressing, insect control, watering and general care necessary to insure survival of the material and good healthy plants.

3.9 CONTRACTOR'S GUARANTEE PERIOD

- A. **Planting work shall be guaranteed for one (1) year from date of Substantial Completion.** Replacement plants are guaranteed one year from their planting date.

- B. After Substantial Completion Acceptance of the construction project, if the Contractor is not responsible for maintenance because the Owner has taken-over this task, he is responsible to see that a proper maintenance program is being undertaken. The Contractor should make periodic site visits to insure that the Owner is supplying proper care for plant materials. Notify Architect in writing of observations within seven days of site visit.
- C. Should the Contractor not follow through on his inspection visits, and plant material dies due to lack of maintenance by the Owner, the Contractor could be held responsible and replacements made at his expense. It is his responsibility to advise the Architect of conditions that may affect his plant materials, and the guarantee. This will be in effect for the full one year plant guarantee.

3.10 FINAL INSPECTION

- A. Contractor shall notify the Owner and Architect upon completion of guarantee. Contractor shall request final inspection prior to end of guarantee period.
- B. Should any plant material be dead, or in an unhealthy state of growth as determined by the Architect at the end of the one year period, Contractor shall make all work acceptable and request a reinspection by the Owner and Architect. Any replaced plant material is guaranteed one year from the replacement plants' planting date.

END OF SECTION

SECTION 329013
TREE PROTECTION AND TRIMMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the protection and trimming of existing trees that interfere with, or are affected by, execution of the Work, whether temporary or permanent construction.
- B. Related Sections include the following:
 - 1. Section 011000 - "Summary" for limits placed on Contractor's use of the site.
 - 2. Section 015600 - "Temporary Facilities and Controls" for temporary tree protection.
 - 3. Section 311000 - "Site Clearing" for removal limits of trees, shrubs, and other plantings affected by new construction.
 - 4. Section 329000 - "Exterior Plants" for tree and shrub planting, tree support systems, and soil materials.

1.3 DEFINITIONS

- A. Tree Protection Zone: Area surrounding individual trees or groups of trees to remain during construction and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 QUALITY ASSURANCE

- A. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning)."
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
 - 1. Before tree protection and trimming operations begin, meet with representatives of authorities having jurisdiction, Owner, Architect, consultants, and other concerned entities to review tree protection and trimming procedures and responsibilities.
 - 2. Existing dogwood within interior courtyard near administration area may require minor pruning. Discuss with Architect prior to work within this area. This tree must be saved.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and toxic and other nonsoil materials.
 - 1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.
- B. Chain-Link Fence: Metallic-coated steel chain-link fence fabric of 0.120-inch- diameter wire; a minimum of 48 inches high; with 1.9-inch- diameter line posts; 2-3/8-inch- diameter terminal and corner posts; 1-5/8-inch- diameter top rail; and 0.177-inch- diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Temporary Fencing: Install temporary fencing around tree protection zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence and remove when construction is complete.
 - 1. Install chain-link fence according to ASTM F 567 and manufacturer's written instructions.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Do not store construction materials, debris, or excavated material inside tree protection zones. Do not permit vehicles or foot traffic within tree protection zones; prevent soil compaction over root systems.
- D. Maintain tree protection zones free of weeds and trash.
- E. Do not allow fires within tree protection zones.

3.2 EXCAVATION

- A. Install shoring or other protective support systems to minimize sloping or benching of excavations.
- B. Do not excavate within tree protection zones, unless otherwise indicated.

- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.
 - 1. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
- D. Where utility trenches are required within tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.
 - 1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

3.3 REGRADING

- A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond tree protection zones. Maintain existing grades within tree protection zones.
 - 1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.
- B. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.4 TREE PRUNING

- A. Prune trees to remain that are affected by temporary and permanent construction.
- B. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
- C. Pruning Standards: Prune trees according to ANSI A300 (Part 1):
 - 1. Type of Pruning: Cleaning, Thinning, Raising, Reduction.
 - 2. Specialty Pruning: Restoration, Utility.
- D. Cut branches with sharp pruning instruments; do not break or chop.
- E. Chip removed tree branches and dispose of off-site.

3.5 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.

- B. Remove and replace trees indicated to remain that die or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 - 1. Provide new trees of 6-inch caliper size and of a species selected by Architect when damaged trees more than 6 inches in caliper size, measured 12 inches above grade, are required to be replaced. Plant and maintain new trees as specified in Section 329300.
- C. Aerate surface soil, compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.6 DISPOSAL OF WASTE MATERIALS

- A. Burning is not permitted.
- B. Disposal: Remove excess excavated material and displaced trees from Owner's property.

END OF SECTION

SECTION 329119
LANDSCAPE GRADING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Providing, placing on previously prepared subgrade, and grading topsoil to finish grade.

1.2 RELATED SECTIONS

- A. Division 01 - GENERAL CONDITIONS: Including but not limited to:
 - 1. Coordination of the Work,
 - 2. Submittals; Procedure for submittals, and
 - 3. Protection of the finished Work.
- B. Section 310900 - Geotechnical Engineering, Inspection, and Testing: Geotechnical Engineer.
- C. Section 310513 - Soil Materials: Topsoil materials.
- D. Section 311000 - Site Preparation and Clearing: Preparation for land disturbance, protection of the Work, and stripping and stockpiling topsoil.
- E. Section 312213 - Rough Grading: Site subgrade contouring; general cutting, grading, filling and rough contouring the site. Dewatering excavations and water control.
- F. Section 312317 - Utility Trenching & Backfilling: Utility excavation, backfill and compaction. Excludes bedding and setting utilities. References this section for provision and placement of topsoil.
- G. Section 312513 - Erosion & Sediment Control: Topsoil stockpile protection.
- H. Section 329219 - Seeding: Temporary and permanent seeding. Topsoil testing.

1.3 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures.
- B. Topsoil source.
- C. Bioretention Filter Materials.
- D. All products identified in PART 2 of this specification.

PART 2 PRODUCTS

2.1 MATERIAL

- A. Topsoil: Fill Type T1 or T2 as specified in Section 310513 – Soil Materials.
- B. Aggregate: As required in Section 310516 – Aggregate.
- C. Bioretention Soil Mix: As required in Section 310513 – Soil Materials.
- D. Non-woven Geotextile Fabric: As required in Section 312513 – ESC.
- E. Underdrain: As required in Section 334600 – Subdrainage.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that building, utility and miscellaneous backfilling have been inspected.
- B. Verify that subgrade has been contoured and compacted and that uneven areas, low spots, and stockpiles have been eliminated.
- C. Do not place topsoil within areas yet to be disturbed by other trades. This may include utility, sidewalk, paving, trellis, sprinkler system or fencing operations.

3.2 SUBGRADE PREPARATION

- A. Establish limits, providing for smooth transition to undisturbed area or other finishes.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch (13 mm) in size. Remove subsoil contaminated with petroleum products, cleaners, paint products, or waste concrete or asphalt.
- C. Scarify subgrade to depth of 3 inches (75 mm) where topsoil is scheduled. Re-scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.3 PLACING TOPSOIL

- A. Use all acceptable, on-site, stockpiled topsoil before importing topsoil. It shall be the Contractor's responsibility to determine the need to import topsoil to complete the project. Latent requests for additional costs due to importing topsoil will not be considered.
- B. Do not deliver or place topsoil in frozen, wet or muddy condition.
- C. Place topsoil in areas where seeding to thickness as scheduled. Manually spread topsoil close to trees, plants, site improvements, and buildings to prevent damage. Place topsoil during dry weather.

- D. Fine grade topsoil eliminating rough or low areas. Maintain profiles and contour of subgrade.
- E. Remove roots, weeds, rocks and foreign material while spreading.
- F. Lightly compact placed topsoil.
- G. Unless otherwise noted or indicated, compacted surface of placed topsoil shall be 1/2" below top of header boards, walks, pavements, and utility structures. Where upslope and against curb, flush with top of curb to allow positive drainage.
- H. All required topsoil (per schedule) shall be in place prior to any landscaping activities within the area to immediately receive landscaping.
- I. Leave stockpile area and site clean and raked, matching existing grade before placement of stockpile or proposed grade, as applicable, and ready to receive landscaping. Grade site surface to prevent free-standing surface water.

3.4 BIORETENTION FILTER

- A. Install bioretention filters in accordance with ~~Minimum Standard 3.11~~ the standards and specifications provided in P-FIL-05 Bioretention of the Virginia Stormwater Management Handbook.
- B. Bioretention soils are very sensitive to sediment laden stormwater; filter shall not be installed until all upstream areas have been completely stabilized and A/E has approved installation.
- C. Prior to final completion, Contractor will be responsible for protecting bio-retention filter from sediment laden stormwater. Any damage caused to the bio-retention filters due to upstream erosion shall be repaired or replaced at the Contractor's expense.
- D. Excavate bioretention filter to a depth as required to contain all layers of the filter and maintain a 0.5% minimum slope on the underdrain pipe. Mechanically compact to 95% a layer of clay soil at the base of the filter to serve as a liner. The clay liner shall be a minimum of 12" in thickness. Onsite soils meeting the ASTM D2487 CL or CH group classification shall be acceptable for use in the liner.
- E. All areas within the limits of bio-retention filters shall receive 30" of suitable bioretention soil mix over perforated piping and a gravel base as shown on plan details. Drainage Stone shall be Aggregate Type A2 - VDOT Std #57, double washed, Pea Gravel Filter shall be Aggregate Type A7 - VDOT Std #8, double washed. Bioretention Mix shall be installed in 12-18" layers. Lightly tamp, but do not compact. Mechanized compaction of the Bioretention Mix is not permitted.
- F. Coordinate the installation of soil and insure that finished grades are as shown on the grading plans. The finished bed shall be level and lower (see plan detail)

than the surrounding ground after the amendments have been "tilled in" and mulch added.

- G. Test the planting soil to verify the ph is between 6.0 and 7.0. These tests shall be made available to the Owner upon request. Add lime or sulfur as necessary to adjust the soil to the proper ph.
- H. Add fertilizer at the rate of 2 pounds of 10-10-10 per 100 square feet. Till the entire area to a minimum depth of 6" until all ingredients are thoroughly mixed. Rake the entire area to a smooth even surface.
- I. Place plants in holes in the locations shown on Drawings. Plants placed in holes shall be placed in their pits so that after final settlement, they will stand at approximately the same depth as in the nursery or field. As the planting soil is backfilled around the ball, it shall be placed in layers around the roots or ball. Each layer shall be carefully hand tamped in place in a manner to avoid injury to the roots or ball or disturbing the position of the plant. B&B plants shall have the burlap cut away or folded back from the top of the ball before applying water. See Section 329000 for additional planting requirements.

3.5 TOLERANCES

- A. Top of Topsoil (Top of Mulch in Bioretention Filter): Plus or minus 1/2 inch (13 mm) adjacent to improvements; 1 inch (25 mm) within 100 feet of buildings or athletic or play fields; and 2 inches (50 mm) on surrounding fields and slopes.

3.6 PROTECTION

- A. Section 017000 – Execution Requirements: Protection of Completed Work.
- B. Comply with Section 311000 – Site Preparation and Clearing: Protection.
- C. Protect landscaping and other features remaining as final work.
- D. Protect any/all existing site improvements including structures, fences, sidewalks, utilities, paving and curbs.

3.7 SCHEDULES

- A. Compacted topsoil thickness at the following areas:
 - 1. Seeded Grass: 4 inches (100 mm).
 - 2. Ground Cover Areas: 8 inches (200 mm).
 - 3. Perennial Bulb Beds: 12 inches (300 mm).
 - 4. Planter Boxes: 12 inches (300 mm) and to within 3 inches (75 mm) of box rim.
 - 5. Landscape Berms: 12 inches (300 mm).
 - 6. Steep slopes where hard fescue or crown vetch re proposed as stabilization: no topsoil required.

END OF SECTION

SECTION 329219 SEEDING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. All labor, materials, equipment and incidentals necessary to provide a complete installation of all tillage, pH balancing, fertilizing, seeding, and mulching of all disturbed areas within the Contract limits not occupied by structures, pavement or plantings, as indicated on the Drawings and specified herein.
- B. Topsoil testing.
- C. Erosion Control/Temporary Seeding.
- D. Permanent Seeding/complete stabilization with natural materials.
- E. Maintenance.
- F. Lawn guarantee.

1.2 RELATED SECTIONS

- A. Division 01 - GENERAL CONDITIONS: Including but not limited to:
 - 1. Coordination of the Work,
 - 2. Submittal Procedures,
 - 3. Closeout Procedures,
 - 4. Protection of Completed Work.
- B. Section 310513 - Soil Materials: Topsoil.
- C. Section 312317 - Utility Trenching & Backfilling: Backfilling to subgrade over utilities.
- D. Section 312513 - Erosion & Sediment Control: References EC / Temporary Seeding.
- E. Section 329119 - Landscape Grading: Preparation of subgrade and provision and placement of topsoil in preparation for the work of this section.

1.3 REFERENCE STANDARDS AND QUALITY ASSURANCE

- A. All materials, preparations and workmanship shall be performed by experienced workmen regularly engaged in the work of this section. Seeding work shall be performed by a single firm specializing and experienced in landscape work.
- B. All products shall be applied or installed in strict conformance with the manufacturer's written instructions and acceptable trade practices.

- C. All products shall be labeled in accordance with the U.S. Department of Agriculture Rules & Regulations.
- D. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- E. Have topsoil classified and analyzed to determine nutritional requirements of soil for establishment of lawns.
- F. FS O-F-241D - Fertilizers, Mixed, Commercial.

1.4 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer composition.

1.5 DEFINITIONS

- A. Noxious Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.
- B. Satisfactory stand of grass: A dense, vigorous and well established cover of living grass of the specified mixture where no individual lawn area has unacceptable portions in excess of one percent of its area or gaps larger than a circle 4 inches in diameter.
- C. Establishment period: The establishment period for lawn areas shall be the time from installation until final acceptance, as determined by the Architect.

1.6 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedure.
- B. Soil analysis report: Testing will be at the Contractor's expense.
- C. Certification that imported topsoil is free from weeds.
- D. Certificates of inspection as required by governing authorities.
- E. Other data substantiating that materials comply with specified requirements.
- F. Manufacturer's or vendor's certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species.
- G. All products identified in PART 2 of this specification.

1.7 SUBMITTALS AT PROJECT CLOSEOUT

- A. Section 017000 - Execution Requirements: Contractor's Closeout Submittals to Architect.
- B. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.
- C. Guarantee and warranties.

1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Section 016000 – Product Requirements.
- B. Fertilizer, soil amendments, and seed shall be delivered to the site in the original, unopened, undamaged containers bearing the manufacturer's guaranteed analysis, name, trade name, trademark, and statement of conformance to state and federal laws. Labels shall be intact and legible. In lieu of containers, fertilizer and soil amendments may be furnished in bulk with a certificate indicating the above information accompanying each delivery. All such certificates shall be submitted to the Architect to confirm quantities of materials used on project.
- C. During delivery and storage, seed, fertilizer, soil amendments, straw and matting shall be kept in dry storage free from the effects of weather and away from contaminants. Should any material become wet or damaged, reject immediately and replace at no cost to the Owner.
- D. Precautions shall be taken to protect containers from rupture prior to use.

1.9 MAINTENANCE SERVICE

- A. Provide service and maintenance of seeded areas through establishment period (see definitions above).

1.10 INITIAL ACCEPTANCE

- A. Establishment of new lawn: Contractor shall be responsible for providing a finished lawn of a satisfactory stand of grass (see definitions above). Any areas which fail to show a satisfactory stand of grass shall be reworked and reseeded at the Contractor's expense with the same seed as originally used thereon until all required areas are satisfactorily covered.

1.11 GUARANTEE AND WARRANTIES

- A. Contractor shall guarantee all seeding work for a period of one (1) year. Guarantee period shall begin on the date of acceptance of the established lawn for the entire project, as determined by the Architect.
- B. Provide written warranties within thirty (30) days of final acceptance.

PART 2 PRODUCTS

2.1 SEED MIXTURE

- A. State-certified seed of the latest season's crop, labeled in conformance with U.S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable State seed laws.
- B. All seed shall be Blue Tag Certified Seed with varieties strictly conforming to those listed on the Virginia Turfgrass Variety Recommendations, latest edition, published by Virginia Polytechnic Institute and State University.
- C. Permanent Seeding: Lawn areas shall be seeded with a mixture of 80 percent by weight (typ) improved or turf-type Fescue, 10 percent Bluegrass and 10 percent Ryegrass. The improved Fescue component shall be composed of three subspecies, each composing between 20 and 40 percent of the Fescue component. The Bluegrass shall be composed of equal parts of three subspecies. The Ryegrass component shall be of a single species of perennial ryegrass. Seed at 5-8 #/1000 square feet. Seeding shall be between April 1 and May 31, or August 15 and October 15.
- D. Seed that has become wet, moldy, or otherwise damaged will not be acceptable.
- E. Erosion Control/Temporary Seeding: ~~Apply at 100#/acre.~~
 - 2/16 to 4/30 Annual rye grass (*Lolium multiflorum*) Apply at 60-100#/acre.
 - 5/1 to 8/31 German Millet (*Setaria italica*) Apply at 50#/acre.
 - 9/1 to 2/15 50/50 Mix of annual ryegrass (*Lolium multiflorum*) & cereal (Winter) rye (*Secale cereale*) Apply at 50-100#/acre

2.2 SOIL MATERIALS

- A. Topsoil: As specified in Section 310513 – Soil Materials: Topsoil Materials.

2.3 ACCESSORIES

- A. Straw Mulch Material:
 - 1. Straw shall be stalks from oats, wheat, rye, barley or rice that are free from noxious weeds, chemicals, mold, decay or foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
 - 2. Straw shall be in an air-dry condition suitable for placing. Straw supplied for mechanical application shall be chopped.
- B. Wood Cellulose Mulch Material:
 - 1. Mulch supplied for use with hydraulic application of grass seed and fertilizer shall consist of specially prepared wood cellulose fiber. Wood cellulose fiber shall not be utilized however from 6/1 to 9/1 or 12/1 to 3/1. During this

- time, straw mulch shall be utilized.
 2. Processing of wood cellulose fiber shall be in such a manner that it will not contain germination or growth inhibiting elements.
 3. Wood cellulose fiber shall be dyed an appropriate color to allow visual metering of its application.
 4. Wood cellulose fiber shall have the property of becoming evenly dispersed and suspended when agitated in water.
 5. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like ground cover which readily absorbs water and allows infiltration to the underlying soil.
 6. Weight specifications from suppliers and for applications shall refer to air dry weight of the fiber, a standard equivalent to 10 percent moisture.
- C. Binder for Mulch: Emulsified asphalt, ASTM D977-86, Grade SS-1.
- D. Fertilizer: Commercial fertilizer shall conform to all applicable state and federal regulations and be certified by the Virginia Department of Agriculture and Consumer services to be in accordance with the type and quantity of material indicated on the bag labels. For EC / temporary seeding, it shall have a minimum guaranteed analysis of 5 percent nitrogen, 10 percent phosphorus, and 10 percent soluble potash or approved equal. For permanent seeding, it shall have a minimum guaranteed analysis of 14 percent nitrogen, 20 percent phosphorus, and 14 percent soluble potash or approved equal.
- E. Soil Amendments:
1. Lime: To pH balance soil, ground, natural, dolomitic limestone containing not less than 85% of total carbonates with a minimum of 30% magnesium carbonates, ground so that not less than 90% passes a 10-mesh sieve and not less than 50% passes a 20-mesh sieve.
 2. Aluminum Sulfate: To pH balance soil, commercial grade in dry power form.
 3. Superphosphate: Soluble mixture of treated minerals; 20% available phosphoric acid.
- F. Water: Potable.
- G. Mulch Stabilization Netting: Plastic or natural fiber netting used to prevent displacement of straw mulch, manufactured by:
1. American Excelsior Co. - Erosion Control Netting
 2. Belton Industries - Soil Anti-wash/Geojute
 3. CONWED Fibers - Erosion Control Netting
- H. Re-vegetation Mats/Erosion Control Mats:
1. Mats manufactured specifically to hold moisture without the additional use of mulch, and retard erosion, manufactured by:
 2. Re-vegetation Mats:
 - a. North American Green, Inc. - SC150 Blanket
 - b. American Excelsior Co. - Curlex Blanket
 - c. Gulf States Paper Corp. - Hold/Gro
 - d. CONWED Fibers - Futerra Revegetation Blanket

- e. CONTECH Constr. Prod., Inc. - Excelsior Erosion Control Blankets
- 3. Erosion Control Mats:
 - a. North American Green, Inc. - P350
 - b. Landlok - TRM 450
- I. Staples: Plain iron wire, No. 8 gauge or heavier, with a minimum in-ground length of 6 inches.
- J. Stakes: Softwood lumber, chisel pointed.
- K. String: Inorganic fiber.
- L. Landscape Fabric: 3.0 oz. Or better non-woven polyester, commercial weed restrictor fabric. UV stabilized
- M. Other Materials: All other materials, not specifically described but required for a complete and proper seeding operation, shall be selected by the Contractor and subject to the approval of the Architect.

2.4 TESTS

- A. Provide and pay for the services of a testing agency certified by the state to:
 - 1. Classify the topsoil in accordance with the Uniform Soil Classification System and provide percentages of sand, silt and clay.
 - 2. Perform an analysis of topsoil to be used, and make a determination of pH and nutritional requirements of the soil for establishment of lawns.
 - 3. Analyze fertilizer to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- B. Submit sample of fertilizer and topsoil proposed (one per source) to approved testing laboratory in sealed containers to prevent contamination. Sample size shall be as required by laboratory.

PART 3 EXECUTION

3.1 EXAMINATION / COORDINATION

- A. Series 01300 – Administrative Requirements: Coordination.
- B. Verify that prepared subsoil base and utility installation work is complete.
- C. Verify that Landscape Grading (topsoil material and depth) is complete, correct and ready to receive the work of this section.

3.2 EROSION CONTROL/TEMPORARY SEEDING

- A. Temporary seeding shall be applied to denuded areas within 7 days after final grade has been established, if season is improper for permanent seeding, and within 7 days to portions of the site which may not be at final grade but which will remain inactive for more than 30 days and less than one year. Lawn areas,

athletic fields and slopes may be topsoiled and permanently seeded only if this can be accomplished during the correct time of year for the permanent seed mixture specified. Permanent Seeding is required for areas which will remain dormant for more than one year.

- B. Where the area is compacted, crusted or hardened, the soil surface shall be loosened by disking, raking, harrowing or other means.
- C. Apply lime at a rate of 50 pounds per 1000 sq. ft. and commercial fertilizer at 10 pounds per 1000 sq. ft. Thoroughly mix into loosened soil.
- D. Seed shall be evenly applied at a rate of 2 lbs. per 1000 sq. ft. to the prepared ground and mulched.
- E. Slopes greater than 3:1 shall be hydroseeded. Other areas may be hydroseeded or dry seeded at the Contractor's option.
- F. Hydroseeding operations shall include seed, fertilizer, mulch and binder in one operation. Areas which are hydroseeded from 6/1 to 9/1 or 12/1 to 3/1 shall be mulched with straw. Wood fiber mulch shall not be used during these times.
- G. After mulching of dry seeded areas, mulch shall be stabilized using a liquid binder. Portions which continue to lose mulch due to wind or runoff shall be further stabilized with mulch stabilization netting. Install netting as specified herein.
- H. Areas which fail to establish vegetative cover adequate in checking erosion shall be re-seeded as soon as such areas are recognized.

3.3 PERMANENT SEEDING - GENERAL

- A. Seeding shall not be done when the ground is frozen, snow covered, saturated, or in any other condition which would make establishment and survival of lawns unlikely.
- B. At the time of beginning seed bed preparation, topsoil shall be in a loose, friable condition, free from stones over 1" in any dimension, sticks, roots and other extraneous matter. If topsoil has become crusty, hardened or eroded since being spread, it shall be a part of this work to restore the soil to the loose condition described above.
- C. Prior to preparation of undisturbed areas, remove vegetation and debris and dispose of such material off-site; do not turn under into soil being prepared for seed bed. Loosen existing grade to a depth of 4", remove all debris which surfaces.
- D. Contractor shall hydroseed all slopes 3 to 1 or steeper. All other areas shall be dry-seeded or hydroseeded at the Contractor's option unless noted otherwise on the Drawings.

3.4 SEED BED PREPARATION:

- A. Work areas of 3 to 1 slope and less to a smooth even surface free from irregularities, ridges or depressions. Prepared areas shall meet required finish grade elevations and shall drain adequately.
- B. Areas greater than 3 to 1 slopes shall be left in a roughened state but meeting required finish grade elevations. Repair all washed and eroded portions.
- C. Spread fertilizer at the rate of 25 lbs. per 1000 sq. ft. or as recommended otherwise by the soil test report. Add pH balancing agents at rate recommended by soil test reports to achieve a pH of 6.0 to 7.0 for turf grass seeding. For vegetative cover other than turf grass, achieve the pH level best suited for that material as suggested by the testing agency. Under circumstances where it is not possible to obtain soil tests, apply lime at a rate of 100 lbs./1000 sq. ft. Blend additives thoroughly into upper 4" of topsoil.
- D. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- E. Blend additives thoroughly into upper 4" of topsoil. Remove any rock or other debris which may surface. Till areas until soil is loose and friable and all soil amendments are uniformly distributed.
- F. Moisten prepared areas if soil is dry. Water thoroughly, then allow surface moisture to evaporate. Do not create muddy soil conditions.

3.5 DRY SEEDING NEW LAWNS:

- A. Within 3 days of finish grading and seed bed preparation, sow seed using a spreader or seeding machine at the rate of 5 lbs. per 1000 sq. ft. Do not seed when wind velocity exceeds 5 mi. per hour. Distribute seed evenly over entire area by sowing equal quantity in 2 directions at right angles to each other.
- B. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- C. Rake seed lightly into top 1/4" of soil, firm entire area with a roller not exceeding 90 lbs. per foot of roller width, and water with a fine spray.
- D. Unless indicated otherwise on the Drawings, protect newly seeded areas by spreading mulch to a uniform and continuous depth of 1/2" loose measurement (70-90 lbs./1000 sq. ft.). Anchor mulch by one of the following methods:
 - 1. Liquid mulch binder, applied at the rate of 10 gal. per 1000 sq. ft. Mask adjacent areas to prevent over-spray damage.
 - 2. Tractor-drawn mulch anchoring equipment, limit use to slopes 3:1 and less. Machinery shall be operated along the contour.
 - 3. Mulch stabilization netting.
- E. Install erosion control/re-vegetation mat in areas designated on the Drawings.

- F. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches (100 mm) of soil.

3.6 HYDROSEEDING NEW LAWNS (Required for 3:1 and greater slopes)

- A. The slurry shall be prepared and applied to yield the following rates:
 - 1. Seed: 5 lbs. per 1000 sq. ft.
 - 2. Fertilizer: 25 lbs. per 1000 sq. ft.
 - 3. Mulch: 35 lbs. per 1000 sq. ft.
- B. Hydroseed mulch is to be an integral part of the slurry mix; it shall be added after the seed and fertilizer have been thoroughly mixed and shall be applied uniformly to all seeded areas.
- C. Areas which are hydroseeded from 6/1 to 9/1 or 12/1 to 3/1 shall be mulched with straw. Wood fiber mulch shall not be used during these times.

3.7 SEED PROTECTION

- A. Identify seeded areas with stakes and string around area periphery. Set string height to 12 inches (300 mm). Space stakes at 10 feet max. (3 m).
- B. Cover seeded slopes where grade is 3H:1V or greater with re-vegetation mats.
- C. Place re-vegetation mats or erosion control mats in ditches where indicated on the Drawings.

3.8 NETTING/MAT PLACEMENT:

- A. Laying the Net/Mat:
 - 1. Start laying net/mat from top of swale/slope and unroll downgrade. Mat shall be placed minimum 12" beyond edges of swale and 18" beyond top and bottom of slopes.
 - 2. Allow to lay loosely on soil - do not stretch or pull.
 - 3. To secure: Upslope ends of net/mat should be buried in a slot or trench no less than 6 inches deep. Tamp earth firmly over net/mat. Staple every 12 inches across the top end.
 - 4. Edges shall be stapled every 3 feet. Where 2 strips are laid side by side, the adjacent edges shall be overlapped 3 inches and stapled together.
 - 5. Staples shall be placed down the center of net/mat strips at 3-foot intervals. DO NOT STRETCH when applying staples.
- B. Joining Strips: Insert new roll of net/mat in trench, as with upslope ends. Overlap the end of the previous roll 18 inches, turn under 6 inches, and staple across end of roll just below anchor slot and at the end of the turned-under portion every 12 inches.
- C. At Bottom of Slopes: Lead net/mat out onto a level area before anchoring. Turn ends under 6 inches, and staple across end every 12 inches.

- D. Provide 12 inch (300 mm) overlap of adjacent rolls. At sides of ditches, lay fabric laps in direction of water flow.
- E. Check Slots: On highly erodible soils and on slopes steeper than 4:1, erosion check slots should be made every 15 feet. Insert a fold into a 6-inch trench and tamp firmly. Staple at 12-inch intervals across the downstream portion.
- F. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- G. Rolling: After installation, net/mat should be rolled to ensure firm contact with soil.

3.9 MAINTENANCE DURING ESTABLISHMENT PERIOD:

- A. The Contractor shall be responsible for all maintenance during the establishment period. This period may extend beyond the Date of Substantial Completion if lawns are not deemed acceptable at that time. Maintenance shall include watering, fertilizing, removal of straw mulch, weed eradication, mowing, trimming, clipping removal, the reconstruction of all areas failing to yield vital stands, and the reconstruction of all area damaged by erosion or other occurrence.
- B. Stands in lawn areas shall be mowed at regular intervals to maintain at a maximum height of 2-1/2 inches (65 mm). Do not cut more than 1/3 of height at any one mowing. Soil stability areas shall not be mowed.
- C. Neatly trim edges and hand clip where necessary.
- D. Immediately remove clippings after mowing and trimming.
- E. Water to prevent grass and soil from drying out with hoses and portable sprinklers in areas that do not receive water from irrigation. Contractor to regularly rotate location of portable sprinklers to ensure that no single area becomes saturated. .
- F. Roll surface to remove minor depressions or irregularities.
- G. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

- H. After the third cutting of the establishment period but prior to inspection by the Architect, lawn areas within the scope of this Contract shall be fertilized with a mixture having 50% or more of the total nitrogen in a water insoluble form:

<u>Time of Application</u>	<u>lbs. Total Nitrogen per 1000 sq. ft.</u>
August 15 - Nov. 15	1-1/2 to 2
April 15 - June 15	1 to 1-1/2

- 3.10 LANDSCAPE FABRIC PLACEMENT: Place between soil and mulch in all mulched planted areas for weed control.

3.11 CLEAN-UP AND PROTECTION

- A. Keep pavements clean and work area in an orderly condition.
- B. Remove from the site, all equipment, surplus materials, debris, etc. resulting from the seeding work as herein specified.
- C. Protect seeded areas and materials from damage due to operations by other contractors, trades and trespassers. Maintain protection during installation and until final acceptance. Treat, repair or replace damaged seeded areas as herein before specified.

3.12 INSPECTION AND ACCEPTANCE:

- A. When establishment period is completed, Architect will, upon written request, make an inspection to determine acceptability.
- B. Work may be inspected for acceptance in sections agreeable to the Architect, provided all work for that section is complete.
- C. When inspected work is not acceptable, replace or remedy rejected work. Continue all applicable requirements of Contract until re-inspection and acceptance by the Architect.

3.13 GUARANTEE

- A. The Contractor shall be responsible for providing a finished lawn by Substantial Completion if possible. The Contractor shall produce dense, vigorous, well established lawns and shall maintain lawn areas until final acceptance of the work by the Owner. Any areas which fail to show a uniform stand of grass shall be reworked, and reseeded at the Contractor's expense with the same seed as originally used thereon, and such reseeded shall be replaced until all required areas are covered with a satisfactory stand of grass.
- B. Re-seeding of bare areas must be accomplished through mechanical means using a slit-seeder or a core aerator.

- C. Contractor's responsibility to maintain shall begin when work is begun and continue until maintenance program is accepted by Owner.
- D. In the event that treatment or replacement is made necessary as a result of damage caused by circumstances which are beyond the Contractor's control, and not due wholly or partially as a result of any act or omission by the Contractor, such treatment or replacement will be authorized by the Owner by Change Order in accordance with the General Conditions.

END OF SECTION

SECTION 331116
WATER MAINS AND SERVICES

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not limited to)

- A. Pipe and fittings for exterior water system including distribution main, domestic service and fire service, as applicable.
- B. Valves, fire hydrants, fire department connection, and domestic water hydrants.
- C. Bedding and compaction.
- D. Adjustment of existing utility structures to meet proposed work.
- E. Provide an approved, operational underground exterior water service and fire service piping system from five (5) feet outside the building through connection to existing system.

1.2 RELATED SECTIONS

- A. Applicable sections of Division 1 - GENERAL CONDITIONS: Including but not limited to:
 - 1. Section 013100 – Coordination of the Work.
 - 2. Section 013300 – Submittal Procedures: Procedures for submittals.
 - 3. Section 014000 – Quality Requirements: Aggregate and concrete testing.
 - 4. Section 015600 – Temporary Facilities and Controls: Dewatering excavations and water control.
 - 5. Section 106000 – Products Requirements: Product delivery, handling, storage, and protection.
 - 6. Section 017000 – Execution Requirements: Contract Closeout, Project Record Documents.
- B. Section 310513 – Soil Materials: Soil and aggregate materials.
- C. Section 310516 – Aggregate Materials.
- D. Section 311000 - Site Preparation and Clearing: Preparation for land disturbance, protection of the Work.
- E. Section 312213 – Rough Grading.
- F. Section 312317 - Utility Trenching & Backfilling: Excavation, backfill, compaction, testing, Trace Wire & ID Tape.
- G. Section 331300 - Disinfection of Water Distribution System: Disinfection of site service utility water piping.

1.3 REFERENCES

- A. AMERICAN SOCIETY OF TESTING & MATERIALS (ASTM)
- B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
- C. AMERICAN WATER WORKS ASSOCIATION (AWWA)
- D. AMERICAN WELDING SOCIETY (AWS)
- E. FACTORY MUTUAL RESEARCH CORP. (FM)
- F. MANUFACTURERS' STANDARDS SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
- G. NATIONAL FIRE PREVENTION ASSOCIATION (NFPA)
- H. UNDERWRITERS LABORATORIES (UL)
- I. UNI-BELL PLASTIC PIPE ASSOCIATION (UNI)
- J. VIRGINIA DEPARTMENT OF HEALTH (VDH)
 - 1. Virginia Department of Health (VDH) "Waterworks Regulations," latest edition, hereinafter Waterworks Regulations.
- K. SOILS
 - 1. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
 - 2. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
 - 3. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 4. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- L. COPPER
 - 1. ANSI/ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 - 2. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - 3. ASTM B32 - Solder, Metal.
 - 4. ASTM B88 - Seamless Copper Water Tube.
 - 5. AWS A5.8 - Brazing Filler Metal.
- M. PVC
 - 1. ASTM D1785 - Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, 120.
 - 2. ASTM D2241 - Polyvinyl Chloride (PVC) Plastic Pipe, (SDR-PR).

3. ASTM D2672 - Bell-End Polyvinyl Chloride (PVC) Plastic Pipe.
4. ASTM D2466 - Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
5. ASTM D2467 - Socket-Type Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
6. ASTM D2564 - Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings.
7. ASTM D2774 - Underground Installation of Thermoplastic Pressure Piping.
8. ASTM D3139 - Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
9. ASTM D2855 - Making Solvent-Cemented Joints With Poly Vinyl Chloride (PVC) Pipe and Fittings
10. ASTM F402 - Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings
11. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
12. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.
13. UNI B3 - Installation of Polyvinyl Chloride (PVC) Pressure Pipe Complying With AWWA C900.

N. DUCTILE IRON

1. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other liquids.
3. ANSI/AWWA C110 - Gray Iron and Ductile Iron Fittings, 3 Inch Through 48 Inches, for Water and Other Liquids.
4. ANSI/AWWA C111- Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.
5. ANSI/AWWA C115- Rubber-Gasket Joints for Ductile Iron and Grey-Iron Flanged Pressure Pipe and Fittings.
6. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
7. ANSI/AWWA C153 - Ductile-Iron Compact Fittings, 3 Inch Through 16 Inch, for Water and Other Liquids.
8. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.
9. ANSI/AWWA C606 - Grooved and Shouldered Type Joints.
10. ASTM A48 - Gray Iron Castings.

O. PE PIPE

1. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, 1/2 inch through 3 inch, for Water
2. ASTM D3035 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.

P. VALVES, ETC

1. ANSI/AWWA C500 - Gate Valves (Double Disc), 3 through 48 in NPS, for Water and Sewage Systems.
2. ANSI/AWWA C502 - Dry Barrel Fire Hydrants.
3. ANSI/AWWA C504 - Rubber Seated Butterfly Valves.

4. ANSI/AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS.
5. ANSI/AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.
6. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.
7. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.
8. MSS SP80 - Bronze Gate, Globe, Angle and Check Valves.
9. MSS SP71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
10. UL 246 - Hydrants for Fire - Protection Service.

Q. FIRE SERVICE

1. NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances."
2. NFPA 13, "Standard for the Installation of Sprinkler Systems."

1.4 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures: Submittals.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. All products identified in PART 2 of this specification.
- C. Manufacturer's Certificate: Certify that above referenced products meet or exceed specified requirements.
- D. Submit NFPA "Contractor's Materials and Test Certificate for Underground Piping." Use NFPA 13 Version with Owner Representative signature block.

1.5 PROJECT RECORD DOCUMENTS

- A. Section 017000 – Execution Requirements: Contract Closeout.
- B. Record actual locations of piping mains, valves, connections per the As-Built Survey requirements of Specifications 31 10 00 – Site Preparation and 31 22 13 – Rough Grading.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- D. Certify in writing to the Owner and to the Architect that the "System" has been approved and is ready for use.
- E. Maintenance Data: Submit maintenance data and parts list for the fire water system materials and products.

1.6 QUALITY ASSURANCE

- A. Code Compliance: Comply with:
 1. VDH Waterworks Regulations,

2. Local water system standards and specifications,
 3. Local Fire Department/Marshal Regulations or Standards: Comply with governing regulations pertaining to hydrants, including hose coupling threading and matching of connections, and
 4. Owner's Insurance Company requirements.
- B. Install fire water systems in accordance with NFPA 24.
- C. Valves: Manufacturer's name and pressure rating shall be marked on valve body.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 – Product Requirements: Deliver, store, protect and handle products to site: Material & Equipment.
- B. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.1 PIPE & FITTINGS (4" & larger)

- A. Ductile Iron Pipe (buried applications): AWWA C151/ANSI 21.51, minimum thickness Class 51 with a minimum working pressure of 250 psi.
1. Fittings: Ductile or grey iron, AWWA C110/ANSI 21.10 with a pressure rating not less than the pipe or AWWA C153/ANSI A21.53 with a working pressure of not less than that of the pipe.
 2. Joints: Mechanical joints per AWWA C111.
 - a. Bituminous Coating & Cement Lining: AWWA C104, Standard thickness for pipe and fittings.
 - b. Examples Meeting the Criteria or 1-3 above include, but are not necessarily limited to:
 1. Clow Super Bell-Tite Push-on Joint Ductile Iron Pipe.
 2. Pipe Tyton (Push-on) Joint Ductile Iron Pipe.
 3. Griffin Super Bell-Tite Push-on Joint Ductile Iron Pipe.
- B. Ductile Iron Pipe (non-buried applications): AWWA C-151/ANSI 21.51, minimum thickness Class 53.
1. Cement Lining: AWWA C104, Standard thickness, for pipe and fittings.
 2. Joints: AWWA C115 flanges or AWWA C606 grooved and shouldered joints. Provide flange joints with AWWA C111 full faced rubber gaskets for each flange in piping. Provide flanges, connection pieces, transition gaskets, transition sleeves and other adapters as required to complete the piping installation.
 3. Fittings:
 - a. AWWA C110/ANSI 21.10 (flanged), or AWWA C606 (grooved & shouldered) and pressure rating not less than the pipe.
 4. Grooved and shouldered joints shall be as manufactured by Victaulic Company of America of Easton, Pennsylvania or approved equal. The supplier of the grooved and shouldered joints shall be a factory certified representative of this piping system.

- C. PVC Pipe (4" - 12"): ANSI/AWWA C900 pressure Class 150 (DR18) with ductile iron pipe equivalent OD.
 - 1. Joints: ASTM D3139 push-on or ASTM D3139 and AWWA C111 compression type mechanical joints, as applicable. ASTM F477 gaskets for push-on joints for pipe and AWWA C111 gaskets for push-on joints and mechanical joints for joint connections between pipe and metal fittings, valves, and accessories.
- D. Examples Meeting the above Criteria include, but are not necessarily limited to:
 - 1. Johns-Manville Blue Brute PVC Water Pipe, DR18, Class 150
 - 2. Johns-Manville PVC Class Water Pipe, DR18, Class 150
 - 3. Clow Super Main 900 Water Main, DR18, Class 150
 - 4. CertainTeed Vinyliron Pipe, DR18, Class 150
 - 5. National C900 Pipe, DR18, Class 150
 - 6. Extrusion Technologies Inc. (ETI) C900, DR18, Class 150
- E. Fittings: ANSI/AWWA C110, ductile iron, with a pressure rating not less than the pipe and AWWA C104 standard thickness cement lining.

2.2 PIPE & FITTINGS (smaller than 4-inch diameter)

- A. Copper Tubing (for water piping only): ASTM B88, Type K:
 - 1. Fittings:
 - a. ANSI/ASME B16.18, cast copper and brass, solder joint fittings, or
 - b. ANSI/ASME B16.22, wrought copper, solder joint fittings.
 - 2. Joints:
 - a. ASTM B32, 95-5 tin antimony solder, or
 - b. Plumbing Code approved lead free solder, or
 - c. Compression connection, as applicable.
- B. Polyvinyl Chloride (PVC) Pipe: ASTM D2241, SDR-21 (200 psig rated).
 - 1. Joints: ASTM F477 rubber gaskets for push-on pipe.
 - 2. Pipe and fittings shall bear the seal of approval of the National Sanitation Foundation for potable water service.
 - 3. Pipe and fittings shall be of the same PVC material and shall be one of the following pipe/fitting combinations, as marked on the pipe and fitting, respectively: PVC 2120/PVC II; PVC 2116/PVC II.
 - 4. Examples Meeting the above Criteria include, but are not necessarily limited to:
 - a. Johns-Manville Ring-Tite PVC Pressure Pipe (D2241) Bell & Spigot
 - b. Clow PVC Bell-Tite Pressure Rated Pipe (D2241) Bell & Spigot
- C. Polyethylene Pipe: AWWA C901 ASTM D3035, with outside Dimension Ratio (DR) of 11.
 - 1. Joints: Butt fusion.
 - 2. Fittings: AWWA C901, molded.

2.3 INSULATING JOINTS

- A. Provide between pipes of dissimilar metals a rubber gasket or other approved type

of insulating joint or dielectric coupling which shall effectively prevent metal-to-metal contact between adjacent sections of piping.

2.4 BALL VALVES - Up to 2 Inches (50 mm)

- A. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, [AWWA] [IPS] [compression] inlet end, [compression] [IPS] outlet [with electrical ground connector], with control rod, extension box [and valve key].

2.5 GATE VALVES - Up to 3 Inches (75 mm):

- A. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, extension box and valve key.

2.6 GATE VALVES - 3 Inches (75 mm) through 14 Inches (350 mm)

- A. UL/FM Rated, Iron or ductile iron body, bronze trim, non-rising stem with square nut, single wedge, rubber encapsulated resilient seat, mechanical joint ends, control rod, available as post indicator, extension box and valve key. ANSI/AWWA C509 except with wall thicknesses exceeding the min. requirements of AWWA C153.
 - 1. Valves shall have a double O-ring stem seal, a minimum stem diameter of 7/8 inch for valves larger than six (6) inches, and shall open left (counter-clockwise).
 - 2. Valves shall be designed for a working pressure not less than that specified for the connecting pipe.
 - 3. Valves shall be coated inside and out with a fusion bonded epoxy coating meeting AWWA C550.
 - 4. Valves for above ground mounting or installed in vaults shall have flanged ends.
 - 5. Valves for buried installation shall have mechanical joints conforming to AWWA Std. C111 unless otherwise specified.
 - 6. Gate valves shall be supplied from a single manufacturer.
 - 7. Supply post indicator where indicated on the Drawings or as required by NFPA 24.
 - 8. Examples meeting the above criteria include, but are not necessarily limited to:
 - a) American Flow Control Model AFC-2500, by American Darling Valve (Ductile Iron)

2.7 SWING CHECK VALVES (smaller than four inches)

- A. MSS SP80, Class 125, except sizes 2.5 inches and larger shall conform to MSS SP71, Class 125.

2.8 SWING CHECK VALVES (4 inches to 24 inches (100 mm to 600 mm))

- A. Check valves shall conform with the specifications in ANSI/AWWA Standard C508. Valves shall be iron body, bronze trim, [45] [22] degree swing disc, renewable disc and seat, flanged ends. Valves shall be equipped with an outside weighted arm.

Provide piston type anti-slam device on all check valves where indicated.

2.9 FIRE DEPARTMENT CONNECTIONS (FDC)

- A. Provide 90-degree cast brass siamese connections and sleeve assembly, with two 2-1/2 inch fire department inlet female hose connections, thread per local fire dept. requirements, and self closing brass double clapper valves. Provide rough brass covers with chains. Acceptable FDC manufacturers include but are not limited to:
 - 1. Allen Manufacturing Div.
 - 2. Moon, Inc.
 - 3. Croker-Standard Div.
 - 4. Fire-End & Croker Corp.
 - 5. Elkhart Brass Mfg. Co., Inc.

2.10 FIRE HYDRANTS

- A. Hydrant: Type as required by utility company.
- B. Examples meeting the above criteria include, but are not necessarily limited to:
 - 1. American Flow Control Model B-84-B, AMERICAN-DARLING VALVE
 - 2. Mueller Centurion A423, by Mueller Co.
 - 3. Kennedy K81D
 - 4. AVK Model 2780
- C. Hydrant Extensions: Fabricate in multiples of 6 inches (150 mm) with rod and coupling to increase barrel length.
- D. Hose and Pumper/Steamer Connections: Two (2) 2-1/2 inch hose connections and one (1) 4-1/2 inch pumper connection per utility company requirements. Nozzle threads shall be National Standard.
- E. Operating nut shall be National Standard, pentagon shape (1.5" point to flat) and turn counter-clockwise to open unless otherwise required by local utility company.
- F. Finish: Primer and two coats of enamel to color required by utility company. All barrels shall be painted silver and the bonnet shall be painted with red reflective paint as required by utility company.
- G. Tools: Provide two (2) complete sets of tools required for maintenance and/or repair.

2.11 WATER VAULT

- A. Vault detailed is manufactured by Clearflow Co., and is available pre-assembled. Allow for proper delivery time.
- B. Backflow Prevention: Provided within vault as detailed on the Drawings.
- C. Meter Assembly: Provided within vault as detailed on the Drawings.

2.12 FROSTPROOF YARD HYDRANT

- A. Provide a self-draining, non-freezing, low lead, Sanitary yard hydrant.
- B. A lockable feature is required.
- C. Riser shall be steel pipe with a cast iron casing guard.
- D. Principal interior operating parts shall be brass and removable from yard hydrant for servicing without excavation.
- E. Yard hydrant shall be set in four cubic yards (4 CY) of crushed stone to allow for proper drainage.
- F. Yard hydrant shall be Woodford Sanitary Yard Hydrant, Model S4H meeting ADA requirements for height and a 5 lbs. maximum operating force to operate.

2.13 ACCESSORIES

- A. General: Provide flanges, connecting pieces, transition glands, transition sleeves, and other adapters as required for a complete and operational system.
- B. Structure top adjustments: Provide grade rings, brick and mortar, or extensions as required for adjusting structure top elevations to meet proposed finish grades.
- C. Thrust Block/Anchorages: Provide at all tees, wyes, crosses, plugs, caps, bends, valves and hydrants.
- D. Valve Box: Each valve on buried piping shall be provided with an adjustable cast-iron valve box of a size suitable for the valve. Provide each cast-iron box with a heavy coat of bituminous paint. The head shall be round and the lid shall have the word "WATER" cast on it. The least diameter of the box shaft shall be 5.25 inches.
- E. Trace Wire for Non-Metallic Piping: Comply with Section 312317 - Utility Trenching & Backfilling.
- F. Buried Utility Warning and Identification Tape: Comply with Section 312317 - Utility Trenching & Backfilling.
- G. Identification Tags and Plates: Provide valves with tags or plates numbered and stamped for their usage. Plates and tags shall be of brass or non-ferrous metal and shall be mounted or attached to the valve.
- H. Rim Adjustments: Provide pre-cast grade rings or install brick and mortar as necessary to level, raise or lower existing or new manhole frames and covers to meet finish grade. Adjustments of 8 inches or less in height shall not be considered for additional compensation.

2.14 BEDDING MATERIALS

- A. Bedding & Haunching: Coarse Aggregate Type A1 (Utility Bedding, Select Backfill)

as specified in Section 310516 - Aggregate Materials.

- B. Cover Bedding/Initial Backfill: Soil Type S1 or S2 as specified in Section 310513 - Soil Materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate with the WVWA for all required meetings, inspections, and approvals.
- B. Verify that building service connection, point of water service connection and municipal utility water main size, location and invert are as indicated.
- C. Verify that grades are within six (6) inches of finished subgrade prior to the commencement of this work. Minimum clear cover over all water pipe shall be three (3) feet.
- D. Inspect all new water piping material upon receipt and immediately prior to installation to verify that it is in acceptable condition and proper working order. Mark all damaged material, remove it from the site at the first opportunity and replace it promptly so the work will not be delayed.
- E. For new and existing water utilities affected by new work, verify that structure top elevations have been adjusted to meet proposed finished grades.

3.2 PREPARATION

- A. Provide adequate means and methods for lowering sections of pipe and associated items into trenches. Do not drop or dump pipe, fittings, valves, or any other water piping material.
- B. Have all necessary arrangements made to complete the work and place it in operation without delays.
- C. Prepare pipe connections to equipment with flanges or unions.

3.3 SEPARATION

- A. Water Piping Installation Parallel to Sewer Piping
 1. Normal Conditions: Water piping shall be laid at least ten (10) feet horizontally from a sewer or sewer manhole wherever possible, measured edge to edge.
 2. Unusual Conditions: When local conditions prevent ten (10) feet horizontal separation, the water piping may be laid closer to a sewer or sewer manhole provided that:
 - a. The bottom (invert) of the water piping shall be at least 18 inches above the top (crown) of the sewer piping.
 - b. Where this vertical separation cannot be obtained, the sewer piping shall be constructed of AWWA-approved water pipe and pressure

- tested in place without leakage prior to backfilling.
 - c. The sewer manhole shall be of water-tight construction and tested in place.
 - B. Water Piping Installation Crossing Sewer Piping
 - 1. Normal Conditions: Water piping crossing above sewer piping shall be laid to provide a separation of at least 18 inches above the top (crown) of the sewer piping.
 - 2. Unusual Conditions: When local conditions prevent the vertical separation described above, the following construction shall be used:
 - a. Sewer piping passing over or under water piping shall be constructed of AWWA-approved water pipe and pressure tested in place without leakage prior to backfilling.
 - b. Water piping passing under sewer piping shall, in addition, be protected by providing the 18 inch vertical separation described above, adequate structural support for the sewer piping to prevent excessive deflection of the joints and the settling on and breaking of the water piping, and that the length (min. 18 feet) of the water piping be centered at the point of crossing so that joints shall be equidistant and as far as possible from the sewer piping.
 - C. Sewer Manholes
 - 1. No water piping shall pass through or come in contact with any part of a sewer manhole.

3.4 BEDDING

- A. Excavate pipe trench in accordance with Section 312317 - Utility Trenching & Backfilling for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated. See Drawings for trench detail.
- B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches (150 mm) compacted depth, compact to 95 percent. Continue until pipe springline elevation is reached and hand excavate an accurate pipe shape to invert required. After setting pipe, where hand excavation is irregular against pipe, hand fill and tamp for an even fit tight to pipe at springline.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.5 INSTALLATION - PIPE

- A. Connection to Existing Water Systems: Connection to existing system will be made by the Contractor and coordinated with the Western Virginia Water Authority. Use tapping and drilling machine valve and mechanical joint type sleeves for connections to be made under pressure. Bolt sleeves around mains; bolt valve conforming to AWWA C500 to the sleeve. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, all without interruption of service. Notify the Owner in writing at least fifteen (15) days prior to the date the connections are required; receive approval before any service is interrupted.

Furnish all materials and labor required to make connections into the existing water supply systems.

- B. The Contractor shall be responsible for all public notification of service interruptions of the water main. Comply with all WVWA requirements regarding safety, temporary services and installation procedures.
- C. The Contractor shall comply with the Waterworks Regulations pertaining to separation of water and sanitary sewer.
- D. Establish elevations of buried piping to ensure not less than 3 ft (900 mm) of cover.

3.6 UTILITY ADJUSTMENT

- A. Adjust the tops of all affected water utility structures whether new or existing to meet finished grades. Provide grade rings, brick and mortar, or extensions for existing or new structures such that tops meet proposed finish grades. Adjustments of 8 inches or less in height shall be made at no additional cost to the Owner.
- B. Coordinate timing of adjustment work to be prior to stone base applications for paved areas and prior to topsoil applications in lawn spaces.

3.7 DUCTILE IRON

- A. Install ductile iron piping and fittings in accordance with ANSI/AWWA C600.

3.8 POLY-VINYL CHLORIDE (PVC)

- A. Install PVC piping and fittings to ASTM D2774.
- B. Inspect pipe, fittings, valves, and accessories before and after installation; those found defective shall be replaced with new materials. Ream pipe and tube ends and remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, removing scale and dirt, on inside and outside, before assembly and maintain in a clean condition.
- C. Route pipe in a straight line, unless otherwise indicated on the Drawings. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.
- D. Cut pipe accurately to measurements established at the site and work into place without springing or forcing and making proper provision for expansion and contraction of piping without stressing pipe or joints. Replace pipe or fitting that does not allow sufficient space for proper installation of joint material with new pipe or fittings of proper dimensions. Blocking or wedging between bells and spigots will not be permitted.
- E. Install pipe to indicated elevations and grade to within tolerance of 5/8 inch (20 mm). Ensure firm and uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells,

joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Keep trenches free of water. At the end of each days work, close open ends of pipe temporarily with wood blocks or bulkheads.

- F. Install access fittings to permit disinfection of water system performed under Section 331300 - Disinfection of Water Distribution System. Position drains at low points.
- G. Conduct testing.
- H. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main, vertical and horizontal, and behind fire hydrant as recommended by manufacturer. See detail on the Drawings.
- I. Install trace wire continuous over top of non-metallic pipe. Coordinate with Section 312317 - Utility Trenching & Backfilling.
- J. Place cover bedding/initial backfill to depth indicated in trench section on the Drawings, compacted to 95%.
- K. Backfill pipe trench in accordance with Section 312317 - Utility Trenching & Backfilling for work of this Section.

3.9 SPECIAL REQUIREMENTS FOR INSTALLATION OF DISTRIBUTION PIPING

- A. Ductile Iron Pipe and Fittings:
 - 1. AWWA C600 for pipe installation, joint assembly, valve and fitting installation, and thrust restraint, except as otherwise specified hereunder. Provide AWWA C600 joint assembly for push-on joints. Provide AWWA C600 joint assembly for mechanical joints and with the recommendations of Appendix A to AWWA C111. Make flanged joints up tight; avoid undue strain on flanges, fitting, valves, and other accessories. Use full-sized bolts for the bolt holes; use of the undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoined flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overtraining the flange. When any flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified for flanged joints, except that bolts with insulating sleeves shall be full size for the bolt holes. Assure that there is no metal-to-metal contact between dissimilar metals after joint has been assembled.
- B. Polyvinyl Chloride (PVC) Pipe and Fittings:
 - 1. UNI B3 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings, except as specified hereunder. Make push-on joints with elastomeric gaskets using either elastomeric gasket bell-end pipe or elastomeric gasket couplings. Use push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same

- as that on ductile-iron pipe used for the same type of joint.
2. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of UNI B3 for laying the pipe. Assemble push-on joints for connection to fittings, valves, and other accessories with the requirements of AWWA C600 for joint assembly. Assemble compression-type joints and mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners in accordance with the requirements of UNI B3 and AWWA C600, and Appendix A to AWWA C111. Cut off spigot end of pipe for compression-type joint and mechanical-joint connections and do not re-bevel.

C. Pipe Anchorage:

1. Provide anchorage of buried piping shall be installed at all 22.5 degrees and sharper bends, and tees. Dead ends of piping shall be securely blocked in the direction of flow.
2. Provide reaction anchors of concrete blocking, metal harness, retainer gland type, or restrained joint type pipe at all changes in direction of pressure pipelines and as shown on the Drawings.
3. Use of metal harness restraints shall be approved by the Engineer.
4. Concrete thrust blocks (reaction backing) shall have a minimum compressive strength of 3000 psi. Dead ends restrained with concrete shall have the concrete bearing solidly against the piping and affording a minimum of 3 square feet of bearing area against a vertical trench face (undisturbed earth) for 3- and 4-inch piping, and in accordance with the drawing details for piping 6-inch diameter and larger.

3.10 SETTING OF VALVES AND VALVE BOXES

A. Valve, Air Release, Meter and Blow-Off Chambers (as applicable):

1. Drain to surface where not subject to flooding by surface water or to absorption pit located above seasonal water table elevation per Waterworks Regulations Section 3.53 C, otherwise to manufacturer's recommendation.
2. Install valves with operator stems in the vertical plane through the pipe axis and perpendicular to the pipe axis. Locate valves where shown on the Drawings. Thoroughly clean before installation. Check valves for satisfactory operation.
3. Equip all underground valves without gearing or operators with valve boxes. Set box in alignment with valve stem centered on valve nut. Set the valve box to prevent transmitting shock or stress to the valve. Set the box cover flush with the finished ground or pavement surface.
4. Valve, Air Release, Meter and Blow-Off Chambers
 - a. Drain to surface where not subject to flooding by surface water or to absorption pit located above seasonal water table elevation per Waterworks Regulations Section 3.53 C, otherwise to manufacturer's recommendation.
 - b. Provide chambers/boxes in accordance with manufacturer's recommendations and of adequate size to permit ease of access and maintenance.

3.11 SPECIAL REQUIREMENTS FOR INSTALLATION OF WATER SERVICE PIPING

- A. Metallic Piping:
 - 1. Install pipe and fittings in accordance with the general requirements for installation of piping and with the applicable requirements of AWWA C600 for pipe installation, except as otherwise specified in the following paragraphs.
- B. Joints for Copper Tubing:
 - 1. Cut copper tubing with square ends; remove fins and burrs. Replace dented, gouged, or otherwise damaged tubing with new tubing. Before making joint, clean ends of tubing and interior of fitting or coupling with wire brush or abrasive. Apply a rosin flux to the tubing end and on recess inside of fitting or coupling. Insert tubing end into fitting or coupling for the full depth of the recess and solder. For compression joints on flared tubing, insert tubing through the coupling nut and then flare tubing with flaring tool.
- C. Flanged Joints:
 - 1. Make flanged joints up tight; avoid undue strain on flanges, valves, fittings, and accessories.
- D. PVC Piping
 - 1. Install pipe and fittings in accordance with the general requirements for installation of piping and with the applicable requirements of ASTM D2774 and ASTM D2855, except as modified herein. ASTM F402 for safe handling of solvent cements.
 - 2. Jointing
 - a. Make solvent-cemented joints and assemble in accordance with ASTM D2855. Make pipe joints to other pipe materials in accordance with the recommendation of the PVC pipe manufacturer, as approved.
- E. Installation of Valves and Valve Boxes:
 - 1. Valves and valve boxes shall be set plumb, with valve boxes centered directly over the valves. Valve boxes shall be located outside the area of the roads and streets whenever possible. Earth fill shall be tamped around the valve box to a distance of 4 feet on all sides of the box, or to the undisturbed trench face if less than 4 feet. Clean foreign matter from interior of valves before installation. Stuffing boxes shall be tightened and the valve shall be inspected in open and closed positions to ensure that all parts are in proper working order.
 - 2. Install a full-ported shut-off valve below each Air Release or Combination Air Valve in the event servicing is required.

3.12 INSTALLATION - FIRE HYDRANT ASSEMBLIES

- A. Set valves on solid bearing.
- B. Center and plumb valve box over valve. Set box cover flush with finished grade. The Contractor shall locate and uncover all valve boxes after pavement/surface

treatment of roads and adjust the tops to final road grades, if necessary.

- C. Set Fire Department Connection (FDC) plumb and locate centerline of nozzles perpendicular to roadway.
- D. Set hydrants plumb and locate pumper nozzle perpendicular to roadway.
- E. Set hydrants to grade in accordance with manufacturer's recommendations, with nozzle centers at least 20 inches (500 mm) above ground.
- F. Locate control valve 4 inches (100 mm) minimum away from hydrant.
- G. Provide a drainage pit 36 inches (900 mm) square by 24 inches (600 mm) deep filled with 2 inch (50 mm) diameter washed gravel. Encase elbow of hydrant in gravel to 6 inches (150 mm) above drain opening. Do not connect drain opening to sewer.
- H. Paint hydrants in accordance with requirements of local fire department.

3.13 FIELD TESTS AND INSPECTIONS OF WATER MAINS

- A. Perform all field tests, and provide all labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with contract requirements. Allow concrete to cure a minimum of 5 days before testing any section of piping where concrete thrust blocks have been provided.
- B. Field Testing of System:
 - 1. The Contractor may backfill over the pipe as laid, except as noted below. The bell holes shall either be left open or reopened for a visual inspection of the joints during the test period. The bell holes of all dry joints may be backfilled following this test. All leaking joints shall be reconnected (or tightened as necessary) and retested and all pipe, valves and fittings and other materials found defective under this test shall be removed and replaced at the Contractor's expense.
 - 2. Exception: When the open trench or open bell holes necessary for a visual inspection and test of the joints present a hazard to safety and welfare, or in an emergency, and/or special case, the operation incident to trenching, pipe laying, backfilling and testing shall be so coordinated as to minimize the lineal footage of open trench and that portion of the system tested in accordance with this section.
 - 3. This portion or portions of the system shall be tested between valves or temporary plugs in sections of not more than 2,500 lineal feet.
- C. Pressure and Leakage Test:
 - 1. Test Restrictions and Certification:
 - a. Per "Contractor's Material and Test Certificate for Underground Piping" following this section.
 - b. Test pressure shall not vary by more than +/-5 psi for the duration of the test.

- c. Valves shall not be operated in either direction at differential pressure exceeding the rated valve working pressure. Use of a test pressure greater than the rated valve pressure can result in trapped test pressure between the gates of a double-disc gate valve. For tests at these pressures, the test setup should include provision, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or fully opened if desired.
- d. Test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

D. Pressurization:

- 1. After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to the required hydrostatic pressure at the point of testing to provide the minimum required pressure at the high point in the test section. Each valved section of pipe shall be slowly filled with water, and the specified test pressure, based on the evaluation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Owner. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test.

E. Air Removal:

- 1. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied.

F. Examination:

- 1. All fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until it is satisfactory to the Owner.

G. Flushing: Per Test Certificate unless test section is a fire service line, then flushing shall be in accordance with NFPA 24.

H. Leakage Defined

- 1. See Test Certificate.

I. Allowable Leakage

- 1. See Test Certificate.

- J. When hydrants are in the test section, the test shall be made against closed hydrant valves.
- K. Acceptance of Installation:
 - 1. Acceptance shall be determined on the basis of allowable leakage. If any test of laid pipe disclosed leakage greater than that specified in Paragraph "H" above, the contractor shall, at his own expense, locate and make approved repairs as necessary until the leakage is within the specified allowance.
 - a. All visible leaks are to be repaired, regardless of the amount of leakage.

3.14 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 331300 -Disinfection of Water Distribution System.

3.15 SERVICE CONNECTIONS

- A. Provide all sleeves, caulk or other materials required to provide a watertight connection at buildings or through walls or foundations.

3.16 FIELD QUALITY CONTROL

- A. Field trench inspection and compaction testing shall be performed under provisions of Section 312317 - Utility Trenching & Backfilling.
- B. Compaction testing will be performed in accordance with ANSI/ASTM D698 Standard Proctor. Field testing methods shall be as deemed appropriate by the Geotechnical Engineer.
- C. Installation and testing shall be inspected in accordance with Section 310900 – Geotechnical Engineering, Inspections & Testing
- D. Disinfection testing shall be performed in accordance with Section 331300 - Disinfection of Water Distribution System.
- E. All equipment shall be tested in operation to demonstrate compliance with the contract requirements.
- F. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

Contractor's Material and Test Certificate for Underground Piping

PROCEDURE

Upon completion of work, inspection, and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

PROPERTY NAME

DATE

PROPERTY ADDRESS

PLANS

ACCEPTED BY APPROVING AUTHORITIES (NAMES)

ADDRESS

INSTALLATION CONFORMS TO ACCEPTED PLANS

☐ YES ☐ NO

EQUIPMENT USED IS APPROVED

☐ YES ☐ NO

IF NO, STATE DEVIATIONS

INSTRUCTIONS

HAS PERSON IN CHARGE OF FIRE EQUIPMENT BEEN INSTRUCTED AS TO LOCATION OF CONTROL VALVES AND CARE AND MAINTENANCE OF THIS NEW EQUIPMENT?

IF NO, EXPLAIN

☐ YES ☐ NO

HAVE COPIES OF APPROPRIATE INSTRUCTION AND CARE AND MAINTENANCE CHARTS BEEN LEFT ON PREMISES?

IF NO, EXPLAIN

☐ YES ☐ NO

LOCATION

SUPPLIES BUILDINGS

UNDERGROUND
PIPES AND
JOINTS

PIPE TYPES AND CLASS

TYPE JOINT

PIPE CONFORMS TO _____ STANDARD

☐ YES ☐ NO

FITTINGS CONFORM TO _____ STANDARD

☐ YES ☐ NO

IF NO, EXPLAIN

JOINTS NEEDING ANCHORAGE CLAMPED, STRAPPED, OR BLOCKED IN ACCORDANCE WITH _____ STANDARD

☐ YES ☐ NO

IF NO, EXPLAIN

TEST
DESCRIPTION

FLUSHING: Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags and outlets such as hydrants and blow-offs. Flush at flows not less than 390 GPM (1476 L/min) for 4-inch pipe, 880 GPM (3331 L/min) for 6-inch pipe, 1560 GPM (5905 L/min) for 8-inch pipe, 2440 GPM (9235 L/min) for 10-inch pipe, 3520 GPM (13323 L/min) for 12-inch pipe. When supply cannot produce stipulated flow rates, obtain maximum available.

HYDROSTATIC: Hydrostatic tests shall be made at not less than 200 psi (13.8 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.3 bars) for two hours.

LEAKAGE: New pipe laid with rubber gasketed joints shall, if the workmanship is satisfactory, have little or no leakage at the joints. The amount of leakage at the joints shall not exceed 2 qts. per hr (1.89 L/h) per 100 joints irrespective of pipe diameter. The leakage shall be distributed over all joints. If such leakage occurs at a few joints the installation shall be considered unsatisfactory and necessary repairs made. The amount of allowable leakage specified above may be increased by 1 fl oz per in. valve diameter per hr. (30 mL/25 mm/h) for each metal sealed valve isolating the test section. If dry barrel hydrants are tested with the main valve open, so the hydrants are under pressure, an additional 5 oz. per minute (150 mL/min) leakage is permitted for each hydrant.

Figure 8-1 (b) Part 1.

FLUSHING TEST	NEW UNDERGROUND PIPING FLUSHED ACCORDING TO <input type="checkbox"/> YES <input type="checkbox"/> NO STANDARDS BY (COMPANY) _____ IF NO, EXPLAIN _____		
	HOW FLUSHING FLOW WAS OBTAINED <input type="checkbox"/> PUBLIC WATER <input type="checkbox"/> TANK OR RESERVOIR <input type="checkbox"/> FIRE PUMP		THROUGH WHAT TYPE OPENING <input type="checkbox"/> HYDRANT BUTT <input type="checkbox"/> OPEN PIPE
	LEAD-INS FLUSHED ACCORDING TO _____ STANDARD BY (COMPANY) _____ IF NO, EXPLAIN _____ <input type="checkbox"/> YES <input type="checkbox"/> NO		
	HOW FLUSHING FLOW WAS OBTAINED <input type="checkbox"/> PUBLIC WATER <input type="checkbox"/> TANK OR RESERVOIR <input type="checkbox"/> FIRE PUMP		THROUGH WHAT TYPE OPENING <input type="checkbox"/> Y.CONN TO FLANGE & SPIGOT <input type="checkbox"/> OPEN PIPE
HYDROSTATIC TEST	ALL NEW UNDERGROUND PIPING HYDROSTATICALLY TESTED AT _____ PSI FOR _____ HOURS		JOINTS COVERED <input type="checkbox"/> YES <input type="checkbox"/> NO
LEAKAGE TEST	TOTAL AMOUNT OF LEAKAGE MEASURED _____ GALS _____ HOURS		
	ALLOWABLE LEAKAGE _____ GALS _____ HOURS		
HYDRANTS	NUMBER INSTALLED	TYPE AND MAKE	ALL OPERATE SATISFACTORILY <input type="checkbox"/> YES <input type="checkbox"/> NO
	WATER CONTROL VALVE LEFT WIDE OPEN IF NO, STATE REASON _____		<input type="checkbox"/> YES <input type="checkbox"/> NO
	HOSE THREADS OF FIRE DEPARTMENT CONNECTIONS AND HYDRANTS <input type="checkbox"/> YES <input type="checkbox"/> NO INTERCHANGEABLE WITH THOSE OF THE FIRE DEPARTMENT ANSWERING ALARM		
REMARKS	DATE LEFT IN SERVICE _____		
SIGNATURES	NAME OF INSTALLING CONTRACTOR _____		
	TESTS WITNESSED BY		
	FOR PROPERTY OWNER (SIGNED)	TITLE	DATE
	FOR INSTALLING CONTRACTOR (SIGNED)	TITLE	DATE
ADDITIONAL EXPLANATION AND NOTES			

Figure 8-1 (b) Part 2.

END OF SECTION

SECTION 331300
DISINFECTION OF WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not necessarily limited to)

- A. Disinfection of all equipment, pipe lines, and all structures in the water project with which water comes in contact and/or which have been contaminated by the Contractor's operations shall be accomplished after completion of construction and immediately before the system or unit is placed in operation.
- B. Testing and reporting results.

1.2 RELATED SECTIONS

- A. Applicable sections of Division 01 – GENERAL CONDITIONS: Including but not limited to:
 - 1. Coordination of the Work,
 - 2. Submittals: Procedures for submittals,
 - 3. Quality Control or Testing Laboratory Services: Testing water samples. Field inspection and testing,
 - 4. Material & Equipment: Delivery, storage and handling, and
 - 5. Contract Closeout: Project Record Documents, Requirements.
- B. Section 331116 – Water Mains and Services

1.3 REFERENCES

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

VIRGINIA DEPARTMENT OF HEALTH (VDH)

- A. VDH "Waterworks Regulations," latest edition, hereinafter Waterworks Regulations.
- B. ANSI/AWWA B300 – Standard for Hypochlorites.
- C. ANSI/AWWA B301 – Standard for Liquid Chlorine.
- D. ANSI/AWWA B302 – Standard for Ammonium Sulfate.
- E. ANSI/AWWA B303 – Standard for Sodium Chlorite.
- F. AWWA C651 – Standards for Disinfecting Water Mains.
- G. ANSI/AWWA C652 – Standards for Disinfecting Water Storage Facilities.

1.4 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of applicable of Division 01: Contract Closeout: Project Record Documents, Requirements.
- B. Disinfection report; record:
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and time of completion.
 - 3. Test locations.
 - 4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - 5. Date and time of flushing start and completion.
 - 6. Disinfectant residual after flushing in ppm for each outlet tested.
- C. Bacteriological report; record:
 - 1. Date issued, project name, and testing laboratory name, address, and telephone number.
 - 2. Time and date of water sample collection.
 - 3. Name of person collecting samples.
 - 4. Test locations.
 - 5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
 - 6. Coliform bacteria test results for each outlet tested.
 - 7. Certification that water conforms, or fails to conform, to bacterial standards of VDH Waterworks Regulations.
 - 8. Bacteriologist's signature and authority.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA C651.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS & DILUTION MEDIUM

- A. Disinfecting Agent: The disinfection agent shall be liquid chlorine ANSI/AWWA B301, or sodium hypochlorite solution ANSI/AWWA B303. Dry hypochlorite ANSI/AWWA B300, similar and equal to "HTH" may also be used as the disinfecting agent.
- B. Potable water.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Piping shall be cleaned immediately after placing and all open ends shall be adequately sealed to prevent entry of debris.

- B. Unless the Contractor adheres to AWWA C651 concerning pipe cleanliness and prevents contamination of pipe, fittings and valves during construction, disinfection will be difficult.
- C. All sediment and foreign matter including debris resulting from cutting, welding or fabrication shall be removed from entire water distribution system including water lines and hydrants, followed by thorough flushing with potable water at a minimum velocity of 2.5 ft/sec to remove any sediment which may have collected during operation with raw water. In cases where this velocity is not attainable or is ineffective, cleaning devices such as foam swabs or "pigs" will be considered.
- D. Perform scheduling and disinfection activity with start-up, testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

- A. Provide and attach required equipment to perform the work of this Section.
- B. Pressure Testing: After the valves and piping have been installed, they shall be subjected for one hour to a hydrostatic pressure test of 150 pounds per square inch at the points of reading when the system is put into operation. Any defective material shall be replaced by the Contractor with sound material.
- C. Disinfection: All water lines shall be disinfected prior to being placed in operation. Potable water shall be introduced into the pipe line at a constant flow rate. This water shall receive a chlorine dosage which will result in a chlorine concentration of 100 mg/L in a "slug" of the water. An approved hypochlorite solution injected by a metering pump or liquid chlorine injected by a solution-feed chlorinator and booster pump may be used. The chlorine shall be added long enough to ensure that all portions of the pipe are exposed to the 100 mg/L chlorine solution for at least 3 hours. The Chlorine residual shall be checked at regular intervals not to exceed 2000 feet to ensure that adequate residual is maintained. As the chlorinated water passes valves and other appurtenances, they shall be operated to ensure disinfection of these appurtenances.

After the required retention period, the heavily chlorinated water shall be flushed from the pipe line using potable water until chlorine measurements show a concentration no greater than that generally prevailing in the source system. Comply with AWWA C651 requirements for disposal of disinfecting water with high chlorine concentrations.

After flushing the waterlines, two series of bacteriological samples shall be taken 24 hours apart. Collect one set of samples at intervals of 1,200 ft. of waterline, plus one set at each end of the new line and at the end of each branch (minimum of three sets total). Sets of two consecutive biological samples, taken at least 24 hours apart, which show no contamination, will indicate acceptable disinfection and the water lines may be placed in service.

- D. Disinfect permanent system devices removed for system disinfection by exposing to a chlorine solution for a similar time period (method shall be approved in the

field). Replace same devices, being sure not to contaminate in the process.

3.3 QUALITY CONTROL

- A. Submit under provisions of applicable section of Division 01: Quality Control or Testing Laboratory Services: Testing water samples. Field inspection and testing.
- B. Test samples in accordance with AWWA C651.
- C. Approval of Disinfection: The complete disinfection program and methods followed, especially if materially different from those specified, shall be in accordance with directives of VDH and all methods employed shall have the approval of VDH. Definite instructions as to the collection and shipment of samples shall be requested from VDH and shall be followed in all respects. Final approval of the bacterial samples shall be received from VDH prior to the time that water mains are placed in service and allowed to be used for distribution of potable water. The Contractor shall deliver copies of the approved test data for the Owner and the Engineer.
- D. All references made above to VDH shall also apply to the local utility purveyor, as applicable.

END OF SECTION

SECTION 333100
SITE SANITARY GRAVITY SEWER SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not limited to)

- A. Sanitary gravity sewerage piping, fittings and accessories, and bedding.
- B. Connection of building sanitary drainage system to municipal sewer.
- C. Cleanout access and manholes.
- D. Utility top elevation adjustment.
- E. Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein from approximately five (5) feet outside building walls.

1.2 RELATED SECTIONS

- A. Applicable sections of Division 01 - GENERAL CONDITIONS: Including but not limited to:
 - 1. Coordination of the Work,
 - 2. Soil and aggregate testing, compaction testing, and inspection of bearing surfaces,
 - 3. Material delivery, storage and handling,
 - 4. Project Record Document Requirements, and
 - 5. Procedures for Submittals.
- B. Section 226600 – Chemical Waste Systems for Laboratory and Healthcare Facilities.
- C. Section 310900 – Geotechnical Engineering, Inspection, & Testing: Underground Utility Quality Assurance.
- D. Section 312213 – Rough Grading: Site subgrade contouring. General cutting, grading, filling and rough contouring the site. Geotechnical Engineer. Subsoil and aggregate materials. Classifications of Excavation. Unauthorized excavation defined. Excavation. Dewatering.
- E. Section 312317 - Utility Trenching & Backfilling: Excavating for sewer system piping and structures. Inspection of bearing surfaces. Bedding & haunching. Trace Wire for Non-Metallic Piping. Initial backfill. Backfill over piping up to subgrade elevation. Warning & ID Tape. Protection of utility from disturbance and damage during backfill operation.

1.3 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Latest revision shall be assumed.

AMERICAN SOCIETY OF TESTING & MATERIALS (ASTM)

- B. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
- C. ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
- D. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- E. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- F. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe

UNI-BELL PLASTIC PIPE ASSOCIATION (UNI)

- G. UNI B5 - Installation of Polyvinyl Chloride (PVC) Sewer Pipe
- H. UNI B6 - Low Pressure Air Testing of Installed Sewer Pipe

VIRGINIA DEPARTMENT OF TRANSPORTATION (VDOT)

- I. VDOT - Virginia Department of Transportation "Road & Bridge Standards & Specifications"

VIRGINIA DEPARTMENT OF HEALTH (VDH)

- J. VDH - Virginia Department of Health "Sewage Conveyance and Treatment (SCAT) Regulations."
- K. VDH - Virginia Department of Health "Sewage Handling and Disposal (SH&D) Regulations."
- L. VDH – Virginia Department of Health "Waterworks Regulations."

1.4 QUALITY ASSURANCE

- A. Qualifications of Installers: Use skilled and experienced workmen to ensure proper installation of the products specified herein. Workmen shall be thoroughly familiar with codes covering work of their trade and work to be performed under this contract. In the acceptance or rejection of installed Work, no allowance shall be made for the lack of experience on the part of the workmen.
- B. Comply with all standards specified in this Section.

1.5 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures: Submittals.
- B. Manufacturer's Product Data:
 - 1. Provide manufacturer's standard drawings or catalog cuts for pipe, pipe accessories, and fittings.
 - 2. Provide manufacturer's drawings for metal work.
 - 3. All products identified in PART 2 of this specification.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise. Production control tests shall have been performed at the intervals or frequency specified in the referenced publication. Other tests shall have been performed within three years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project. Include:
 - 1. Pipe and fittings, including factory applied linings,
 - 2. Pipe joint materials,
 - 3. Cast iron frames and covers,
 - 4. Precast concrete manhole sections.

1.6 DELIVERY, STORAGE, HANDLING, AND PROTECTION

- A. Delivery and Storage
 - 1. Piping: Inspect materials delivered to the site for damage; store with minimum of handling, on site in enclosures or under protective covering and not directly on the ground. Store plastic piping, jointing materials and rubber gaskets out of direct sunlight. Keep inside of pipes and fittings free of dirt and debris.
 - 2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
- B. Handling: Handle pipe, fittings, and other accessories in such a manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs or replace. Carry, do not drag, pipe to the trench.
- C. Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of other trades.

- 1.7 Damage: in the event of damage, immediately make all repairs and replacements necessary to the approval of and at no additional cost to the Owner or Engineer.

PROJECT RECORD DOCUMENTS

- A. Record location of pipe runs, connections, manholes, cleanouts, structure top elevations and all pipe invert elevations.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities (active or abandoned).

1.8 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this section. Conform to materials' manufacturer's installation recommendations. Code shall take precedence.
- B. The Contractor shall comply with the VDH Waterworks Regulations Section pertaining to separation of water and sanitary sewer. Comply also with VDOT Std. UB-1 where separation requirements cannot be maintained.

1.9 COORDINATION

- A. Verify that field measurements and elevations are as indicated.
- B. Coordinate the Work with earthwork, trenching, point of connection to building sanitary plumbing, and connection to municipal sanitary sewer.
- C. Assure that structure tops will be at proposed finish grade and slope and that pipe cover is as specified.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

- A. Plastic Gravity Sewer Pipe & Fittings (12" and less in diameter with 10' max. bury): Conform to ASTM D3034, Type PSM, Poly-Vinyl Chloride (PVC) material, SDR-35; inside nominal diameter as indicated on Drawings. Examples meeting design criteria:
 - 1. National Pipe Company, PVC Sewer Pipe (SDR 35),
 - 2. Robintech, King's Joint PVC Sewer Main (SDR-35),
 - 3. Clow, Deflec-Tite PVC Sewer Pipe (SDR-35), or
 - 4. Approved equal.
- B. Refer to Section 226600 for Acid Neutralization Waste Piping Materials.
- C. Joints: Bell and spigot type suitable for elastomeric gasket joints conforming to ASTM D3212.
- D. Gaskets: Conform to ASTM F477.

2.2 PIPE ACCESSORIES

- A. Joints of Dissimilar Pipe: Provide standard manufactured fitting specifically for

the proposed connection by same manufacturer of either type pipe or provide mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required and with gaskets conforming to ASTM F477.

2.3 MANHOLES

- A. Manholes indicated on Drawings shall be precast VDOT Std. MH-2 with nominal shaft diameter of 4 feet unless otherwise indicated. Taper shape shall be as indicated on Drawings by symbol or description. No parging will be permitted on interior manhole walls.
- B. Manhole frames and covers shall conform to VDOT Std. MH-1 except as herein modified. The frame shall be drilled to permit using 3/4 inch diameter bolts to secure it to the structure. Three such bolts shall be used per frame at 120 degrees. The words "SANITARY SEWER" shall be cast into the cover so as to be plainly visible. Covers shall be solid with two (2) "pick holes" at opposing edges.
- C. Steps shall be per VDOT Std. ST-1 placed in line with vertical wall of eccentric tapers or as creates most desirable access in other situations. All structures in excess of 3'-6" depth shall be provided with steps.
- D. Shaping shall be per VDOT Std. IS-1. All structures shall be provided with shaping.
- E. Base Pad (Precast): VDOT Standard B-1.
- F. Base Pad (Cast-in-place): VDOT Std. B-2 footing.
- G. Resilient Pipe Sleeve: For pipes from 4" to 22" diameter, provide resilient connectors in the wall of the reinforced concrete base/riser made of rubber with stainless steel sleeves and clamps, all conforming to ASTM C-923 equal.
- H. Riser Joint Sealant: Provide flexible rubber gasket conforming to ASTM C443 to create permanently flexible watertight joints.
- I. Waterproofing: Provide a 2 component, low-modulus, chemically cured coal tar epoxy polyimide waterproofing vapor barrier to manhole exteriors. It shall be spray applicable cure to a durable, flexible consistency.
- J. Rim Adjustments: Provide pre-cast grade rings or install brick and mortar as necessary to level, raise or lower existing or new manhole frames and covers to meet finish grade. Adjustments of 8 inches or less in height shall not be considered for additional compensation.

2.4 CLEANOUTS

- A. Per detail(s) on Drawings.

2.5 BEDDING & BACKFILL MATERIALS

- A. See Section 312317 - Utility Trenching & Backfilling for:
 - 1. Bedding & Haunching,
 - 2. Cover Bedding/Initial Backfill, and
 - 3. Backfill Materials.

2.6 UTILITY ADJUSTMENT

- A. Provide grade rings, brick and mortar, or extensions for existing or new structures such that tops meet proposed finish grades. Adjustments of 8 inches or less in height shall be made at no additional cost to the Owner.

2.7 CONCRETE MATERIALS

- A. Concrete Materials not otherwise described herein shall be as specified in Section 033000 - Cast-In-Place Concrete.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that all prerequisite work has been completed. Verify location and elevation of points of connection. Notify Engineer of any discrepancies.
- B. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 GENERAL

- A. See Section 312317 - Utility Trenching & Backfilling: Excavating for sewer system piping and structures. Inspection of bearing surfaces. Bedding & haunching. Trace Wire for Non-Metallic Piping. Initial backfill. Backfill over piping up to subgrade elevation. Warning & ID Tape. Protection of utility from disturbance and damage during backfill operation.

3.3 INSTALLATION - PIPE

- A. These General Requirements for installation of pipelines apply except where specific exception is made in the following paragraph entitled, "Special Requirements." "Also" shall mean in addition to the general requirements.
- B. Obtain required approvals before making connection to existing line. Conduct work so that there is minimum impact from any interruption of service on existing line.
- C. Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Ream pipe and tube ends and remove fins and burrs from pipe and fittings. Provide adequate means and methods for lowering sections of pipe and associated items into trenches. Do not drop or dump pipe, fittings, or any other sewer piping material. Before placing in position, clean pipe, fittings and accessories, removing scale and dirt, on inside and outside, before assembly and maintain in a clean condition.
- D. Install pipe, fittings, and accessories in accordance with ASTM D2321 (PVC) and manufacturer's instructions. Seal joints watertight.
- E. Route pipe in straight line. Lay non-pressure pipe with bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around unless a curved section is indicated on Drawings.
- F. Cut pipe accurately to measurements established at the site and work into place without springing or forcing and making proper provision for expansion and contraction of piping without stressing pipe or joints. Replace pipe or fitting that does not allow sufficient space for proper installation of joint material with new pipe or fittings of proper dimensions. Blocking or wedging between bells and spigots will not be permitted.
- G. Tolerance: Lay pipe to slope gradients indicated on Drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m). Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose.
- H. Ensure firm and uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Keep trenches free of water. At the end of each days work, close open ends of pipe temporarily with plugs, wood blocks or bulkheads.
- I. Install haunching to springline of pipe (compacted thickness) per Section 312317 - Utility Trenching & Backfilling.
- J. Conduct required testing of piping system.

- K. Install trace wire continuous over top of non-metallic pipe and place cover bedding/initial backfill above springline of pipe per Section 312317 - Utility Trenching & Backfilling.
- L. Connect to building sanitary plumbing outlet and municipal sewer system, septic tank & drainfield, or on-site treatment, as applicable.

3.4 SPECIAL REQUIREMENTS

- A. PVC Plastic Piping: Also conform to the requirements of UNI B5 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of UNI B5 for joint assembly. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.5 INSTALLATION - CLEANOUTS

- A. Location/spacing: As indicated on Drawings, at all angular changes of direction and at 60 feet O.C. maximum in gravity lines not between manholes.
- B. Establish location, top elevation and pipe inverts and install wye as indicated in pipe installation above.
- C. Set vertical piping (adjusted to make ferrule or cover at proper finish grade), backfill per Section 312317 - Utility Trenching & Backfilling, then set cleanout ferrule.
- D. Level top surface of backfill, form for the concrete collar pad (coordinating with adjacent work as necessary), and cast-in-place.
- E. Traffic Bearing Only: Set adapter so that in the completed work the cleanout plug has 2 inches minimum to 6 inches maximum clearance beneath the cover but no deeper than flush with the concrete anchor pad. Fill from cleanout invert with VDOT Std. #26 coarse aggregate to beneath the concrete anchor pad. Wrap cleanout adapter with welder's cloth followed by aluminum flashing prior to placing concrete. See detail on Drawings for other dimensions. Mount cover frame on grout to slope and elevation of finished traffic surface. Anchor frame with 5/8" bolts to anchor pad.

3.6 MANHOLE CONSTRUCTION

- A. Construct base slab of cast-in-place concrete or use precast concrete base sections as indicated. Make inverts conforming with VDOT Std. IS-1 Shaping. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as the manhole size will permit. For cast-in-place concrete construction, key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. Make joints between precast manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints for precast concrete manholes. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the

recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, applicable local utilities standards shall take precedence over the above.

- B. Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and rises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.
- C. Apply waterproofing to exterior of structures, which have fully cured, to a minimum dry film thickness of 35 mils.

3.7 UTILITY ADJUSTMENTS

- A. Adjust new and existing structure tops affected by new work to meet proposed finish grades.
- B. Coordinate timing of adjustments to be prior to stone base applications for paved areas and prior to topsoil applications for lawn spaces.

3.8 FIELD QUALITY CONTROL

- A. The Engineer or other assigned Owner's representative will conduct field investigations and witness field tests specified in this section. The Contractor shall provide sufficient notice of tests for Owner's representative to be present (24 hours minimum). The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished as set forth in applicable section of Division 1; Temporary Utilities. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the Drawings and Specifications.
- B. Trench, Bedding and Compaction Tests: Per Section 312317 - Utility Trenching & Backfilling.
- C. Tests for Non-Pressure Lines: Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the other end of the segment/run of pipe. When pressure piping is used in a non-pressure line for non-pressure use, test as specified for non-pressure line.
- D. Leakage Test: Test lines for leakage by low-pressure air tests. Prior to testing for leakage, place and compact haunching. When necessary to prevent pipeline movement during testing, place cover bedding/initial backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make

satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

- E. Low-Pressure Air Test for PVC Piping: Test in accordance with UNI B6, including the allowable pressure drop. Make calculations in accordance with the Appendix to UNI B6.
- F. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.9 SCHEDULE

- A. Sanitary Gravity Line: Indicated on the Drawings as "SS". Size: as indicated on Drawings and Profiles.
- B. Cleanout: As indicated on Drawings by "SSCO".

END OF SECTION

SECTION 334100
SITE STORM DRAINAGE SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not limited to)

- A. Site storm drainage piping, fittings and accessories, and bedding.
- B. Drainage system from origin at inlets and/or connection to building rain leaders or downspouts to connection to municipal sewers or outfall, as applicable.
- C. Manholes, drop inlets (yard, sump or curb), detention basin structure(s).

1.2 RELATED SECTIONS

- A. Applicable sections of Division 01 - GENERAL CONDITIONS: Including but not limited to:
 - 1. Frequency of Tests,
 - 2. Coordination of the Work,
 - 3. Soil and aggregate testing, compaction testing, and inspection of bearing surfaces,
 - 4. Material delivery, storage and handling,
 - 5. Project Record Document Requirements, and
 - 6. Procedures for Submittals.
- B. Section 310900 - Geotechnical Engineering, Inspection, & Testing: Underground Utility Quality Assurance.
- C. Section 310513 - Soil Materials: Sub-soil materials.
- D. Section 310516 - Aggregate Materials.
- E. Section 312213 - Rough Grading: General cutting, grading, filling and rough contouring the site. Classification of Excavation. Unauthorized excavation defined.
- F. Section 312513 - Erosion & Sediment Control.
- G. Section 312323 - Backfilling.
- H. Section 312317 - Utility Trenching & Backfilling: Excavating for sewer system piping and structures. Inspection of bearing surfaces. Backfilling over piping up to subgrade elevation.
- I. Section 334600 - Subdrainage: Foundation, retaining wall and or slab-on-grade weep drainage system.

1.3 REFERENCES

VIRGINIA DEPARTMENT OF TRANSPORTATION (VDOT)

- A. VDOT "Road & Bridge Standards & Specifications", latest edition (hereinafter VDOT Std. ...).
- B. VDOT Memorandum LD-94(D)121.11 dated May 12, 1994 "Drainage Structure Criteria" - Polyethylene, Corrugated exterior, smooth interior (type S)

AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS (AASHTO)

- C. AASHTO M-198B - (flexible butyl resin sealant (ConSeal))

AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

- D. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- E. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- F. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets. (for use in structure risers)
- G. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
- H. ASTM D698 (Standard Proctor) - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- I. ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- J. ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- K. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- L. ASTM D3033 - Type PSP Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- M. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- N. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- O. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- P. ASTM F405 - Polyethylene perforated drain pipe.

1.4 DEFINITIONS

- A. Bedding: Fill placed under pipe to provide support.
- B. Haunching: Fill placed from bedding to springline of the pipe, also considered bedding, which further supports pipe in both the horizontal and vertical.
- C. Cover Bedding/Initial Backfill: Fill placed above haunching to protect pipe prior to further backfill.

1.5 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittal Procedures: Submittals.
- B. All products identified in PART 2 of this specification. Include joint sealer for concrete pipe.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of pipe runs, connections, drainage structures, structure top elevations and invert elevations for each pipe.
- B. Identify and describe unexpected variations in subsoil conditions or discovery of uncharted utilities.

1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for materials and installation of the Work of this section.

1.8 COORDINATION

- A. Coordinate the Work with termination of rain water leaders outside building, trenching, connection to foundation drainage system (as applicable), grading and erosion & sediment control/stabilization, and local governing authorities for work off-site.

1.9 QUALITY ASSURANCE

- A. For concrete pipe and structures, all work shall be performed in accordance with the VDOT Road & Bridge Standards; however, the Contractor shall note that the City requires that the bell/spigot or tongue/groove connection be 100% complete with no missing sections. This requirement takes precedence over the VDOT RBS, any ASTM specifications, or any concrete trade association literature, etc.

PART 2 PRODUCTS

2.1 DRAINAGE PIPE MATERIALS

- A. Pipe materials have been indicated on the plans, profiles and Schedule at the end of this section. If no material is specifically required, the Contractor shall have the option of choosing the following.
- B. Cast Iron Pipe (CIP) (max. 12" diameter): VDOT Spec. Section 232, Service type, inside nominal diameter as indicated on Drawings, bell and spigot end.
- C. Concrete Pipe (CP) (max. 12" diameter): VDOT Spec. Section 232.02 (a) 1. a. Plain concrete culvert pipe, non-reinforced; inside nominal diameter as indicated on Drawings, standard or modified tongue-and-groove joints.
- D. Reinforced Concrete Pipe (RCP): VDOT Spec. Section 232.02 (a) 1. b. Reinforced concrete culvert pipe, circular, Class III (for 14' max. cover and H-20 live load); mesh reinforcement; inside nominal diameter as indicated on Drawings. Utilize bell and spigot joint connections with mastic joint compound, pre-formed mastic or butyl joint sealer. Note that tongue-and-groove joints shall not be allowed.
- E. Plastic Pipe (Poly-vinyl Chloride - PVC) (max. 12" diameter): VDOT Spec. Section 232.02 (g) 2. PVC Storm Drains; inside nominal diameter as indicated on Drawings.
- F. Plastic Pipe (HDPE) (12" to 36" diameter): HDPE (high density poly-ethylene) corrugated storm drain and culvert pipe, type S (smooth interior wall); inside nominal diameter as indicated on Drawings. Pipe shall conform to AASHTO M-294. Corrugated interior pipe will not be allowed.
- G. Plastic Pipe (HDPE) (42" to 48" diameter): HDPE (high density poly-ethylene) corrugated storm drain and culvert pipe, type S (smooth interior wall); inside diameter as indicated on the Drawings. Pipe shall have a minimum pipe stiffness of 20 psi for 42" pipe and 17 psi for 48" pipe at 5% deflection; Pipe shall conform to AASHTO M-294. Corrugated interior pipe will not be allowed.
- H. Plastic Pipe (PE) (only use in locations specifically indicated on the drawings): Perforated, corrugated, poly-ethylene (PE) pipe; inside nominal diameter as indicated on Drawings.

2.2 ACCESSORIES

- A. Joints of Dissimilar Pipe: Provide standard manufactured fitting specifically for the proposed connection by same manufacturer of either type pipe or stainless steel mechanical clamp contracting ring type, neoprene ribbed gasket for positive seal (Fernco type).
- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required flared end sections, tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

- C. Filter Fabric: Per Section 312513 - Erosion & Sediment Control, Silt Fence/Filter Fabric.
- D. Filter Cloth: (Encourages drainage) Woven geotextile fabric Manufactured by LINQ, Model #GTF 200 S.
- E. Geotextile Fabric: (Structural support) Non-woven geotextile fabric, Manufactured by LINQ Model #GTF 180 EX.
- F. Trace Wire for Non-Metallic Piping: Comply with Section 312317 - Utility Trenching & Backfilling.
- G. Buried Utility Warning and Identification Tape: Comply with Section 312317 - Utility Trenching & Backfilling.
- H. Hydraulic Cement Mortar: Mortar for concrete pipe to concrete structure connections shall conform to ASTM C270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar but in no case shall exceed 6 gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with proper covering until satisfactorily cured.
 - 1. Grout shall not be allowed in lieu of mortar.

2.3 DRAINAGE STRUCTURES

- A. VDOT Standard or Modified VDOT Standard structures where indicated on the Drawings. Modified VDOT Standard structures shall conform to VDOT Standards for all work except structure shape or configuration modified per detail on Drawings. No parging will be permitted on interior walls.
- B. Manhole style access covers shall be labeled as "STORM SEWER".
- C. Gratings: Unless noted otherwise, all grates shall be cast iron material. Gratings within sidewalks, plazas, or areas that receive pedestrian traffic shall be ADA compliant.
- D. Nominal shaft diameter as required for proposed piping or as otherwise indicated on Drawings (48 inches (1200 mm) minimum for round or square, unless otherwise noted).
- E. Throat inlet lengths shall be as indicated on Drawings.
- F. Concrete manhole taper shape and orientation shall be as indicated by symbol on Drawings.
- G. Steps shall be per VDOT Std. ST-1 placed in line with vertical wall of eccentric tapers or as creates most desirable access in other situations. All structures over

3.5 feet deep, from top to invert out, shall be provided with steps.

- H. Flow channel shaping shall be per VDOT Std. IS-1. All structures shall be provided with shaping.
- I. Base Pad (Precast): As detailed in VDOT Standard B-1 for VDOT Std. structures, otherwise per detail on drawings.
- J. Base Pad (Cast-in-place): VDOT Std. B2 footing.
- K. Riser Joint Sealant: Provide flexible rubber compression gaskets to create permanently flexible watertight joints.

2.4 AREA DRAINS

- A. Refer to schedule and details on the Drawings for in-line drains and drain basins.

2.5 EXTERIOR MECHANICAL AREA FLOOR DRAINS

- A. Floor Drain: Coated cast iron construction, deep two-piece body with double drainage flange, non-puncturing flashing clamp collar, weepholes, bottom outlet, 12.625" dia. round bronze top-grate with 43.5 sq. in. free area minimum, removable deep sediment bucket which supports a medium-duty loose-set anti-silting grate with perimeter slots, size to match shaft construction below. JOSAM 32330 Series, SUPER-FLO 12-5/8" Top w/ Bucket (2" to 8" pipe outlet).
- B. Shaft Construction: Pipe type and size shall match horizontal run of pipe indicated on Drawings (minimum 4" to maximum 8" shaft). Bell end at top of shaft shall be adjusted to set finished grade of final product.

2.6 CLEANOUTS

- A. In Lawn Areas: (See detail on Drawings)
 - 1. Cleanout Ferrule: Cast iron construction, bronze countersunk threaded cleanout plug with recessed socket, size to match shaft construction below. JOSAM 58190-22 Series (2" to 8" pipe size).
 - 2. Shaft Construction: Pipe type and size shall match horizontal run of pipe indicated on Drawings (minimum 4" to maximum 8" shaft). Bell end at top of shaft shall be adjusted to set finished grade of final product.
 - 3. Base/Collar Pad: Cast-in-place VDOT Class A3 concrete.
- B. In Concrete Paved Areas (non-traffic bearing): (See detail on Drawings)
 - 1. Cleanout Ferrule: Cast iron construction, bronze countersunk threaded cleanout plug with recessed socket, 58190-22 Series as manufactured by Josam, size to match shaft construction below.
 - 2. Shaft Construction: Pipe type and size shall match horizontal run of pipe indicated on Drawings (minimum 4" to maximum 8" shaft). Bell end at top of shaft shall be adjusted to set finished grade of final product.
 - 3. Base/Collar Pad: Concrete pavement (sidewalk, etc.) shall act as collar. Scoring and finishing shall be that specified for the sidewalk. Do not strike or score dimensions of collar around cleanout unless the sidewalk scoring

or jointing fall within that area. If so obtain Architects input on orientation of collar.

- C. In Paved Areas (traffic bearing): (See detail on Drawings)
 - 1. Cleanout Lid and Frame: Cast iron construction, hinged lid, #R-1976 manufactured by Neenah:
 - a. Lid Design: Checkerboard grill.
 - b. Nominal Lid and Frame Size: 11-1/4 inch dia. lid, 10 inch clear opening, 20 inch dia. flange, and 8 inch height.
 - 2. Base/Collar Pad: Cast-in-place VDOT Std. Class A3 concrete.

2.7 BEDDING AND BACKFILL MATERIALS

- A. Bedding & Haunching: See Section 312317 - Utility Trenching & Backfilling. [Except dry-mix lean concrete shall be used for bedding (saddle) of pipe through detention basin berm.]
- B. Cover Bedding/Initial Backfill (Select Backfill): See Section 31 23 17 - Utility Trenching & Backfilling.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions.
- B. Verify that sizes, locations and elevations of any/all points of connection to existing or proposed work are as indicated on Drawings.
- C. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Excavate pipe trench and correct over excavation in accordance with Section 312317 - Utility Trenching & Backfilling for work of this section. See Drawings for trench detail.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated. Remove large stones or other hard matter, which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches (150 mm) compacted depth and compact to 95 percent. Continue until pipe springline is reached and hand excavate an accurate pipe shape to invert required. After setting pipe, where hand excavation is irregular against pipe, hand fill and tamp for an even fit tight to pipe at springline.

- B. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with VDOT Standards, applicable ASTM Standard for material and manufacturer's instructions, whichever is most stringent. Seal joints watertight.
- B. Concrete Pipe: Contractor shall use manufacturer's installation recommendations for installing the pipe. The Contractor shall be warned that bell-spigot confined o-ring gasket pipe requires a special installation technique to avoid cracking the bell-spigot connections. Cracks in the bell-spigot connections shall be rejected by the City.
 - 1. When connecting the concrete pipe to a concrete structure, the Contractor shall thoroughly wet, with clean water, the adjoining concrete material before applying the mortar. This will help achieve the bond at the joint and also prevent shrinkage cracking in the mortar. The City shall reject connections that are not bonded or connections that have shrinkage cracking.
- C. Lay pipe to slope gradients noted on Drawings with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m). See Drawings for storm sewer profiles.
- D. Install aggregate at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches (300 mm), compact to 95 percent.
- E. Refer to Section 312317 - Utility Trenching & Backfilling for backfilling requirements. Do not displace or damage pipe when compacting.
- F. Make connection to all storm water collectors and receiving channel or system to include, but are not necessarily limited to building rain leaders, downspouts, foundation drains, existing storm sewer to remain, etc.
- G. Install trace wire continuous over top of non-metallic pipe. Coordinate with Section 312317 - Utility Trenching & Backfilling.
- H. Install Utility Warning and Identification Tape continuous over pipe. Coordinate with Section 312317 - Utility Trenching & Backfilling. See Drawings for trench detail; ID tape location.

3.5 INSTALLATION - CLEANOUTS AND FLOOR DRAINS

- A. Establish elevations and pipe inverts as indicated in pipe installation above.
- B. Form bottom of excavation clean and smooth to correct elevation.
- C. Install wye per pipe installation above.
- D. Set vertical piping (adjusted to make ferrule or grate at proper finished grade),

backfill per Section 312317 - Utility Trenching & Backfilling, then set cleanout ferrule.

- E. Level top surface of backfill, form for the concrete collar pad (coordinating with adjacent work as necessary), and cast-in-place.
- F. Traffic Bearing Cleanout Only: Set adapter so that in the completed work the cleanout plug has 2 inches minimum to 6 inches maximum clearance beneath the lid but no deeper than flush with the concrete anchor pad. Fill from cleanout invert with VDOT Std. #26 coarse aggregate to beneath the concrete anchor pad. Wrap cleanout adapter with welder's cloth followed by aluminum flashing prior to placing concrete. See detail on drawings for other dimensions. Mount lid and frame on grout to slope and elevation of finished traffic surface. Anchor frame with 5/8" bolts to anchor pad.

3.6 INSTALLATION - DRAINAGE STRUCTURES

- A. Form bottom of excavation clean and smooth to correct subgrade elevation.
- B. Place and level a 4 inch (50 mm) base of Type A3 coarse aggregate.
- C. Set bottom riser section (doghouse or with precast base).
- D. Set pipe in and out of structure to line and grade.
- E. If not precast, form and place cast-in-place concrete base pad to pipe inverts per Drawings, providing for shaping.
- F. If precast, level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.
- G. Pipes shall be neatly and tightly mortared in place. Provide for required shaping.
- H. Set remaining risers and top segments to elevation indicated coordinating with adjacent work in line and grade.
- I. Mount manhole lid and frame in grout to elevation and slope of paved surface or level in lawn areas, secure top cone section to orientation (if eccentric) indicated.
- J. Contractor shall mortar all lifting lug locations.

3.7 FIELD QUALITY CONTROL

- A. Trench, Bedding & Backfilling Tests: Field trench inspection and compaction testing will be performed under provisions of Section 312213 – Rough Grading and Section 312317 - Utility Trenching & Backfilling.
- B. The Architect or other assigned Owner's representative will conduct field investigations and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished as set forth in Div. 1; Temporary Utilities. Be able to produce evidence, when

required, that each item of work has been constructed in accordance with the Drawings and Specifications.

- C. Request inspection of installed piping prior to placing cover bedding/initial backfill over pipe. Place initial backfill and reinspect.
- D. Tests for Non-Pressure Lines: Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the other end of the segment/run of pipe. When pressure piping is used in a non-pressure line for non-pressure use, test as specified for non-pressure line.
- E. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- F. Once completed, the City of Roanoke Planning and Stormwater Department will conduct a storm drain acceptance review. Part of that process includes the Stormwater Department televising the installed pipe for defective workmanship and substandard joint conditions using a robotic pipe camera. Any defective work discovered during this process shall be corrected by removing the pipe and installing a new section.

3.8 PROTECTION

- A. Protect finished Work under provisions of Section 311000 - Site Preparation & Clearing.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

3.9 SCHEDULE

- A. Refer to Drawings (Profiles) for additional pipe and structure types and sizes.
- B. Storm Sewer Branch Lines: Connect inlets at various site locations with intersection of main sewer line. Size and type as indicated on Drawings (profiles).
- C. Storm Sewer within VDOT Right-of-way and/or Easement: Size as indicated on Drawings (profiles).
- D. Rain Leaders (RL): From 5 feet (1.5 m) beyond building wall, to municipal storm sewer; PVC; size as indicated on Drawings.

END OF SECTION

SECTION 334600 SUBDRAINAGE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Complete system through outfall / terminus connection.
 - 2. Sub-surface weep-type drainage system for building perimeter, retaining walls, and slabs-on-grade as applicable.
 - 3. Filter aggregate and fabric.
 - 4. Bedding.
- B. Related Sections:
 - 1. Section 310516 - Aggregate Materials.
 - 2. Section 312316 - Excavating: Excavating for site subdrainage system piping and surrounding filter aggregate.
 - 3. Section 312323 - Backfilling: Backfilling over filter aggregate, up to subgrade elevation.
 - 4. Section 334100 - Storm Drainage: Connection to weep drainage system, sump, etc.

1.2 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM D3034 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 2. ASTM D3212 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe Bell and Spigot Type Joints.
 - 3. ASTM F477 – Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe Bell and Spigot Type Joint Gaskets.
 - 4. ASTM F758 – Standard Specification for Subdrainage Perforations.
- B. UNI-BELL
 - 1. UNI-B-1 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe Bell and Spigot Type Joints.
 - 2. UNI-B-4 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- C. American Association of State Highway & Transportation Officials (AASHTO):
 - 1. AASHTO M252 – Standard Specification for Corrugated Polyethylene Drainage Tubing.
 - 2. AASHTO M288 – Standard Specification for Geotextiles, latest edition.

1.3 SUBMITTALS FOR REVIEW

- A. Section 013300 - Submittal Procedures.

- B. Product Data for Information: Submit data on pipe drainage products, pipe accessories, and appurtenances. All products identified in PART 2 of this specification.

1.4 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution Requirements: Requirements for submittals.
- B. Section 017810 - Project Record Documents: Record location of pipe runs, connections, cleanouts and principal invert elevations (highs, bends, penetrations, and connections).

PART 2 PRODUCTS

2.1 PIPE MATERIALS

- A. Polyvinyl Chloride (PVC) Pipe: ASTM D3034 and/or UNI-BELL UNI-B-4, SDR 35 with bell and spigot joints per ASTM D3212 and/or UNI-BELL UNI-B-1 and ASTM F477 gaskets; size as indicated on Drawings (4 inch (100 mm) minimum inside diameter); with required fittings. Solid or perforated as required. Perforation pattern shall conform to ASTM F758. Perforations shall be circular, 3/16 to 1/2 inch diameter, on 3 to 3.5 inch centers, and arranged in four rows along the barrel where rows are 45 and 80 degrees either side from bottom centerline of the pipe.
- B. Corrugated Plastic Tubing: AASHTO M252; Single-wall flexible type corrugated HDPE pipe with soil-tight joints with required fittings; size as indicated on Drawings (4 inch (100 mm) minimum inside diameter). If connection to storm sewer system is indicated, supply appropriate connector for differing materials as recommended by manufacturers.
- C. Use perforated pipe at subdrainage system; unperforated through sleeved walls.

2.2 AGGREGATE AND BEDDING

- A. Filter Aggregate and Bedding Materials: Fill Type A2 as specified in Section 310516 – Aggregate Materials.

2.3 ACCESSORIES

- A. Filter Fabric: AASHTO M288 for subsurface drainage, Survivability Class 3, non-woven, as manufactured by TC Mirafi, Amoco Fabrics and Fibers Co., Typar Geotextiles (Reemay, Inc.). Products meeting this requirement are Mirafi 180N, Amoco ProPex 4553, or Typar 3401.
- B. Filter Cloth: (Encourages drainage) Woven geotextile fabric Manufactured by LINQ, Model #GTF 200 S.
- C. Geotextile Fabric: (Structural support) Non-woven geotextile fabric, Manufactured by LINQ Model #GTF 180 EX.

- D. Pipe Sleeve: Steel type for foundation wall penetrations, as applicable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 013100 – Administrative Requirements: Coordination: Verification of existing conditions before starting work.
- B. Verify trench cut or excavated base is ready to receive work and excavations, dimensions, and elevations are as indicated on shop drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation per excavation or trenching spec as applicable.
- B. Remove large stones or other hard matter, which could damage drainage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION

- A. Place filter fabric.
- B. Place drainage pipe on fabric. Use PVC pipe where depth of fill over pipe exceeds 10 feet. Use same pipe throughout a section or loop. Separate runs may be of other materials.
- C. Lay pipe to slope gradients of 1/8 inch per foot; with maximum variation from indicated slope of 1/8 inch (3 mm) in 10 feet (3 m).
- D. Place pipe with perforations facing down. Mechanically join pipe ends.
- E. Install Type A2 aggregate at sides and top of pipe. Install top cover compacted thickness of 12 inches (300 mm).
- F. Close filter fabric over leveled top surface of aggregate cover prior to subsequent backfilling operations.
- G. Place aggregate in maximum 6 inch (150 mm) lifts, consolidating each lift.
- H. Refer to applicable area or trench excavation and backfill section for compaction requirements. Do not displace or damage pipe when compacting.
- I. Connect to storm sewer system or sump pit or rout to surface discharge point per Drawings. Where the need for subdrainage is unnecessary use unperforated pipe (ie. extensions away from structure to sewer outlet or discharge).
- J. Coordinate the Work with connection to indicated outfall, and trenching.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Testing and inspection services.
- B. Request inspection prior to placing aggregate cover over pipe.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 017000 - Execution Requirements: Protecting installed construction.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION

Appendix A

Tank Specifications

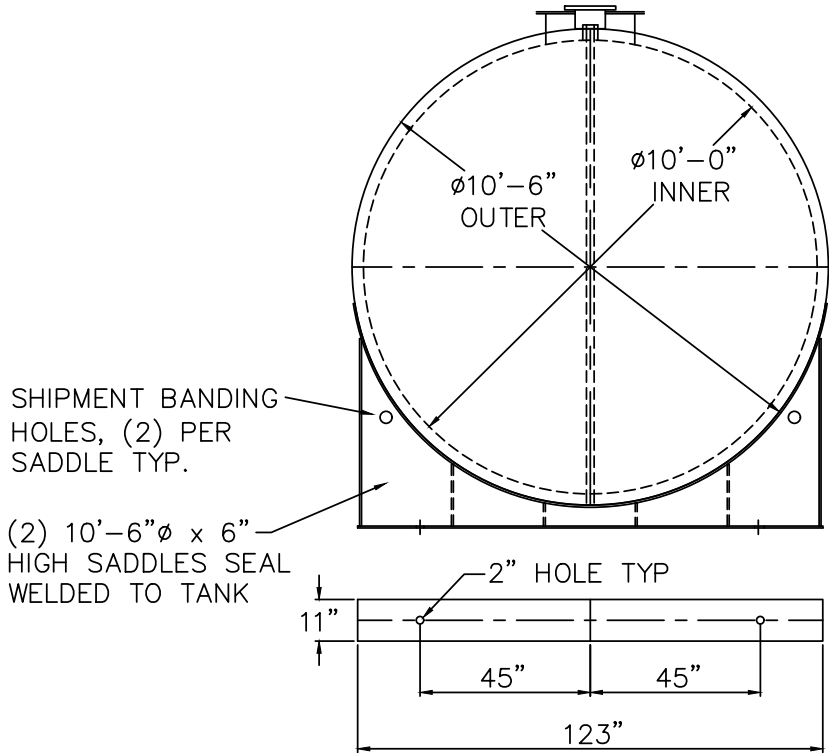
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TOUCH UP OF FINISHED PAINT IS REQUIRED BY INSTALLATION CONTRACTOR. TOUCH UP PAINT SHIPPED WITH TANK.

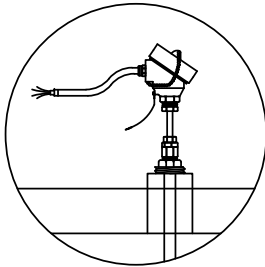
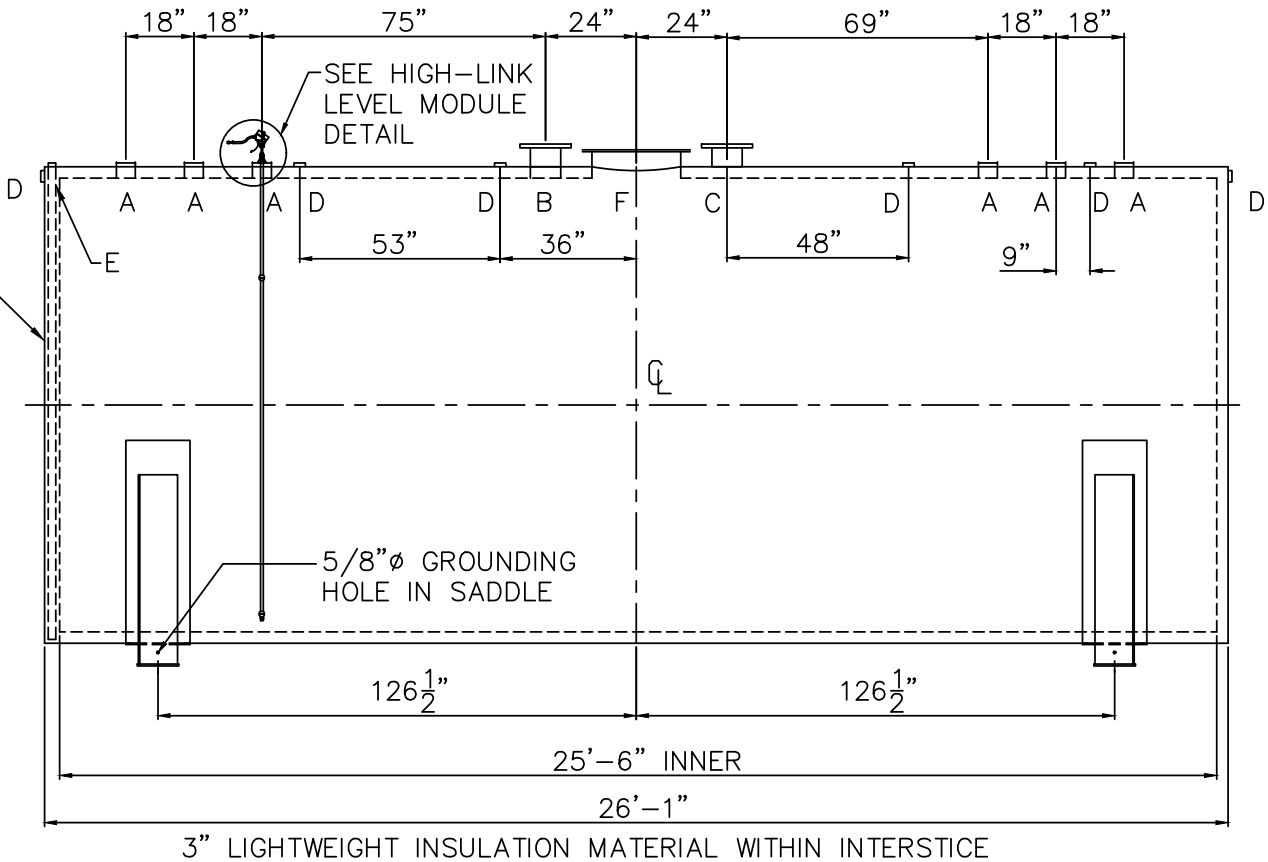
SHIPPING LUGS AS NEEDED

SHIP LOOSE

- (2) 8" FLANGED EMERGENCY VENTS
- (1) HIGH-LINK LEVEL SHIELD MODEL# LS_XEXD_3500 138" LONG & BUSHING WITH LS_LINK_GPRS COMMUNICATION BOX.



4" INTERSTICE THIS END ONLY



HIGH-LINK LEVEL SHIELD DETAIL



COMMUNICATION BOX DETAIL

DESIGN DATA

CAPACITY : 15,000 GALLONS
TYPE: FIREGUARD® CYLINDRICAL
FIREGUARD® IS A TRADEMARK OF THE STEEL TANK INSTITUTE
NO. REQ. – –
OPERATING PRESSURE – ATMOSPHERIC
SPECIFIC GRAVITY = 1.0
TANK MATERIAL – MILD CARBON STEEL
THICKNESS – INNER – HEADS: 5/16", SHELL: 1/4"
THICKNESS – OUTER – HEADS: 5/16", SHELL: 1/4"
MIN. GAUGE OR THICKNESS (PER U.L. 2085)
CONSTRUCTION – INNER – LAP WELD OUTSIDE ONLY
CONSTRUCTION – OUTER – LAP WELD OUTSIDE ONLY
TANK TEST – INNER – 5 PSIG
OUTER – 5 PSIG
INT. FINISH – NONE
EXT. FINISH – SP-6 BLAST, FINISH PAINT WHITE
LABEL– UL 2085 AND FIREGUARD® PER sti

LEGEND

A	4" FEMALE FIREGUARD COUPLING
B	8" FFSO 150# FLANGE – PRIMARY EMERGENCY VENT USE ONLY
C	8" FFSO 150# FLANGE THROUGH OUTER SHELL ONLY, MARK WITH SPECIAL WARNING LABEL INTERSTITIAL EMERGENCY VENT USE ONLY
D	2" FITTING THROUGH OUTER SHELL ONLY WITH CAST IRON PLUG– MFG USE ONLY
E	2" INTERSTITIAL MONITOR PIPE – MALE NPT END
F	24" x 1/4" PLATE TIGHT BOLT MANWAY WITH 1/8" THICK FIBREFLEX GASKET

NOTES:
STRIKER PLATES ARE NOT SUPPLIED ON FIREGUARDS® UNLESS SPECIFIED

△					
		Highland Tank			
UNLESS NOTED, TOLERANCES ARE +/- 1"					
15,000 GAL 120"Ø CYL. FIREGUARD®					
PATENT: 5,695,089 PATENT: 5,809,650					
CUSTOMER:					
PROJECT:					
QUOTE NO:				CHK'D BY:	
SCALE: 1/4"=1'-0"	DATE:	DWG. BY:	DWG. NO: 15000FGCYL120		

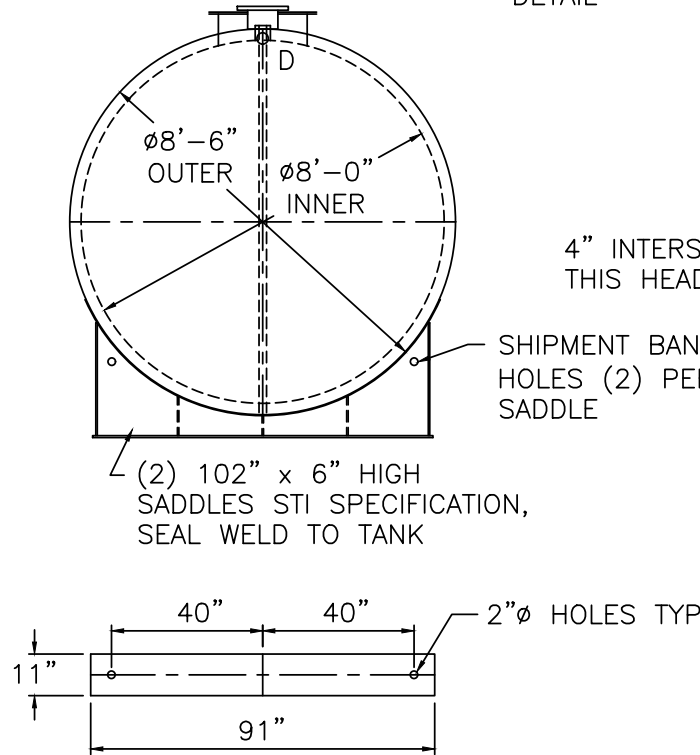
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TOUCH UP OF FINISHED PAINT IS REQUIRED BY INSTALLATION CONTRACTOR. TOUCH UP PAINT SHIPPED WITH TANK.

SHIP LOOSE

- (2) 8" FLANGED EMERGENCY VENTS
- (1) HIGH-LINK LEVEL SHIELD MODEL# LS_XEXD_2750 108" LONG & BUSHING WITH LS_LINK_GPRS COMMUNICATION BOX.

SHIPPING LUGS AS NEEDED



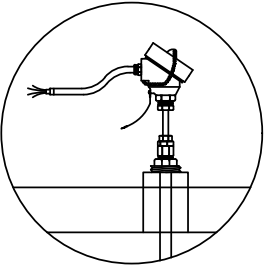
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LEVEL MODULE
DETAIL

4" INTERSTICE
THIS HEAD ONLY

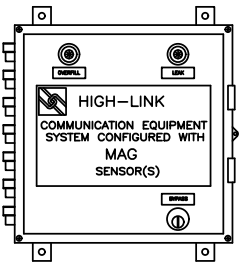
SHIPMENT BANDING
HOLES (2) PER
SADDLE

5/8"Ø GROUNDING
HOLE IN SADDLE

3" LIGHTWEIGHT INSULATION MATERIAL WITHIN INTERSTICE



HIGH-LINK LEVEL
SHIELD DETAIL



COMMUNICATION
BOX DETAIL

DESIGN DATA

CAPACITY: 12,000 GALLONS
TYPE: FIREGUARD® CYLINDRICAL
FIREGUARD® IS A TRADEMARK OF THE STEEL TANK INSTITUTE
NO. REQ. – –
OPERATING PRESSURE – ATMOSPHERIC
SPECIFIC GRAVITY = 1.0
TANK MATERIAL – MILD CARBON STEEL
THICKNESS – INNER – HEADS–5/16" SHELL–1/4"
THICKNESS – OUTER – HEADS– 5/16" SHELL–1/4"
MIN. GAUGE OR THICKNESS (PER U.L. 2085)
CONSTRUCTION – INNER – LAP WELD OUTSIDE ONLY
CONSTRUCTION – OUTER – LAP WELD OUTSIDE ONLY
TANK TEST – INNER – 5 PSIG
OUTER – 5 PSIG
INT. FINISH – NONE
EXT. FINISH – SP-6 BLAST, FINISH PAINT WHITE
LABEL– UL 2085 AND FIREGUARD® PER sti

LEGEND

A	4" FEMALE FG COUPLING
B	8" FFSO 150# FLANGE – PRIMARY EMERGENCY VENT USE ONLY
C	8" FFSO 150# FLANGE THROUGH OUTER SHELL ONLY, MARK WITH SPECIAL WARNING LABEL INTERSTITIAL EMERGENCY VENT USE ONLY
D	2" FITTING THROUGH OUTER SHELL ONLY WITH CAST IRON PLUG– MFG USE ONLY
E	2" MONITOR PIPE WITH MALE NPT END
F	24" x 1/4" PLATE TIGHT BOLT MANWAY WITH 1/8" THICK FIBREFLEX GASKET

NOTES:
STRIKER PLATES ARE NOT SUPPLIED ON
FIREGUARDS® UNLESS SPECIFIED

△					
		Highland Tank			
UNLESS NOTED, TOLERANCES ARE +/- 1"					
12,000 GAL 96"Ø CYL. FIREGUARD®					
PATENT: 5,695,089 PATENT: 5,809,650					
CUSTOMER:					
PROJECT:					
QUOTE NO:		CHK'D BY:			
SCALE: 1/4" = 12"	DATE:	DWG. BY:	DWG. NO: 12000FGCYL96		

FITTING LEGEND	
A	4" FEMALE FG COUPLING
B	6" FFSO 150# FLANGE – PRIMARY EMERGENCY VENT USE ONLY
C	8" FFSO 150# FLANGE THROUGH OUTER SHELL ONLY, MARK WITH SPECIAL WARNING LABEL INTERSTITIAL EMERGENCY VENT USE ONLY
D	2" FITTING THROUGH OUTER SHELL ONLY WITH CAST IRON PLUG– MFG USE ONLY
E	2" MONITOR PIPE WITH MALE NPT END
F	24" x 1/4" PLATE TIGHT BOLT MANWAY WITH 1/8" THICK FIBERFLEX GRADE "A" GASKET AND "B" IN COVER ON CL
G	2" MALE NPT WITH DROP PIPE TO WITHIN 4" OF PRIMARY TANK BOTTOM – BULKHEAD MONITOR
H	24" x 1/4" PLATE TIGHT BOLT MANWAY WITH 1/8" THICK FIBERFLEX GRADE "A" GASKET
J	8" FFSO 150# FLANGE – PRIMARY EMERGENCY VENT USE ONLY

SHIPPING LUGS AS NEEDED

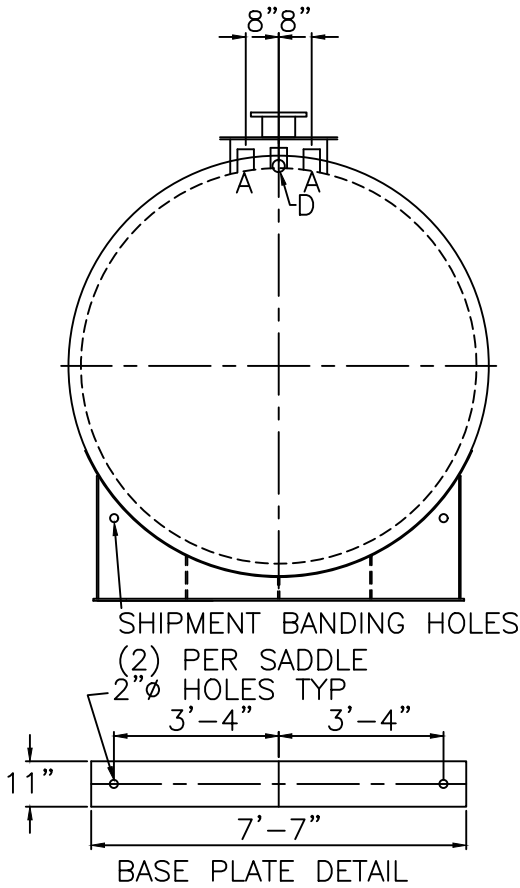
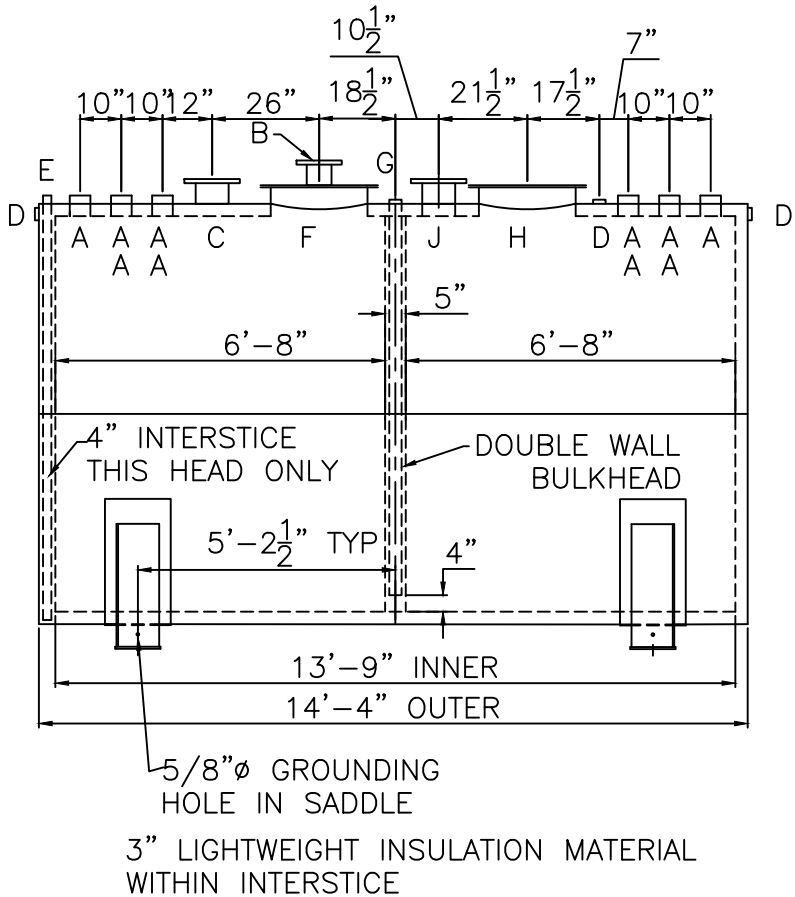
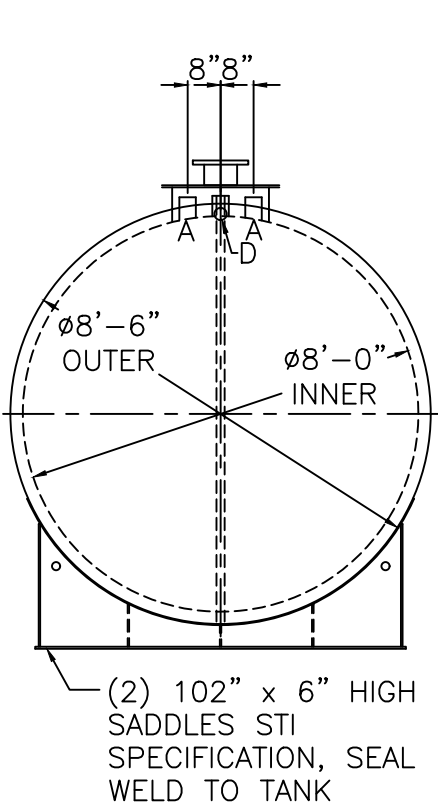
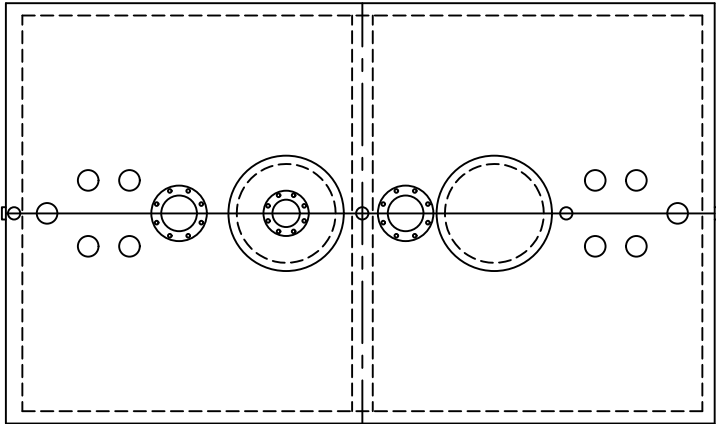
NOTES:
STRIKER PLATES ARE NOT SUPPLIED ON FIREGUARDS® UNLESS SPECIFIED

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TOUCH UP OF FINISHED PAINT IS REQUIRED BY INSTALLATION CONTRACTOR. TOUCH UP PAINT SHIPPED WITH TANK.


SHIP LOOSE

- (1) 8" FLANGED EMERGENCY VENTS (160Z)
- (1) 6" FLANGED EMERGENCY VENTS (160Z)
- (1) 8" FLANGED EMERGENCY VENTS (80Z)



DESIGN DATA	
CAPACITY : 5,000 GALLON SPLIT 2,500//2,500	
TYPE: FIREGUARD® CYLINDRICAL	
FIREGUARD® IS A TRADEMARK OF THE STEEL TANK INSTITUTE	
NO. REQ. – 1	
OPERATING PRESSURE – ATMOSPHERIC	
SPECIFIC GRAVITY = 1.0	
TANK MATERIAL – MILD CARBON STEEL	
THICKNESS – INNER– HEADS: 5/16", SHELL: 1/4"	
THICKNESS – OUTER– HEADS: 5/16", SHELL: 1/4"	
MIN. GAUGE OR THICKNESS (PER U.L. 2085)	
CONSTRUCTION – INNER – LAP WELD OUTSIDE ONLY	
CONSTRUCTION – OUTER – LAP WELD OUTSIDE ONLY	
TANK TEST – INNER AND OUTER 5 PSIG	
INT. FINISH – NONE	
EXT. FINISH – SP-6 BLAST, EPOXY PRIMER, WHITE URETHANE PAINT	
LABEL– UL 2085 AND FIREGUARD® PER sti	



		Highland Tank	
UNLESS NOTED, TOLERANCES ARE +/- 1"			
5,000 GAL 96"Ø CYL. FIREGUARD®			
PATENT: 5,695,089 PATENT: 5,809,650			
CUSTOMER: SPECTRUM DESIGN PC			
PROJECT:			
QUOTE NO:		570185	
SCALE:		CHK'D BY:	
1/4"=1'-0"			
DATE:		DWG. NO.:	
04/03/25		001	
		129275	

Appendix B

Geotechnical Report



Issue Date: 16 November, 2020
F&R Project Number: 62C-016

Report of Geotechnical Engineering Evaluation

Roanoke Public Works Service Center (PWSC), 1000 New Market Road, Roanoke, VA 24012

Prepared By:

M. Hissan, M.S.
Geotechnical Staff Engineer

Reviewed By:

Stephen D. Hjelle, M.S., P.E.
Geotechnical Department Manager

Prepared for:

**City of Roanoke Engineering
Division**



Report of Subsurface Exploration
And Geotechnical Engineering Evaluation
Public Works Service Center (PWSC), Two New Fuel Canopies & Refueling Center
Roanoke, Virginia
F&R Project No. 62C-0164

Prepared For:
City of Roanoke – Engineering Division
215 Church Avenue, S.W.
Roanoke, VA 24011

Prepared By:
Froehling & Robertson, Inc.
1734 Seibel Drive, N.E.
Roanoke, Virginia 24012
Phone: 540.344.7939
Fax: 540.344.3657

January 2025



F&R Project No.: 62C0164

16 January 2025

City of Roanoke,
215 Church Avenue, S.W.
Roanoke, VA 24011

Attention: Mr. James Nuckles, P.E.
Civil Engineer II

Subject: Report of Subsurface Exploration and Geotechnical Engineering Evaluation for
Roanoke PWSC, Two New Fuel Canopies and Refueling Center
Roanoke, VA

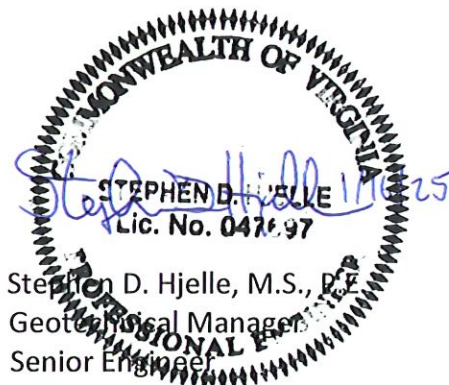
Mr. James,

The purpose of this report is to present the results of the subsurface exploration program and geotechnical engineering analyses undertaken by Froehling & Robertson, Inc. (F&R) in connection with the Roanoke City's Public Work Service Center, including new Wash House and fueling Center as well as two new fuel canopies at fire station Nos.4 and 6. Our services were performed in general accordance with F&R Proposal No. 2462-00024 as authorized by City of Roanoke. The attached report presents our understanding of the project, reviews our exploration procedures, describes existing site and general subsurface conditions, and presents our evaluations, conclusions, and recommendations.

We have enjoyed working with you on this project, and we are prepared to assist you with any quality assurance monitoring and testing services you may desire during construction. Please contact us if you have any questions regarding this report or if we may be of further service.

Sincerely,
FROEHLING & ROBERTSON, INC.

M. Hissan khattak, MSc
Geotechnical Staff Engineer



Stephen D. Hjelle, M.S., P.E.
Geotechnical Manager
Senior Engineer

Distribution: Addressee (1 copy via e-mail: (james.nuckles@roanokeva.gov))

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APPENDICES

APPENDIX A

GBA Important Information about This Geotechnical Engineering Report
Site Vicinity Map (Drawing Nos. 1 & 1.A)

APPENDIX B

Classification of Soils for Engineering Purposes
Key to Boring Log Soil Classification
Soil Classification Chart
Boring Location Plan (Drawing Nos. 2 and 3)
Boring Logs

- (B-1(FH-4) and B-1(FH-6))
- (F-1 through F-6)
- (H-1 through H-4)
- (P-1 through P-11)
- (T-1 through T-3)

APPENDIX C

Laboratory Test Results

APPENDIX D

Rock Sub-Excavation Detail (Drawing No. 4)

APPENDIX E

Extent of Select Backfill (Drawing No. 5)



EXECUTIVE SUMMARY

This Executive Summary is provided as a brief overview of our geotechnical engineering evaluation for the project and is not intended to replace more detailed information contained elsewhere in this report. As an overview, this summary inherently omits details that could be very important to the proper application of the provided geotechnical design recommendations. This report should be read in its entirety prior to implementation into design and construction. The Project Information section of this report should be particularly reviewed by project designers to confirm that the geotechnical engineer's understanding of the project concurs with the current project parameters at the time of project design.

- The subsurface exploration program involved a total of twenty-six (26) borings, categorized as follows: P-1 to P-11, H-1 to H-4, F-1 to F-6, B1 (FH-4, FH-6), and T-1 to T-3. These boring activities were carried out between October 29, 2024, and November 8, 2024. Site subsurface conditions generally consisted of surficial soil underlain by fill/possible existing fill materials, residual/possible residual soils, partially weathered rock, auger refusal/skewing materials, and rock.
- **PWSC Wash House (H-1 to H-4)** the proposed wash house may be supported on shallow foundation systems bearing on approved existing fill, residual soils, or controlled structural fill placed in accordance with our recommendations. We recommend that foundations be designed for a maximum allowable bearing pressure of 1,500 pounds per square foot (psf) for footings bearing on approved subgrades. To reduce the possibility of localized shear failures, spread and strip footings should be a minimum of 3 feet and 2 feet wide, respectively.
- **PWSC Fuel Canopy (F-1 to F-6)** the proposed fuel canopy may be supported on shallow foundation systems bearing on approved existing fill, residual soils, or controlled structural fill placed in accordance with our recommendations. We recommend that foundations be designed for a maximum allowable bearing pressure of 1,500 pounds per square foot (psf) for footings bearing on approved subgrades. To reduce the possibility of localized shear failures, spread and strip footings should be a minimum of 3 feet and 2 feet wide, respectively.
- **Fire Station No. 4 Refueling Center (B-1 (FH-4))** the proposed Fire Station No. 4 Refueling Center may be supported on shallow foundation systems bearing on approved existing fill, residual soils, or controlled structural fill placed in accordance with our recommendations. We recommend that foundations be designed for a maximum allowable bearing pressure of 2,000 pounds per square foot (psf) for footings bearing on approved subgrades. To reduce the possibility of localized shear failures, spread and strip footings should be a minimum of 3 feet and 2 feet wide, respectively.
- **Fire Station No. 6 Refueling Center (B-1 (FH-6))** the proposed Fire Station No. 6 Refueling Center may be supported on shallow foundation systems bearing on



- Heavy-duty: 2" SM-9.0 asphaltic surface course/ 3" IM-19 asphaltic intermediate course/ 10" VDOT 21A crushed stone subbase course.



1.0 INTRODUCTION

1.1 Project Information

The first project site is the existing Roanoke City's Public Work Service Center (PWSC) located at 1802 Courtland Road in Roanoke, Virginia. There is the need to improve the existing infrastructure of the PWSC including a new wash house and refueling center. A site plan illustrating the footprint of the planned new site features was provided in the RFP. The existing wash house will be demolished. There will be a new building, tank pad, canopy structures, and concrete pavement and asphalt pavement sections. The two additional work locations will be the existing Fire Station No. 4 off of Brandon Avenue and Fire Station No. 6 off Jamison Avenue within the City of Roanoke. New fuel canopy structures are planned at both locations. Illustrations of the planned new development footprints are shown in Appendix A (Drawing 2 and Drawing 3).

Previously, provided building load estimates indicate structures may have maximum loads on the order of 250 kips, and wall loads of 8 kips per linear foot (klf). In addition to the planned new site facilities, supporting paved parking areas and drive aisles are planned. Definitive traffic loading information has not been provided at this time. We have assumed that traffic loading will be limited to 50 bus and 2,000 passenger vehicular passes daily as well as a weekly disposal type vehicle in heavy duty pavement areas and that standard duty pavements will be limited to 2000 passenger vehicles and 10 heavy delivery trash type vehicles a week.

1.2 Scope of Services

The purposes of our involvement on this project were to 1) provide general descriptions of the subsurface soil conditions at the locations explored, 2) provide foundation support and lateral earth pressure recommendations, 3) provide preliminary pavement recommendations, and 4) comment on geotechnical aspects of the proposed development including general recommendations regarding site preparation and earthwork. To accomplish the above objectives, we undertook the following scope of services:

- 1) Visited the site to observe existing surface conditions and features and mark boring locations.
- 2) Coordinated utility clearance with Miss Utility services.
- 3) Reviewed and summarized readily available geologic information relative to the project site.
- 4) Executed the requested subsurface exploration consisting of twenty-six (26) standard penetration test (SPT) borings drilled to depths ranging up to 15 feet for pavement areas, up to 25 feet for canopy refueling centers and wash house, and up to 40 feet in tank footprints. At three (3) select boring locations, borings were extended beyond encountered auger refusal conditions an additional 5 feet using rock coring techniques.



- 5) Performed a laboratory testing program consisting of five (5) soil classification tests, three (3) California Bearing Ratio (CBR) with Standard Proctor tests, and ten (10) natural moisture content tests.
- 6) Provided a Seismic Site Class Definition per VCC 2021 Guidance which follows ASCE 7-22's interpretation of shear wave velocity data.
- 7) Evaluated the findings of the test borings and laboratory test results relative to shallow foundation and pavement support and lateral earth pressures and provided appropriate design criteria.
- 8) Prepared this written report summarizing our work on the project, providing descriptions of the subsurface conditions encountered, providing shallow foundation design, pavement design, and lateral earth pressure recommendations, and discussing geotechnical related aspects of the proposed construction. Copies of the test boring logs are included in the attached Appendices.

Our geotechnical scope of services did not include survey services, quantity estimates, preparation of plans or specifications, formal slope stability analyses, shoring recommendations, detention pond considerations, evaluations of earthquake motions, retaining wall design, or the identification and evaluation of wetlands or other environmental aspects of the project site.



2.0 SUBSURFACE EXPLORATION PROCEDURES

The subsurface exploration program consisted of twenty-sixty test borings performed on October 29, 2024, through November 8, 2024 at the approximate locations shown on the attached Boring Location Plan (Drawing Nos. 2 and 3, Appendix B). F&R personnel marked the boring locations in the field by taping and/or otherwise estimating distances from existing site features. Ground surface elevations were interpolated to the nearest foot from readily available topographic information (Source: *Google™*). In consideration of the methods used in their determination, the test boring locations and elevations shown on the attached Boring Location Plan boring logs should be considered approximate.

The test borings were performed in accordance with generally accepted practice using remote track-mounted CME-55 and Dietrich D-50 drill rigs equipped with automatic hammers. Hollow-stem augers were advanced to pre-selected depths, the center plug was removed, and representative soil samples were recovered with a standard split-spoon sampler (1 3/8 in. ID, 2 in. OD) in general accordance with ASTM D 1586, the Standard Penetration Test (SPT). Utilizing an automatic hammer, a weight of 140 pounds is freely dropped from a height of 30 inches to drive the split-spoon sampler into the soil. The number of blows required to drive the split-spoon sampler three consecutive 6-inch increments is recorded, and the blows of the last two increments are summed to obtain the Standard Penetration Resistance (N-value). The N-value provides a general indication of in-situ soil conditions and has been correlated with certain engineering properties of soils. Sometimes the weight of the hammer or the weight of the rod is enough to advance the split spoon sampler. In these instances the N-value is reported as Weight of Hammer (WOH) or Weight of Rod (WOR).

An automatic hammers was used to perform the Standard Penetration Test (SPT) on this project. Research has shown that the Standard Penetration Resistance (N-value) determined by an automatic hammer is different than the N-value determined by the safety hammer method. Most correlations that are published in the technical literature are based on the N-value determined by the safety hammer method. This is commonly termed N_{60} as the rope and cathead with a safety hammer delivers about 60 percent of the theoretical energy delivered by a 140-pound hammer falling 30 inches. Several researchers have proposed correction factors for the use of hammers other than the safety hammer to correct the values to be equivalent to the safety hammer SPT N_{60} -values. The correction is made using the following equation:

$$N_{60} = N_{\text{field}} \times C_E$$

N_{field} in the equation above is the SPT N-value as recorded with the equipment utilized in the field, and for our use of this equation, C_E a relative hammer efficiency ratio, i.e. our automatic hammer efficiency (specifically 82.7% and 87.2% for the CME-55 and D-50 drill rigs used on this project) divided by the theoretical N_{60} efficiency (60%). Accordingly, we recommend a correction factor (C_E) of approximately 1.38 and 1.45 for conversion of the recorded N_{field} values to normalized N_{60} values for the automatic hammers used on this project. We note that the N-values reported on the Boring Logs included in this report are the actual, uncorrected, field derived N-values (N_{field}).



In some soils it is not always practical to drive a split-spoon sampler the full three consecutive 6-inch increments. Whenever more than 50 blows are required to drive the sampler over a 6-inch increment, or the sampler is observed not to penetrate after 50 blows, the condition is called split-spoon refusal. Split-spoon refusal conditions may occur because of obstructions or because the earth materials being tested are very dense or very hard. When split-spoon refusal occurs, often little or no sample is recovered. The SPT N-value for split-spoon refusal conditions is typically estimated as greater than 100 blows per foot (bpf). Where the sampler is observed not to penetrate after 50 blows, the N-value is reported as 50/0. Otherwise, the depth of penetration after 50 blows is reported in inches, i.e. 50/6, 50/2, etc.

Site Borings H-1, F-1 and T-1 were advanced beyond auger refusal using rock-coring techniques generally following procedures outlined in ASTM D 2113. The rock cores were logged by a member of our professional staff and relative hardness, rock type, percent recovery, and rock quality designation (RQD) were measured. The percent recovery is the ratio of the sample length obtained to the total length of the core run, expressed as a percent. The RQD is the percentage of the length of the core recovered in segments 4 or more inches long, compared to the total length of the core run. Care is taken during observation of the core to see that breaks in the core length caused by drilling or handling are ignored in the RQD determination. The percent recovery and RQD are related to rock soundness and continuity. The percent recovery and RQD values are shown on the attached boring logs in Appendix B.

Subsurface water level readings were taken in each of the borings immediately upon completion of the soil drilling process. Upon completion of drilling, the boreholes were backfilled with auger cuttings (soil). Borings in asphalt were capped with asphalt cold patch. Periodic observation and maintenance of the boreholes should be performed due to potential subsidence at the ground surface, as the borehole backfill could settle over time.

Representative portions of the split-spoon soil samples and rock cores obtained throughout the exploration program were classified by a member of our professional staff in general accordance with techniques outlined in the visual-manual identification procedure (ASTM D 2488) and the Unified Soil Classification System (ASTM D 2487). The soil descriptions and classifications discussed in this report and shown on the attached boring logs are generally based on visual observation and should be considered approximate.

Copies of the boring logs are provided and classification procedures are further explained in the attached Appendix B. Split-spoon soil samples recovered on this project will be stored at F&R's office for a period of sixty days. After sixty days, the samples will be discarded unless prior notification is provided to us in writing.



3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Description

The first twenty four (24) borings for the proposed projects are located at and around the Roanoke Public Works Division office at 1802 Courtland Road in Roanoke, Virginia. The two (2) fuel Canopies are located at Roanoke Fire Station No.4 and Fire Station No.6. All the three sites are developed sites with the borings located in undeveloped areas of the site covered with pavement gravel or short maintained grass with landscaping. Buried water, sewer, and electric lines, are reportedly present in the vicinity of the project sites. Other undisclosed buried utilities may also be present.

3.2 Regional Geology

The proposed project site lies within the Valley and Ridge Physiographic province of Virginia. Available geologic references (Geologic Map of the Roanoke and Stewartville Quadrangles, 1981) indicate that the site is underlain by Cambrian-aged rocks of the Rome Formation. The Rome formation is composed of maroon, green, and gray mudstone interbedded with fine-grained shale, sandstone, and siltstone.

Our experience with the Rome Formation in the vicinity of the site indicates that there are medium-bedded, alternating rock layers oriented nearly vertical. The varying susceptibility to weathering creates seams of soil like material sandwiched between weather resistant rock pinnacles. From an excavation and support point of view, the Rome contains near vertical, very hard, layers that may require blasting to excavate, interbedded with soft clay seams that may require undercutting to some depth to provide adequate structural support. Where the test borings encountered a vertical bed of auger refusal material, direct interpretation of the field data might lead one to envision a rock surface between the auger refusal points. Likewise, where vertical soil seams are encountered, a deep soft soil profile might be anticipated. However, in the Rome Formation our experience is that a combination of both conditions exists. Therefore, the borings data should be viewed as a specific example of the subsurface condition at each explored location rather than a broad interpretation of conditions across the site area.

The Rome also contains numerous carbonate intervals of gray dolomite and/or limestone. Carbonate rocks may decompose in the presence of subsurface water that is slightly acidic. This decomposition may leave subsurface voids that may ravel up to the ground surface and form sinkholes. There are numerous variations on potential sinkhole development. Regardless of the mode of development, it is important to note that changes in soil stress and water regime can greatly accelerate sinkhole development. Natural geologic processes that might otherwise occur over thousands of years can occur within several years or even months.



Construction activities such as site grading, building construction, and water impoundment have reportedly caused sinkholes to develop rapidly or to collapse suddenly. This site lies within a geologic formation known to contain solutional features; however, the potential for development of sinkholes, along with the rate at which a sinkhole will develop, are not easily determined or accurately predicted.

3.3 Subsurface Conditions

3.3.1 General

The subsurface conditions discussed in the following paragraphs and those shown on the boring logs represent an estimate of the subsurface conditions based on interpretation of the borings data using normally accepted geotechnical engineering judgments. The transitions between different soil strata are usually less distinct than those shown on the boring logs. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times. Sometimes the relatively small amount of sample recovered does not allow for definitive origin definition. In these instances the term “possible” is applied (i.e. possible fill, possible residuum, etc.). Data from the specific test borings are shown on the attached boring logs in Appendix B. The borings generally encountered an existing sections of surficial soil underlain by fill/possible existing fill materials, residual/possible residual soils, partially weathered rock, auger refusal/skewing materials, and rock. These materials are generally discussed in the following paragraphs.

3.3.2 Surficial Soils

Surficial soils were encountered in Fire Station Borings B-1 (FH-4), B-1 (FH-6), and PWSC pavement Borings, (P-1, P-02 and P-05) to depths ranging from 1 to 6 inches. Surficial soils are typically a dark-colored soil material containing roots, fibrous matter, and/or other organic components, and are generally unsuitable for engineering purposes. We note that no laboratory testing has been performed to determine the organic content or horticultural properties of the observed surficial soil materials. Therefore, the term “surficial soils” is not intended to indicate suitability for landscaping and/or other purposes. The surficial soil depths provided in this report are based on driller observations and should be considered approximate. The transition from surficial soils to underlying materials may be gradual and therefore the observation and measurement of surficial soil depths is subjective. Actual surficial soils depths should be expected to vary across the site.

3.3.3 Existing Fill/Possible Fill Materials

Existing fill materials include those materials deposited by man. Materials identified as fill/possible fill were encountered in Boring B1 (FH-6) to a depth of 2 feet as well as in P-03, P-04 and P-05 below existing site grades to a depth of 3 to 6 feet. The sampled fill materials were generally described as Poorly Graded Sand (SP) and Clayey Sand (SC), with standard penetration resistances (N-values) ranging from 2 to 66 blows per foot (bpf). Higher blow counts may be inflated by gravel content in fill layers.

3.3.4 Residual Soils

Residual soils, formed by the in-place weathering of the parent rock, were encountered below surficial soils and/or possible fill in each of the test borings. Sampled residual soils were



generally described as clays (CH and CL), silts (MH and ML), sands (SC and SP) and gravel (GC). Standard penetration resistances (N-values) within the sampled residuum ranged from 0 to 96 bpf, with typical values of 3 to 16 bpf.

3.3.5 Partially Weathered Rock

Partially weathered rock (PWR) is a transitional material between soil and rock, which retains the relic structure of the rock and has very hard or very dense consistencies. Partially weathered rock is defined, for engineering purposes, as residual material with penetration resistances in excess of 100 blows per foot. PWR was encountered 7 of the borings ranging in depth from 3.5 to 25 feet below existing site grades. Sampled PWR was generally described sands (SC and SP), gravels (GC and GP), and clays (CH and CL) exhibiting a penetration resistances ranging from 50 to 100 blows per 6 inches of split-spoon penetration (50/6) to 50/0.

3.3.6 Auger Refusal/Skewing

Auger refusal occurs when materials are encountered that cannot be penetrated by the soil auger and is normally indicative of a hard or very dense material, such as debris within fill, boulders, cobbles, rock lenses, pinnacles, or the upper surface of bedrock. Auger skewing occurs when the soil augers veer off the previously mentioned materials to the point where they are too skewed to continue. Partially weathered rock, auger refusal and auger skewing were encountered in the majority of our test borings as summarized in the following table.

Partially Weathered Rock (PWR), Auger Refusal (AR), & Auger Skewing (AS) Summary

Boring No's.	Depth to PWR (feet)	Depth of AR/AS (feet)
B-1 (FH-4)	NE	NE
B-1 (FH-6)	NE	NE
F-1	0.5	10**
F-2	2	8.5*
F-3	22	NE
F-4	22	NE
F-5	NE	16
F-6	NE	NE
H-1	12	15**
H-2	NE	16
H-3	NE	12.5
H-4	NE	NE
P-1	NE	NE
P-2	NE	28
P-3	12	NE
P-4	3.5	7
P-5	NE	NE
P-6	NE	NE
P-7	NE	NE
P-8	NE	6



Boring No's.	Depth to PWR (feet)	Depth of AR/AS (feet)
P-9	NE	NE
P-10	NE	8.5*
P-11	NE	6.6
T-1	3.5	10.5**
T-2	NE	32.5
T-3	NE	NE

Notes:

NE = Not Encountered

*Boring terminated due to auger skewing.

**Rock core recovered at this location.

Auger refusal discussed herein is based on conditions impenetrable to our drilling equipment (CME-55 and D-50 drill rigs). Auger refusal conditions with a CME-55 or D-50 drill rig do not necessarily indicate conditions impenetrable to other equipment. Auger refusal conditions may exist intermediate of the boring locations or in unexplored areas of the site.

3.3.7 Rock

Rock coring was performed to further advance Borings F-1, H-1, and T-1 beyond auger refusal/skewing conditions. Rock recovered during the coring operations was generally described as: Gray, slightly to moderately weathered, close to medium fractured, low to moderate angled, very fine grained, very hard, poor to excellent, limestone with trace calcite veins. The percent recovery and RQD values are included on the attached boring logs in Appendix B.

3.3.8 Subsurface Water

Subsurface water for the purposes of this report is defined as water encountered below the existing ground surface. Measurable subsurface water was encountered during the soil drilling process in Boring T-3 at a depth of 32.3 feet. Rest of the borings were noted as dry upon completion of drilling. Fluctuations in subsurface water levels and soil moisture can be anticipated with changes in precipitation, run-off, and the season.

3.4 Laboratory Testing Program

Laboratory testing was performed in general accordance with applicable ASTM International (ASTM) standards. Split spoon samples were tested for moisture content (ASTM D 2216), Atterberg limits (ASTM D 4318), Unconfined Compressive Strength of Rock (ASTM D7012 Method C), and percent passing #200 sieve (ASTM D 1140). Standard Proctor moisture-density relationship (ASTM D 698) testing was performed on recovered bulk samples. The results of the laboratory tests are summarized in the following tables and Standard Proctor test results are included in Appendix C.



USCS Soil Classification Test Summary

Boring No's.	Sample Depth (feet)	Sample Type	% Moisture Content	% Finer than No. 200	Atterberg Limits			USCS Classification
					L.L.	P.L.	P.I.	
P-2	0-10	Bulk	17.3	35.4	30	19	11	Light Brown Clayey SAND (SC) with Rock Fragments
P-6	0-10	Bulk	14.0	35.6	33	19	14	Light Brown Clayey SAND (SC) with Rock Fragments
P-11	0-5	Bulk	10.8	40.6	28	17	11	Light Gray to Tan Clayey SAND (SC) with Rock Fragments
F-4	8.5-10	SS	45.9	98.1	66	30	36	Light Brown Silty CLAY (CH)
T-3	3.5-5	SS	29.5	53.5	36	32	4	Tan Brown Sandy SILT (ML)

SS=Split Spoon Sample

Standard Proctor Test Summary

Boring No's.	Sample Depth (ft)	Natural Moisture Content (%)	Optimum Moisture Content (%)	Maximum Dry Density (pcf)	CBR
P-2	Bulk	17.3	12.8	120.5	18.0
P-6	Bulk	14.0	13.5	121.5	10.3
P-11	Bulk	10.8	10.8	130.0	10.0



Natural Moisture Content Test Summary

Bore No.	Sample Depth (feet)	Sample Type	Natural Moisture Content (%)
P-2	0-10	Bulk	17.3
P-6	0-10	Bulk	14.0
P-11	0-5	Bulk	10.8
F-4	8.5-10	SS	45.9
T-3	3.5-5	SS	29.5
F-6	13.5-15	SS	20.1
P-7	8.5-10	SS	19.9
P-5	3.5-5	SS	15.0
F-3	18.5-20	SS	20.8
H-1	8.5-10	SS	26.7

SS=Split Spoon

Unconfined Compressive Strength of Rock Summary

Boring No's.	Sample Depth (feet)*	Rock UCS (psi)
B-8	16.25-17	3567
B-10	17.75-18.5	4244

*Depth interval noted is the section of rock core from which the cut sample was obtained.



4.0 DESIGN RECOMMENDATIONS

4.1 General

The following evaluations and recommendations are based on our observations at the site, interpretation of the field and laboratory data obtained during this exploration, and our experience with similar subsurface conditions and projects. Soil penetration data has been used to develop an allowable bearing pressure and to estimate settlements using established correlations. Subsurface conditions in unexplored locations may vary from those encountered. If structure locations, loadings, or elevations are changed, we should be notified and requested to confirm and, if necessary, re-evaluate our recommendations.

Determination of an appropriate foundation system for a given structure is dependent on the proposed structural loads, soil conditions, and construction constraints such as proximity to other structures, etc. The subsurface exploration aids the geotechnical engineer in determining the soil stratum appropriate for structural support. This determination includes considerations with regard to both allowable bearing capacity and compressibility of the soil strata. In addition, since the method of construction greatly affects the soils intended for structural support, consideration must be given to the implementation of suitable methods of site preparation, fill compaction, and other aspects of construction.

4.2 Foundation Design

The proposed new structures which includes PWSC wash house, and PWSC fuel canopy may be supported on shallow foundation systems designed for a maximum allowable bearing pressure of 1500 pounds per square foot (psf) for footings bearing on approved subgrade, existing fill materials, undisturbed residual soils, PWR, or newly placed controlled structural fill placed in accordance with our recommendations. To reduce the possibility of localized shear failures, spread and strip footings should be a minimum of 3 feet and 2 feet wide, respectively.

The Fire Station No.4 Canopy may be supported on shallow foundation systems designed for a maximum allowable bearing pressure of 2000 pounds per square foot (psf), and the Fire Station No.6 Canopy may be supported on shallow foundations designed for maximum allowable bearing pressure of 2500 pounds per square foot (psf), for footings bearing on approved subgrade, existing fill materials, undisturbed residual soils, PWR, or newly placed controlled structural fill placed in accordance with our recommendations. To reduce the possibility of localized shear failures, spread and strip footings for both stations should be a minimum of 3 feet and 2 feet wide, respectively.

In some areas, specifically Borings F-1, F-2, P-4, P-8, P-10, P-11 and T-1 partially weathered rock and or shallow auger refusal materials (presumed rock) were encountered with in a depth of 10 feet as shown in Section 3.3.6. The variability of the underlying rock profile and the geologic setting indicates the possibility that a pinnacled condition could exist. If due to unforeseen variability, foundations were to interface with rock, we recommend over-excavating the rock areas by 12 inches and replacement with a select granular backfill or an alternative backfill material approved by the geotechnical engineer to reduce the potential for point loading on the



foundation from the bedrock and possible structural damage (see Rock Sub-Excavation Detail, Drawing No. 4, Appendix D). Further discussion regarding difficult excavation conditions is provided in Report Section 5.4 Excavation Conditions.

Some softer (low consistency) existing fill and residual materials ($N \leq 4$ bpf) were encountered at the PWSC site in Borings P-1, P-5, and P-9, near anticipated pavement as well as in Borings F-4, and F-5 potentially near footing bearing levels. Similar pockets of softer soils may exist in other areas intermediate of our test borings. We note that the recommended design bearing pressure has taken into consideration that some softer materials may be encountered at or very near the foundation or pavement subgrade level and depending on observations at the time of construction (by a representative of the geotechnical engineer), some of these materials may be acceptable for foundation support. However, if very low consistency soil conditions are encountered during foundation or pavement construction, localized undercutting and/or in-place stabilization of subgrades will likely be required.

4.3 Estimated Settlements

Based on the boring data and the assumed structural loading and grading information, we estimate total settlements less than 1 inch, with differential settlement of $\frac{1}{2}$ to $\frac{3}{4}$ the estimated total settlement. The magnitude of differential settlements will be influenced by the variation in excavation requirements across the structure and tank footprints, the distribution of loads, and the variability of underlying soils.

Our settlement analysis was performed on the basis of provided structural loading information and grading assumptions discussed in the project information section of this report. Actual settlements experienced by the structure and the time required for these soils to settle will be influenced by undetected variations in subsurface conditions, actual structural loads, final grading plans, and the quality of fill placement and foundation construction.

4.4 Support on Existing Fills

Material identified as fill/ possible fill was only encountered in Borings B-1(FH-6), P-3, P-4 as well as P-5. During the construction phase if any fill material is found the geotechnical engineer should be informed. In general, construction on existing fill material requires a building owner to accept some risks due to unforeseen conditions within the material. Associated risks may be additional support related costs (i.e. undercutting, etc.) and excessive settlement. To eliminate the risks associated with structural support on existing fill materials, the existing materials could be completely removed and replaced with new controlled structural fill. However, based on the boring data obtained during our subsurface exploration, it appears that controlled structural fill placement as well as foundation, pavement, and slab support on the existing fill materials is possible with a reduced risk to the owner, provided the recommended engineering evaluations provided in this report are performed during construction and with the understanding that some undercutting and/or in-place stabilization may be recommended as a result of those time of construction evaluations. In areas where lower consistency materials are encountered, we anticipate that localized remediation including limited undercutting will be required in these areas at or near foundation bearing grade.



4.5 Ground Floor Slabs

Ground floor slabs may be designed as a slab-on-grade supported by approved existing fill materials, residual soils, PWR, or controlled structural fill subgrades. Slab-on-grade support is contingent upon successful completion of the subgrade evaluation process as described in Site Preparation (Section 5.1).

A vapor retarder should be used beneath ground floor slabs that will be covered by tile, wood, carpet, impermeable floor coatings, and/or if other moisture-sensitive equipment or materials will be in contact with the floor. However, the use of vapor retarders may result in excessive curling of floor slabs during curing. We refer the floor slab designer to ACI 302.1-15, for further discussion on vapor retarders, curling, and the means to reduce concrete shrinkage and curling.

Proper jointing of the ground floor slab is also essential to minimize cracking. ACI suggests that unreinforced, plain concrete slabs may be jointed at spacing's of 24 to 36 times the slab thickness, up to a maximum spacing of 18 feet. Floor slab construction should incorporate isolation joints along bearing walls and around column locations to allow minor movements to occur without damage. Utility or other construction excavations in the prepared floor subgrade should be backfilled to a controlled fill criterion to provide uniform floor support.

4.6 Seismic Site Class Definition

The following recommendations are based on the seismic site class definition per the 2021 Virginia Construction Code (VCC) which has adopted ASCE 7-22 as a model code. Our scope of services did not include a seismic conditions survey to determine site specific shear wave velocity information. Therefore the site's shear wave velocity was estimated based on correlations with Standard Penetration Test resistance values (N-values) to determine a Site Class Definition. We note that the borings for this project were extended to a maximum depth of 40 feet below existing site grades. In-situ shear wave velocity measurements or deep (100 foot) borings were not included in our scope of services.

It should be understood that since shear wave velocities were not directly measured, the geotechnical engineer must evaluate a range of shear wave velocities (+/- 30% of the estimated shear wave velocity), which results in multiple site classes being assessed.

The available subsurface data from our exploration indicates an N-value range of about 0 to greater than 100 bpf within the upper 50 feet below existing site grades. Based on the boring data and in general accordance with the ASCE 7-22, a Site Class Definition "D" should be used to develop the project's Seismic Design Category for further evaluations relative to Earthquake Load design. It should be noted that this site class is based on the assumption that the planned site structures fundamental period will be greater than 0.3 seconds and that the Risk Category is an III.

We note that the above provided Site Classification is based on information available at this time. Should this classification be so impactful to the project cost that further study is warranted, we can perform a site specific geo-physical survey to attain sufficient detail to refine the project's Seismic Site Classification. This additional testing is beyond the currently authorized scope of services for this project.



4.7 Lateral Earth Pressures

The following information is provided to aid in analysis of soil loads on retaining/below grade walls. Earth pressures on walls below-grade are influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction, and the strength of the materials being restrained. The most common conditions assumed for earth retaining wall design are the active and at-rest conditions. Active conditions apply to relatively flexible earth retention structures, such as freestanding walls, where some movement and rotation may occur to mobilize soil shear strength. Walls that are rigidly restrained, such as basement, pit, and tunnel walls, require design using at-rest earth pressures.

A third condition, the passive state, represents the maximum possible pressure when a structure is pushed against the soil, and is used in wall foundation design to help resist active or at-rest pressures. Because significant wall movements are required to develop the passive pressure, the total calculated passive pressure should be reduced by one-half to two-thirds for design purposes.

Based on the subsurface exploration, we envision that site soils will predominately consist of clays (CH and CL) with some sands and rock fragments (SC). Highly-plastic clays and silts (CH and MH) should not be used behind below grade walls and it should be noted that these soil types were encountered at varying depths throughout our exploration. Therefore we do not recommend onsite soils be used behind onsite retaining walls.

As an alternative a select granular material may be used as backfill behind retaining walls. Since an applicable borrow source has not been identified at the time this report was written and because structural design requires the use of established earth pressure parameters prior to construction, we suggest that a select cohesionless backfill material consisting of VDOT No. 57 crushed stone be considered. The select material should be extended laterally from back heel of the wall footing, a minimum distance of 0.5 times the wall height at the top of the wall (see Extent of Select Backfill for Retaining Walls, Drawing No. 5, in Appendix 2).

No. 57 crushed stone should be placed in lifts no greater than 2 feet in thickness and compacted with a backhoe bucket or similar. In addition, we recommend that the No. 57 crushed stone backfill be placed using a separation geotextile at the interface between the coarse-grained crushed stone backfill and existing in-place or new fill soils.

The following table provides lateral earth pressure parameters for a select No. 57 crushed stone alternative.

SELECT ALTERNATIVE - No. 57 CRUSHED STONE

Earth Pressure Conditions	Coefficient	Recommended Equivalent Fluid Pressure (pcf)
Active (K_a)	0.22	24
At-Rest (K_o)	0.36	40

*A crushed stone unit weight of 110 pounds per cubic foot should be used for design calculations.



For design calculations of resistance to sliding (regardless of selected backfill materials), a value of 0.34 should be used as the coefficient of friction between concrete surfaces and the underlying site soils.

Our recommendations assume that the ground surface above the wall is level. The recommended equivalent fluid pressures assume that constantly functioning drainage systems are installed between walls and soil backfill to prevent the accidental buildup of hydrostatic pressures and lateral stresses in excess of those stated. In the event that a functioning drainage system is not installed, the lateral earth pressures should be determined using the buoyant weight of the soil and the appropriate above provided coefficient of earth pressure. Hydrostatic pressures calculated with the unit weight of water (62.4 pcf) should then be added to these earth pressures to obtain the total stresses for design.

Heavy equipment should not operate within 5 feet of below-grade walls to prevent lateral pressures in excess of those cited. If footings or other surcharge loads are located a short distance outside below-grade walls, they may also exert appreciable additional lateral pressures. Surcharge loads should be evaluated using the appropriate active or at-rest pressure coefficients provided above. The effect of surcharge loads should be added to the recommended earth pressures to determine total lateral stresses.

4.8 Pavement Design

The following flexible pavement design recommendations were developed based on the assumed traffic loading information and our understanding of the 1993 AASHTO Guide for Design of Pavement Structures, and the following assumptions:

- A 20-Year design life
- A design CBR of 6.7 (Based on the average lab determined CBR value of 10 reduced by 2/3).
- assumed traffic loading as discussed in the Project Information section
- the pavement subgrade will be prepared in accordance with the recommendations indicated here and in Section 5.1 (Site Preparation) of our previously issued report
- Based on the above assumptions, we recommend using the following standard and heavy duty asphalt pavement sections for preliminary considerations:

PAVEMENT SECTION		STANDARD	HEAVY
LAYER	VDOT SPECIFICATION	THICKNESS (INCHES)	THICKNESS (INCHES)
Surface Course	Asphalt Concrete (SM-9.5)	1.5	2
Base Course	Asphalt Concrete (IM-19)	2.0	3
Subbase Course	Type I Crushed Aggregate (No. 21A or 21B)	6.0	10

Our pavement recommendations are based on pavements being supported on soils with similar CBR characteristics to those used in design or better. We suggest that where off-site borrow



materials are required to develop pavement support areas, the proposed borrow be tested to confirm that its CBR value is sufficient. Fill materials underlying pavements should be placed in accordance with the controlled fill and pavement subgrade recommendations contained in this report. In addition, all pavement subgrades should be evaluated by a representative of the geotechnical engineer prior to base stone placement. If excessive subgrade movement is observed, appropriate improvements such as undercutting and/or in-place stabilization will be required at that time.

We recommend that the asphaltic concrete base course and surface course be placed and compacted in general accordance with the requirements of the Virginia Department of Transportation Road and Bridge Specifications (VDOT Specifications) Section 315. The subbase course should be placed, compacted, and tested in general accordance with the requirements of VDOT Specifications Section 308.

It is recommended that the approaches, loading and unloading areas, main turnaround areas and other areas subjected to excessive starting and stopping motion be supported with concrete pavement constructed in general accordance with ACI 330R-01. For pavements where excessive starting and stopping motions are anticipated, we recommend a rigid pavement system be constructed to a minimum 5-inch thick concrete underlain by a minimum 4-inch thickness of aggregate subbase course consisting of compacted VDOT No. 21A or No. 21B crushed stone.

It is also recommended that any dumpsters be supported on a minimum 6-inch thick concrete pad over a minimum 6-inch thick compacted VDOT No. 21A or No. 21B crushed stone base. The pad should project horizontally in front of the dumpster such that the front wheels of any service truck are supported by the concrete pad during loading and unloading of the dumpster.

4.9 Temporary Excavations

Mass excavations and other excavations required for construction of this project must be performed in accordance with the United States Department of Labor, Occupational Safety and Health Administration (OSHA) guidelines (29 CFR 1926, Subpart P, Excavations) or other applicable jurisdictional codes for permissible temporary side-slope ratios and/or shoring requirements. The OSHA guidelines require daily inspections of excavations, adjacent areas and protective systems by a “competent person” for evidence of situations that could result in cave-ins, indications of failure of a protective system, or other hazardous conditions. All excavated soils, equipment, building supplies, etc., should be placed away from the edges of the excavation at a distance equaling or exceeding the depth of the excavation.

F&R cautions that the actual excavation slopes will need to be evaluated frequently each day by the “competent person” and flatter slopes or the use of shoring may be required to maintain a safe excavation depending upon excavation specific circumstances. The contractor is responsible for providing the “competent person” and all aspects of site excavation safety.



5.0 CONSTRUCTION RECOMMENDATIONS

5.1 Site Preparation

Before proceeding with construction, any existing pavements, surficial soils, roots, and any other deleterious non-soil materials should be stripped or removed from the proposed construction area. During the clearing and stripping operations, positive surface drainage should be maintained to prevent the accumulation of water. Underground utilities should be re-routed to locations a minimum of 10 feet outside of the proposed new structure footprint.

After stripping, areas intended to support new fill, pavements, floor slabs, and foundations should be carefully evaluated by a representative of the geotechnical engineer. At that time, the engineer may require proofrolling of the subgrade with a 20- to 30-ton loaded truck or other pneumatic-tired vehicle of similar size and weight. Proofrolling should be performed during a time of good weather and not while the site is wet, frozen, or severely desiccated. The purpose of the proofrolling is to locate soft, weak, or excessively wet soils present at the time of construction and provides an opportunity for the geotechnical engineer to locate inconsistencies intermediate of our boring locations.

Particular attention should be given to existing/abandoned utility trenches within the new structure footprint. For obvious reasons, existing underground utility trenches were avoided in our drilling program. Our experience is that utility trenches are sometimes backfilled with very little compactive effort. Where utility lines are removed, the trench subgrade should be verified by an F&R representative prior to backfilling in accordance with the controlled structural fill recommendations provided in this report. If in-place abandonment is preferred, open conduits, pipes, or culverts should be grouted full and the overlying in-place backfill evaluated prior to at-grade and/or new fill construction.

It should be noted that low consistency soils ($N \leq 5$ bpf) were encountered at varying depths through the subsurface profile. Where lower consistency soils are encountered and depending on how these materials respond during the proofrolling operations, some in-place densification, undercutting, or in-place stabilization may be required prior to new fill placement or for foundation/slab support. The actual extent of densification, undercutting and/or in-place stabilization required can best be determined by a representative of the geotechnical engineer at the time of construction. Once the site has been properly prepared, at-grade construction may proceed.

5.2 Foundation Construction

All foundation subgrades should be observed, evaluated, and tested for the design bearing pressure by a representative of the geotechnical engineer after excavation and prior to reinforcement steel placement. While not envisioned to be extensive, some localized undercutting and/or in-place stabilization of foundation subgrades may be required. The actual need for, and extent of, undercutting should be based on field observations made by a representative of the geotechnical engineer at the time of construction.



Excavations for footings should be made in such a way as to provide bearing surfaces that are firm and free of loose, soft, wet, or otherwise disturbed soils. Foundation concrete should not be placed on frozen or saturated subgrades. If such materials are allowed to remain below foundations, settlements will increase. Foundation excavations should be concreted as soon as practical after they are excavated. If an excavation is left open for an extended period, for example overnight or if precipitation is eminent, a thin mat of lean concrete should be placed over the bottom to minimize damage to the bearing surface from weather or construction activities. Water should not be allowed to pond in any excavation, or in areas planned for earthwork in the near future..

5.3 Controlled Structural Fill

Based on the boring data, controlled structural fill may be constructed using the non-organic on-site soils. However, if encountered, CH and MH soils should not be used for below grade wall backfill. If needed, off-site borrow materials should generally have a classification of CL, ML, SM, or SC as defined by the Unified Soil Classification System (USCS). Other materials may be suitable for use as controlled structural fill material and should be individually evaluated by the geotechnical engineer. Controlled structural fill should be free of boulders, organic matter, debris, or other deleterious materials and should have a maximum particle size no greater than 3 inches. In addition, we recommend a minimum Standard Proctor (ASTM D 698) maximum dry density of 90 pounds per cubic feet for fill materials

As with proof rolling, structural fill placement should also be performed during a time of good weather and not while the site is wet, frozen, or severely desiccated. Fill materials should be placed in horizontal lifts with a maximum height of 8 inches loose measure. New fill should be adequately keyed into stripped and scarified subgrade soils and should, where applicable, be benched into the existing slopes. During fill operations, positive surface drainage should be maintained to prevent the accumulation of water. We recommend that structural fill be compacted to at least 95 percent of the Standard Proctor maximum dry density. In confined areas such as utility trenches, portable compaction equipment and thin lifts of 3 to 4 inches may be required to achieve specified degrees of compaction. Each lift of fill should be tested to confirm that the recommended degree of compaction is attained.

In general, we recommend that the moisture content of fill soils be maintained within three percentage points of the optimum moisture content as determined from the Standard Proctor test. We recommend that the contractor have equipment on site during earthwork for both drying and wetting of fill soils. Moisture control may be especially difficult during winter months or extended periods of rain. Attempts to work the soils when wet can be expected to result in deterioration of otherwise suitable soil conditions, both existing soils or previously placed and properly compacted fill. Where construction traffic or weather has disturbed the subgrade, the upper 8 inches of soils (or more if warranted) intended for structural support should be scarified and re-compacted. Each lift of fill should be tested to confirm that the recommended degree of compaction is attained.



5.4 Excavation Conditions

According to the test boring data, partially weathered rock and potential shallow rock (due to auger refusal or skewing conditions) were potentially encountered close to the anticipated foundation bearing levels of the buildings. Though foundations are not anticipate to interface with rock, difficult excavation conditions could be encountered during site development. The following recommendations are provided relative to difficult excavation conditions.

In mass excavations for general site work, hard or dense soils (soils with standard penetration resistances of 30 or more blows per foot) can usually be removed by ripping with a single-tooth ripper attached to a large crawler tractor or by breaking it out with a large front-end loader. In addition, in mass excavations PWR exhibiting a standard penetration resistance of 50 blows per 6 inches to 2 inches of split-spoon penetration can usually be removed using large backhoes. In confined excavations such as foundations, utility trenches, elevator pits, etc., removal of partially weathered rock typically requires use of large backhoes, pneumatic spades, or light blasting. Refusal materials and PWR exhibiting a penetration resistance of 50 blows per 1 inch or less will normally require blasting for removal in all types of excavations. Any blasting in footing excavations must be done carefully to prevent damage to the bearing materials.

Prior to any blasting operations, we recommend conducting a pre-blast survey for all structures within 300 feet. A written blasting program should then be submitted by the blasting subcontractor for review by the architect/structural engineer. Peak particle velocities produced by blasting should be measured adjacent to the foundations of nearby structures and should be restricted to levels of no more than 0.5 to 1.0 inches per second, depending on the distance from the blasting. Air blast levels should also be monitored and restricted to less than 130 to 140 decibels. Trial blasting should be required to confirm that ground motions are reasonably predictable. All work should be performed by an experienced licensed contractor. To reasonably measure quantities of rock, you may wish to use a land surveyor to cross-section the upper surface of rock prior to blasting.

The definition of rock can be a source of conflict during construction. The following definitions have been incorporated into specifications on other projects and are provided for your general guidance:

GENERAL EXCAVATION:

- Rip Rock - Any material that cannot be removed by scrapers, loaders, pans, dozers, or graders; and requires the use of a single-tooth ripper mounted on a crawler tractor having a minimum draw bar pull rated at not less than 56,000 pounds.
- Blast Rock - Any material which cannot be excavated with a single-tooth ripper mounted on a crawler tractor having a minimum draw bar pull rated at not less than 56,000 pounds (Caterpillar D-8K or equivalent) or by a Caterpillar 977 front-end loader or equivalent; and occupying an original volume of at least one (1) cubic yard.



TRENCH EXCAVATION:

Blast Rock - Any material which cannot be excavated with a backhoe having a bucket curling force rated at not less than 25,700 pounds (Caterpillar Model 225 or equivalent), and occupying an original volume of at least one-half (1/2) cubic yard.

5.5 Subsurface Water Conditions

Subsurface water for the purposes of this report is defined as water encountered below the existing ground surface. Based on the subsurface water data obtained during our exploration program and the anticipated grading requirements, we generally anticipate that subsurface water will not be encountered during anticipated earthwork or shallow foundation excavations at the site. However, we note that groundwater conditions were encountered above the PWR/rock profile and some soil samples at this strata level were noted as “wet”. The contractor should be prepared to dewater during construction if conditions vary from those encountered during our exploration. Fluctuations in subsurface water levels and soil moisture can be anticipated with changes in precipitation, runoff, and the season.



6.0 CONTINUATION OF SERVICES

We recommend that we be given the opportunity to review the grading plan and project specifications when construction documents approach completion. This review evaluates whether the recommendations and comments provided herein have been understood and properly implemented. We also recommend that Froehling & Robertson, Inc. be retained for professional follow-up consulting services during construction of the project. Our continued involvement on the project helps provide continuity for proper implementation of the recommendations discussed herein.



7.0 LIMITATIONS

This report has been prepared for the exclusive use City of Roanoke Engineering division. Or their agent, for specific application to the Roanoke City Public Works and Wash house refueling Center, Roanoke, Virginia, in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made. Our conclusions and recommendations are based on design information furnished to us, the data obtained from the previously described subsurface exploration program, and generally accepted geotechnical engineering practice. The conclusions and recommendations do not reflect variations in subsurface conditions which could exist intermediate of the boring locations or in unexplored areas of the site. Should such variations become apparent during construction, it will be necessary to re-evaluate our conclusions and recommendations based upon on-site observations of the conditions.

Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, experienced geotechnical engineers should evaluate earthwork and foundation construction to verify that the conditions anticipated in design actually exist. Otherwise, we assume no responsibility for construction compliance with the design concepts, specifications, or recommendations.

In the event that changes are made in the design or location of the proposed structures, the recommendations presented in the report shall not be considered valid unless the changes are reviewed by our firm and conclusions of this report modified and/or verified in writing. If this report is copied or transmitted to a third party, it must be copied or transmitted in its entirety, including text, attachments, and enclosures. Interpretations based on only a part of this report may not be valid. This report contains 22 pages of text and the attached appendices.

APPENDIX A

Important Information about This Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be, and, in general, if you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying it.* A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may

perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old*.

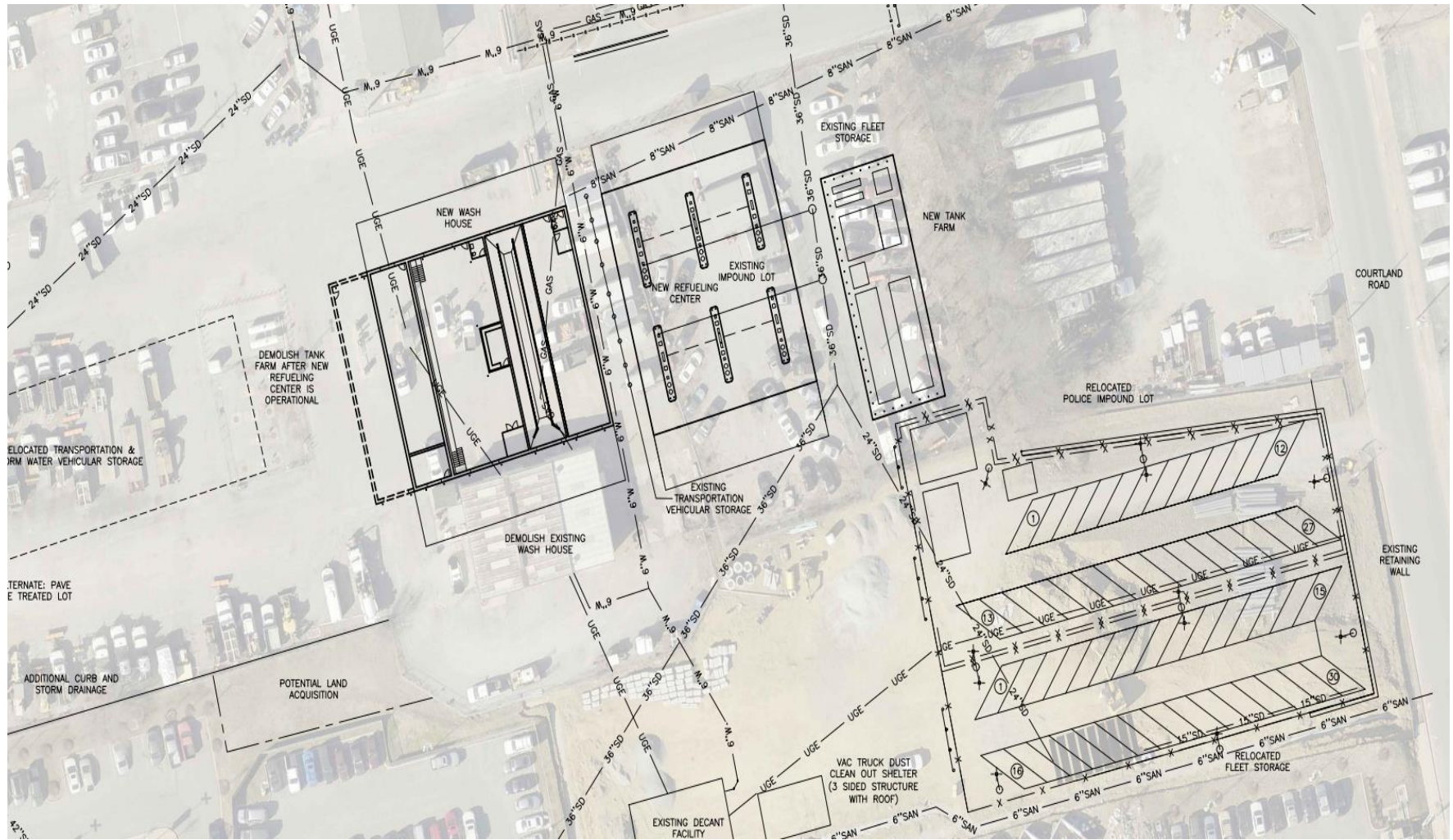
Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration*. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists*.



Telephone: 301/565-2733

e-mail: info@geoprofessional.org www.geoprofessional.org



Note: Adapted from provided existing site plan and readily available aerial imagery (Source: *Google™*). No claim is made to the accuracy of the base map information. The boring locations shown should be considered approximate.



FROEHLING & ROBERTSON, INC.

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1734 Seibel Drive, NE

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T 540.344.7939 | F 540.344.3657

City of Roanoke
Public Works Wash House & Refueling Center

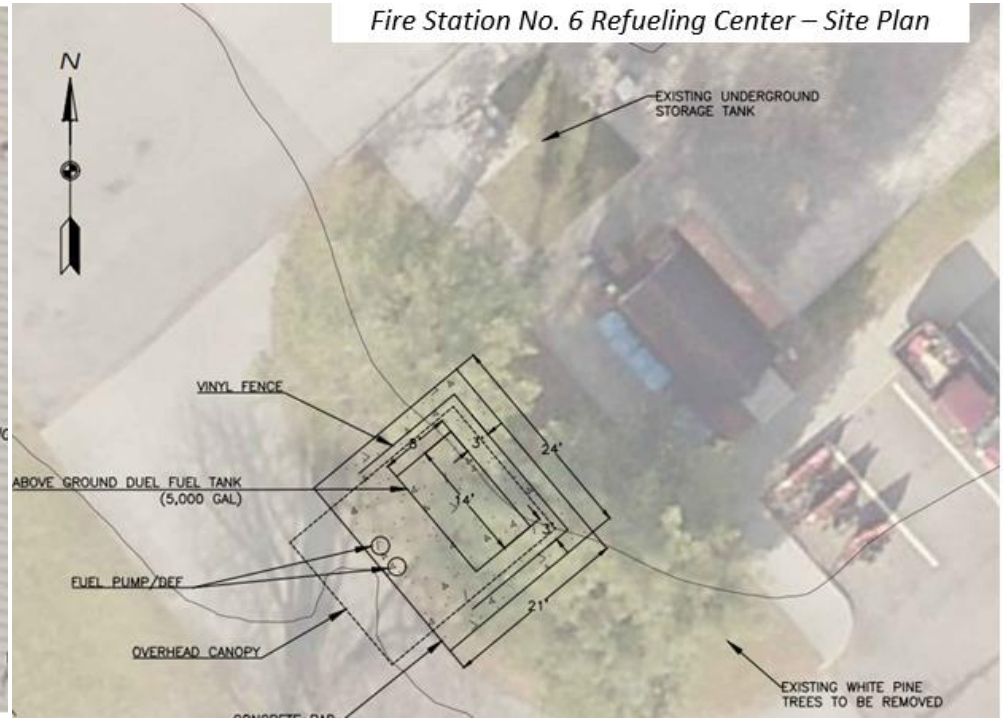
DATE: 07/27/2027

SCALE: As Shown (Approx.)


DRAWN: KMD 62C-0164

Sheet 1 of 1
Plan

DRAWING NO.
1



Note: Adapted from provided existing site plan and readily available aerial imagery (Source: *Google™*). No claim is made to the accuracy of the base map information. The boring locations shown should be considered approximate.

<div> <div> <div>SINCE</div> <div>  <div>1881</div> </div> </div> <div> <div>FROEHLING & ROBERTSON, INC.</div> <div>Engineering Stability Since 1881</div> <div>1734 Seibel Drive, NE</div> <div>Roanoke, Virginia 24012-5624 USA</div> <div>T 540.344.7939 F 540.344.3657</div> </div> </div>	DATE: 7/27/2022	
	SCALE: As Shown (Approx.)	
	DRAWN: KMD	62C-0164
City of Roanoke PW2C22Fire Station Refueling Canopies	Sheet 2 of 2 Plans	DRAWING NO. 1.A

APPENDIX B



CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES
ASTM Designation: D 2487
 (Based on the Unified Soil Classification System)

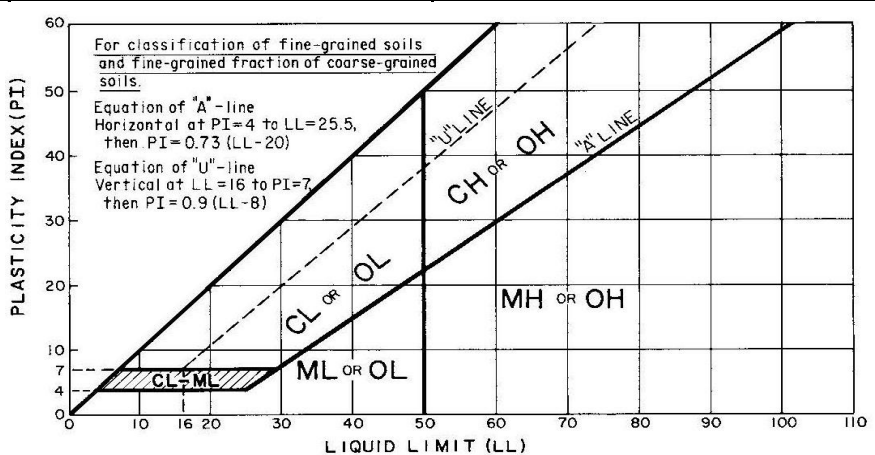
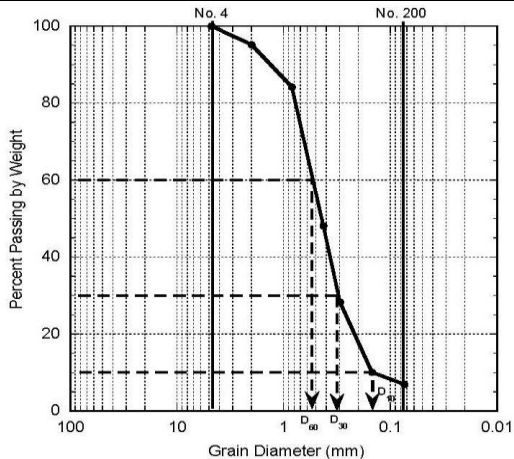
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Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification	
				Group Symbol	Group Name ^B
COARSE-GRAINED SOILS More than 50% retained on the No. 200 sieve	Gravels (More than 50% of coarse fraction retained on No. 4 sieve)	Clean gravels (Less than 5% fines ^C)	$Cu \geq 4$ and $1 \leq Cc \leq 3^D$	GW	Well-graded gravel ^E
			$Cu < 4$ and/or $[Cc < 1 \text{ or } Cc > 3]^D$	GP	Poorly graded gravel ^E
		Gravels with fines (More than 12% fines ^C)	Fines classify as ML or MH	GM	Silty gravel ^{E,F,G}
			Fines classify as CL or CH	GC	Clayey gravel ^{E,F,G}
	Sands (50% or more of coarse fraction passes No. 4 sieve)	Clean Sands (Less than 5% fines ^H)	$Cu \geq 6$ and $1 \leq Cc \leq 3^D$	SW	Well-graded sand ^I
			$Cu < 6$ and/or $[Cc < 1 \text{ or } Cc > 3]^D$	SP	Poorly graded sand ^I
		Sands with fines (More than 12% fines ^H)	Fines classify as ML or MH	SM	Silty sand ^{F,G,I}
			Fines classify as CL or CH	SC	Clayey sand ^{F,G,I}
FINE-GRAINED SOILS 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	Inorganic	$PI > 7$ and plots on or above "A" line ^J	CL	Lean clay ^{K,L,M}
			$PI < 4$ or plots below "A" line ^J	ML	Silt ^{K,L,M}
		Organic	$\frac{\text{Liquid limit} - \text{oven dried}}{\text{Liquid limit} - \text{not dried}} < 0.75$	OL	Organic clay ^{K,L,M,N} Organic silt ^{K,L,M,O}
	Silts and Clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line	CH	Fat clay ^{K,L,M}
			PI plots below "A" line	MH	Elastic silt ^{K,L,M}
		Organic	$\frac{\text{Liquid limit} - \text{oven dried}}{\text{Liquid limit} - \text{not dried}} < 0.75$	OH	Organic clay ^{K,L,M,P} Organic silt ^{K,L,M,Q}
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic in odor			PT	Peat

- ^A Based on the material passing the 3-in. (75-mm) sieve.
^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
^C Gravels with 5 to 12 % fines require dual symbols:
 GW-GM well-graded gravel with silt
 GW-GC well-graded gravel with clay
 GP-GM poorly graded gravel with silt
 GP-GC poorly graded gravel with clay
^D $Cu = \frac{D_{60}}{D_{10}}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
^E If soil contains $\geq 15\%$ sand, add "with sand" to group name.
^F If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

- ^G If fines are organic, add "with organic fines" to group name.
^H Sands with 5 to 12 % fines require dual symbols:
 SW-SM well-graded sand with silt
 SW-SC well-graded sand with clay
 SP-SM poorly graded sand with silt
 SP-SC poorly graded sand with clay
^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.
^J If Atterburg limits plot in hatched area, soil is a CL-ML, silty clay.

- ^K If soil contains 15 to $< 30\%$ plus No. 200, add "with sand" or "with gravel", whichever is predominant.
^L If soil contains $\geq 30\%$ plus No. 200, predominantly sand, add "sandy" to group name.
^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel add "gravelly" to group name.
^N $PI \geq 4$ and plots on or above "A" line.
^O $PI < 4$ or plots below "A" line.
^P PI plots on or above "A" line.
^Q PI plots below "A" line.





KEY TO BORING LOG SOIL CLASSIFICATION

Particle Size and Proportion

Visual descriptions are assigned to each soil sample or stratum based on estimates of the particle size of each component of the soil and the percentage of each component of the soil.

Particle Size		Proportion		
Descriptive Terms		Descriptive Terms		
Soil Component	Particle Size	Component	Term	Percentage
Boulder	> 12 inch	Major	Uppercase Letters (e.g., SAND, CLAY)	> 50%
Cobble	3 - 12 inch	Secondary	Adjective (e.g., sandy, clayey)	20% - 50%
Gravel-Coarse	3/4 - 3 inch			
-Fine	#4 - 3/4 inch			
Sand-Coarse	#10 - #4	Minor	Some Little Trace	15% - 25%
-Medium	#40 - #10			
-Fine	#200 - #40			
Silt (non-cohesive)	< #200			
Clay (cohesive)	< #200			5% - 15%
				0% - 5%

Notes:

- Particle size is designated by U.S. Standard Sieve Sizes
- Because of the small size of the split-spoon sampler relative to the size of gravel, the true percentage of gravel may not be accurately estimated.

Density or Consistency

The standard penetration resistance values (N-values) are used to describe the density of coarse-grained soils (GRAVEL, SAND) or the consistency of fine-grained soils (SILT, CLAY). Sandy silts of very low plasticity may be assigned a density instead of a consistency.

DENSITY		CONSISTENCY	
Term	N-Value	Term	N-Value
Very Loose	0 - 4	Very Soft	0 - 1
Loose	5 - 10	Soft	2 - 4
Medium Dense	11 - 30	Medium Stiff	5 - 8
Dense	31 - 50	Stiff	9 - 15
Very Dense	> 50	Very Stiff	16 - 30
		Hard	> 30

Notes:

- The N-value is the number of blows of a 140 lb. Hammer freely falling 30 inches required to drive a standard split-spoon sampler (2.0 in. O.D., 1-3/8 in. I.D.) 12 inches into the soil after properly seating the sampler 6 inches.
- When encountered, gravel may increase the N-value of the standard penetration test and may not accurately represent the in-situ density or consistency of the soil sampled.


SOIL CLASSIFICATION CHART

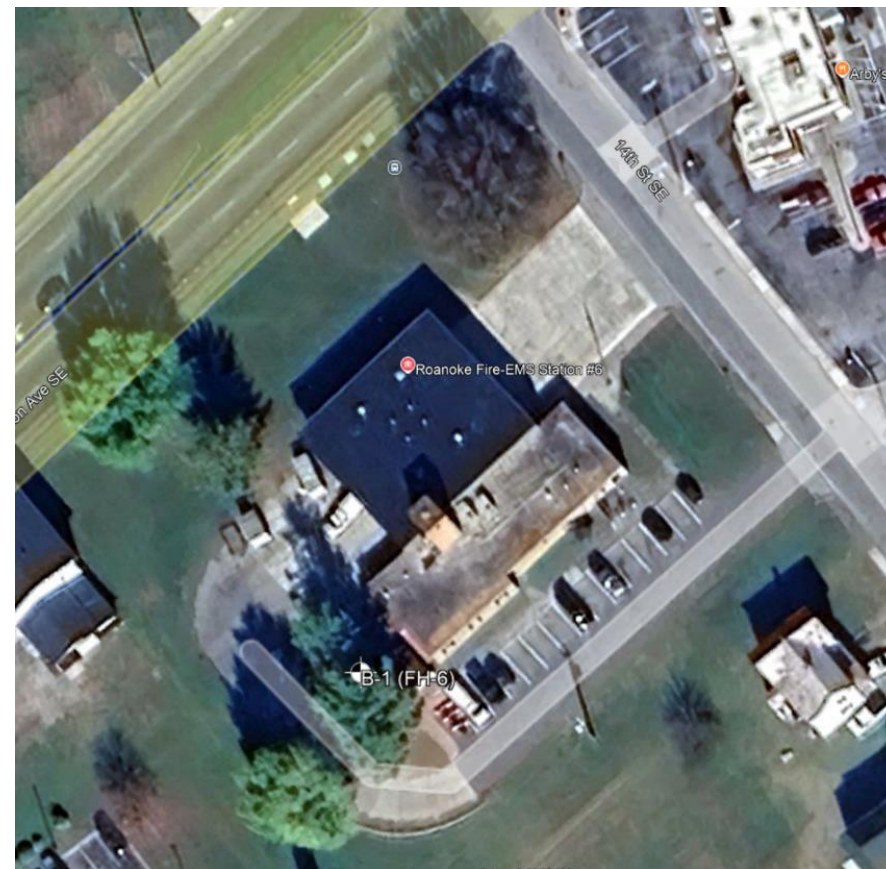
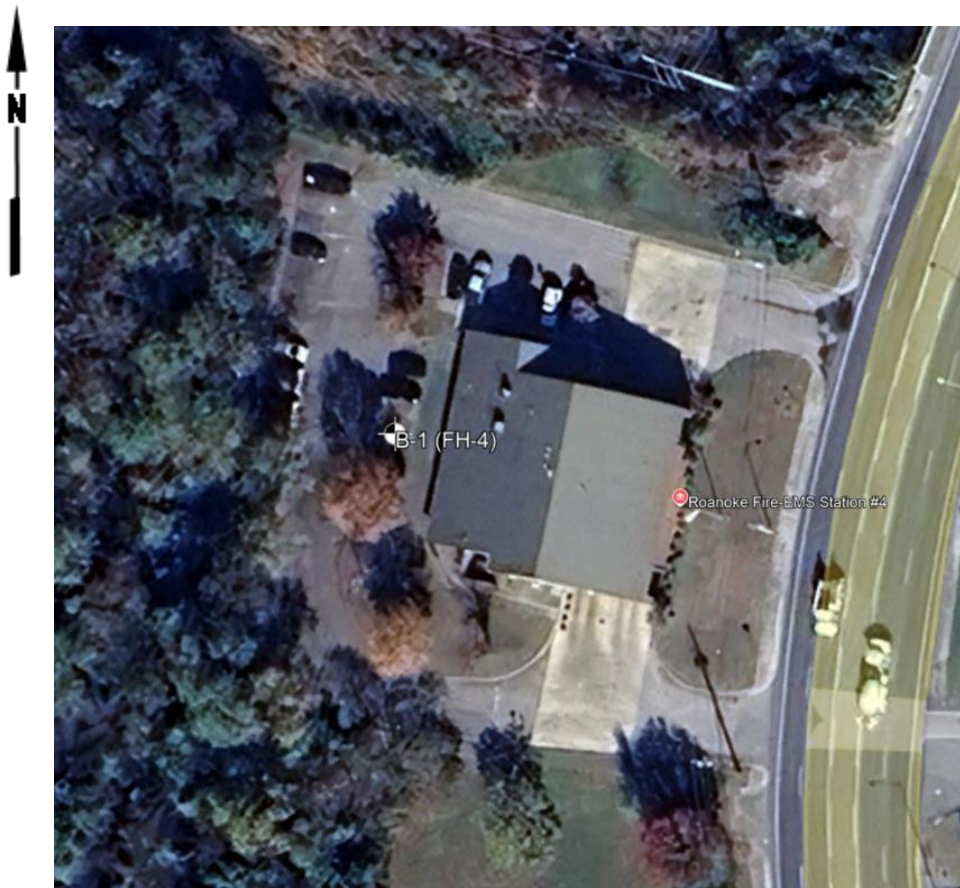
MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
EXISTING FILL				FILL	EXISTING FILL MATERIALS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS



Note: Adapted from provided existing site plan and readily available aerial imagery (Source: *Google™*). No claim is made to the accuracy of the base map information. The boring locations shown should be considered approximate.

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			SCALE: As Shown (Approx.)
			DRAWN: KMD 62C-0164
<p>City of Roanoke Roanoke PW/C Fire station & Refueling Center Roanoke, Virginia</p>		<p>BORING LOCATION PLAN</p>	<p>DRAWING NO.</p> <p>2</p>



Note: Adapted from provided existing site plan and readily available aerial imagery (Source: *Google™*). No claim is made to the accuracy of the base map information. The boring locations shown should be considered approximate.



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City of Roanoke
PW2C22Fire stations Refueling Canopies
Roanoke, Virginia

DATE: 3/22/2022

SCALE: As Shown (Approx.)

DRAWN: KMD 62C-0164

BORING
LOCATION
PLAN

DRAWING NO.

3



FROEHLING & ROBERTSON

Engineering Stability Since 1881

BORING LOG

Boring: B-1 (FH-4) (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 25.0'

Boring Location: See Boring Location Plan

Latitude: 37.2673583333333

Longitude: 80.0106055555556

Drilling Method: 3.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.38

Date Drilled: 11/8/24

Driller: S. Douglas

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.4	5" Surficial Soil	4-4-3	0.0		No subsurface water was encountered immediately upon completion of drilling.
		POSSIBLE RESIDUUM: Sampled loose, orange, moist, fine to coarse, CLAYEY SAND (SC)		1.5	7	
	2.0	RESIDUUM: Sampled loose, orange, moist, fine to coarse, CLAYEY SAND (SC)	3-3-4	2.0	7	
			3-4-4	3.5	8	
				5.0		
	6.0	Very loose to loose, orange-tan, moist, fine to coarse, CLAYEY SAND (SC)	3-2-2	6.5	4	
				8.0		
			2-2-3	8.5	5	
	10.0	Very loose to loose, orange-tan, moist, fine to coarse, CLAYEY SAND (SC)		10.0		
			3-2-2	13.5	4	
				15.0		
						Cave-in at 17.5'.
			2-3-3	18.5	6	
				20.0		
			2-3-4	23.5	7	
	25.0	Boring Terminated at 25'		25.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON

Engineering Stability Since 1881

BORING LOG

Boring: B-1 (FH-6) (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 25.0'

Boring Location: See Boring Location Plan

Latitude: 37.2710944444444

Longitude: 79.9205556656

Drilling Method: 3.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.38

Date Drilled: 11/8/24

Driller: S. Douglas

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.3	4" Surficial Soil	4-5-6	0.0		No subsurface water was encountered immediately upon completion of drilling.
		FILL: Sampled as medium dense, yellow with tan-brown, moist, fine to coarse, CLAYEY SAND (SC) with organics gravel/rock and shell fragments		1.5	11	
	2.0		4-9-8	2.0	17	
	3.5	RESIDUUM: Medium dense, orange-tan, moist, fine to coarse, CLAYEY SAND (SC) with gravel/rock shell fragments	6-16-11	3.5	27	
		Medium dense, orange-tan, moist, fine to coarse, CLAYEY SAND (SC) with gravel/rock shell fragments		5.0		Cave-in at 15.5'.
			4-5-14	6.5	19	
			4-7-9	8.0		
				8.5	16	
				10.0		
	12.0	Medium dense, orange-tan, moist, fine to coarse, SILTY SAND (SM) with gravel/rock shell fragments				
			6-7-5	13.5	12	
				15.0		
			10-27-39	18.5	66	
				20.0		
			12-31-37	23.5	68	
	25.0	Boring Terminated at 25'		25.0		

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON

Engineering Stability Since 1881

BORING LOG

Boring: F-1 (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 15.0'

Boring Location: See Boring Location Plan

Latitude: 37.2867611111111

Longitude: 79.9364277777778

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/30/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.5	6" Gravel	12-15 -50/4	0.0	100+	No subsurface water was encountered immediately upon completion of drilling.
		PARTIALLY WEATHERED ROCK: Sampled as very dense, orange brown and gray, moist, fine to coarse CLAYEY SAND (SC) with little fine gravel		1.5		
			50/3	2.0	100+	
			50/4	3.5	100+	
				5.0		
			31-50/4	6.5	100+	
				8.0		
			50/2	8.5	100+	
	10.0	Auger Refusal at 10'		10.0		
		ROCK: Gray, slightly weathered, close to medium fractures, low to high angle, very fine grained, very hard, poor, LIMESTONE	REC=100% RQD=33%			
	15.0	Coring Terminated at 15'		15.0		

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 8.5'

Boring Location: See Boring Location Plan

Latitude: 37.2867416666667

Longitude: 79.9365388888889

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/30/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.8	9" Gravel	12-40-39	0.0	79	No subsurface water was encountered immediately upon completion of drilling.
	2.0	RESIDUUM: Very dense, light gray-tan, moist, fine to coarse, POORLY -GRADED SAND (SP) with gravel/rock shell fragments		1.5		
				2.0	100+	
		PARTIALLY WEATHERED ROCK: Sampled as very dense, orange brown and gray, moist, fine to coarse CLAYEY SAND (SC) with little fine gravel	36-50/4			
				3.5	100+	
			47-50/5			
				5.0		Cave-in at 5'.
				6.5	100+	
			50/4			
				8.0		
	8.5	Auger Skew at 8.5'				



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BORING LOG

Boring: F-3 (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 25.0'

Boring Location: See Boring Location Plan

Latitude: 37.2867166666667

Longitude: 79.9366444444444

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/30/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.7	8" Gravel	10-10-30	0.0		No subsurface water was encountered immediately upon completion of drilling.
	1.5	POSSIBLE RESIDUUM: Dense, brown, moist, fine to coarse, CLAYEY SAND (SC), trace gravel/rock fragments		1.5	40	
		RESIDUUM: Loose to dense, brown, moist, fine to coarse, CLAYEY SAND (SC), with gravel/rock fragments	5-7-7	2.0	14	
			11-8-6	3.5	14	
				5.0		
			4-3-5	6.5	8	
	8.0	Loose to dense, brown, moist, fine to coarse, CLAYEY SAND (SC), with gravel/rock fragments		8.0		
			19-34-34	8.5	68	
				10.0		
				13.5	24	
				15.0		
				18.5	8	
			2-4-4	20.0		
	22.0	PARTIALLY WEATHERED ROCK: Sampled as very dense, orange brown and gray, moist, fine to coarse LEAN CLAY (CL) with fine gravel		23.5		Cave-in at 22'.
			19-16-50/5		100+	
	25.0	Boring Terminated at 25'		25.0		

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



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BORING LOG

Boring: F-4 (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 25.0'

Boring Location: See Boring Location Plan

Latitude: 37.2865833333333

Longitude: 79.9365972222222

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/30/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.8	9" Gravel	8-4-3	0.0	7	No subsurface water was encountered immediately upon completion of drilling.
		RESIDUUM: Firm, light brown, moist, CLAYEY SAND (CL) with gravel/rock shell fragments		1.5		
			2-2-3	2.0	5	
			2-3-4	3.5	7	
				5.0		
			1-1-1	6.5	2	
	8.0	Soft, brown, moist, FAT CLAY (CH)		8.0		
			1-1-2	8.5	3	
				10.0		
	12.0	Loose, orange-brown, wet, fine to coarse, CLAYEY SAND (SC), with gravel/rock fragments				
			3-2-3	13.5	5	
				15.0		
			4-4-4	18.5	8	
				20.0		
	22.0	PARTIALLY WEATHERED ROCK: Sampled as very dense, orange brown and gray, moist, FAT CLAY (CH) contains shale fragments				
			2-1-50/3	23.5	100+	
	25.0	Boring Terminated at 25'		25.0		Cave-in at 21'.

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON

Engineering Stability Since 1881

BORING LOG

Boring: F-5 (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 16.0'

Boring Location: See Boring Location Plan

Latitude: 37.2866027777778

Longitude: 79.9364888888889

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/30/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.6	7" Base Stone	8-10-12	0.0	22	No subsurface water was encountered immediately upon completion of drilling.
		RESIDUUM: Medium dense, brown, moist, fine to coarse, CLAYEY SAND (SC), contains gravel/rock fragments		1.5		
	2.0	Soft, orange, moist, LEAN CLAY (CL), contains gravel/rock fragments	1-1-1	2.0	2	
			1-1-1	3.5	2	
				5.0		
	6.0	Medium dense, brown, moist, fine to coarse, CLAYEY SAND (SC), contains gravel/rock fragments	5-6-9	6.5	15	
				8.0		
	8.0	Very soft, dark brown, moist, LEAN CLAY (CL), contains rock and shell fragments	2-1-0	8.5	1	
				10.0		
	12.0	Medium dense, brown, moist, fine to coarse, CLAYEY SAND (SC), contains gravel/rock fragments	2-2-15	13.5	17	
				15.0		Cave-in at 15'.
	16.0	Auger Refusal at 16'				

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON

Engineering Stability Since 1881

BORING LOG

Boring: F-6 (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 25.0'

Boring Location: See Boring Location Plan

Latitude: 37.286625

Longitude: 79.9363777777778

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/30/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.5	6" Gravel	16-14-18	0.0		No subsurface water was encountered immediately upon completion of drilling.
		RESIDUUM: Dense, brown, moist, fine to coarse, CLAYEY SAND (SC), with rock/shell fragments		1.5	32	
			21-33-42	2.0	75	
	3.5	Medium dense to dense, brown, moist, fine to coarse, CLAYEY SAND (SC), with rock/shell fragments	19-24-20	3.5	44	
				5.0		
			18-21-22	6.5	43	
				8.0		
			16-13-12	8.5	25	
				10.0		
	12.0	Medium dense to dense, dark brown, moist, fine to coarse, CLAYEY SAND (SC), with rock/shell fragments				
			5-6-7	13.5	13	
				15.0		
			21-14-14	18.5	28	
				20.0		
	22.0	Dense, dark brown, moist, fine to coarse, CLAYEY GRAVEL (GC), with rock/shell fragments				Cave-in at 22.5'.
			8-15-16	23.5	31	
	25.0	Boring Terminated at 25'		25.0		

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON

Engineering Stability Since 1881

BORING LOG

Boring: H-1 (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 20.0'

Boring Location: See Boring Location Plan

Latitude: 37.28675

Longitude: 79.9368027777778

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/31/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.3	3.5" Asphalt				No subsurface water was encountered immediately upon completion of drilling.
	1.0	8" Base Stone				
		POSSIBLE RESIDUUM: Loose, dark-brown, moist, fine to coarse, CLAYEY SAND (SC), contains gravel/rock fragments	3-3-4	2.0	7	
	3.5	RESIDUUM: Loose to medium dense, brown, moist, fine to coarse, CLAYEY SAND (SC), contains rock/shell fragments	3-3-2	3.5	5	
				5.0		
			5-8-8	6.5	16	
	8.0	Stiff, brown, moist, fine, sandy, FAT CLAY (CH)		8.0		
			6-9-6	8.5	15	
				10.0		
	12.0	PARTIALLY WEATHERED ROCK: Sampled as hard, orange brown and gray, moist, FAT CLAY (CH) contains shale fragments	9-19-50/2	12.5	100+	
				14.0		
	15.0	Auger Refusal at 15'		15.0		
		ROCK: Gray, slightly weathered, close fractures, moderate to high angle, very fine grained, very hard, fair, LIMESTONE, trace calcite veins	REC=82% RQD=60%			
	20.0	Coring Terminated at 20'		20.0		

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling
Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 16.0'

Boring Location: See Boring Location Plan

Latitude: 37.28665

Longitude: 79.9371944444444

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/31/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.4	4.5" Asphalt				No subsurface water was encountered immediately upon completion of drilling.
		7" Base Stone				
	1.0	POSSIBLE RESIDUUM: Medium dense to dense, orange, moist, fine to coarse, CLAYEY SAND (SC), contains gravel/rock fragments				
			2-5-10	2.0	15	
			12-19-20	3.5	39	
				5.0		
	6.0	RESIDUUM: Medium dense, red-orange, moist, fine to coarse, CLAYEY SAND (SC), contains gravel/rock fragments				
			8-8-16	6.5	24	
				8.0		
			11-12-17	8.5	29	
				10.0		
	12.0	Dense, orange-brown, moist, coarse, CLAYEY GRAVEL (GC)				
			12-22-29	13.5	51	
				15.0		Cave-in at 15'.
	16.0	Auger Refusal at 16'				

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 12.5'

Boring Location: See Boring Location Plan

Latitude: 37.286422222222

Longitude: 79.937102777778

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/31/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.3	3" Asphalt				No subsurface water was encountered immediately upon completion of drilling.
		9" Base Stone				
	1.0	RESIDUUM: Medium dense, light brown, moist, fine to coarse, CLAYEY SAND (SC), contains gravel/rock fragments				
			4-5-6	2.0	11	
			4-9-5	3.5	14	
				5.0		
	6.0	Medium dense, orange-brown, wet, fine to coarse, POORLY GRADED SAND (SP), contains gravel/rock fragments				
			11-19-27	6.5	46	
				8.0		
			33-20-27	8.5	47	
				10.0		
						Cave-in at 11'.
	12.5	Auger Refusal at 12.5'				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON

Engineering Stability Since 1881

BORING LOG

Boring: H-4 (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 25.0'

Boring Location: See Boring Location Plan

Latitude: 37.2865166666667

Longitude: 79.9367166666667

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/31/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.8	10" Gravel	23-17-7	0.0		No subsurface water was encountered immediately upon completion of drilling.
	2.0	POSSIBLE RESIDUUM: Medium dense, brown, moist, fine to coarse, CLAYEY SAND (SC), contains gravel/rock fragments		1.5	24	
				2.0		
		RESIDUUM: Stiff, dark brown, moist, FAT CLAY (CH), contains gravel/rock fragments	4-4-5		9	
	3.5	Soft to stiff, dark orange, moist, LEAN CLAY (CL), contains gravel/rock fragments	3-5-8	3.5	13	
				5.0		
			4-4-5	6.5	9	
				8.0		
			2-2-2	8.5	4	
				10.0		
	12.0	Soft to firm, light brown, moist, LEAN CLAY (CL)				
			2-2-3	13.5	5	
				15.0		
		Color changed from brown to dark brown from 18.5 to 22	2-2-2	18.5	4	
				20.0		
	22.0	Medium dense, brown and tan, moist, fine to medium, POORLY-GRADED SAND (SP) contains shell/rock fragments and have petroleum odor				Cave-in at 22.5'.
			18-10-8	23.5	18	
	25.0	Boring Terminated at 25'		25.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON

Engineering Stability Since 1881

BORING LOG

Boring: P-01 (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 15.0'

Boring Location: See Boring Location Plan

Latitude: 37.287180555556

Longitude: 79.936716661

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 11/1/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.2	2" Surficial Soil	10-17-17	0.0	34	No subsurface water was encountered immediately upon completion of drilling.
		POSSIBLE RESIDUUM: Dense, orange-brown, moist, fine to coarse, CLAYEY SAND (SC)		1.5		
	2.0	RESIDUUM: Loose, dark-brown, moist, fine to coarse, CLAYEY SAND (SC), contains gravel/rock fragments	4-6-4	2.0	10	
			1-2-2	3.5	4	
				5.0		
	6.0	Stiff, dark-brown, moist, LEAN CLAY (CL), contains gravel/rock fragments	3-5-7	6.5	12	
				8.0		
	8.0	Stiff, dark-brown, moist, FAT CLAY CLAY (CL), contains gravel/rock fragments	2-5-7	8.5	12	
				10.0		
	12.0	Very Dense, light gray-brown, moist, fine to coarse, POORLY -GRADED SAND (SP), contains gravel/rock fragments	14-38-39	12.5	77	Cave-in at 13'.
				14.0		
	15.0	Boring Terminated at 15'				

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON

Engineering Stability Since 1881

BORING LOG

Boring: P-02 (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 15.0'

Boring Location: See Boring Location Plan

Latitude: 37.2872388888889

Longitude: 79.9363833333333

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 11/1/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.8	9" Surficial Soil	4-15-12	0.0	27	No subsurface water was encountered immediately upon completion of drilling.
		RESIDUUM: Medium dense, orange-brown, moist, fine to coarse, CLAYEY SAND (SC), contains rock/shell fragments		1.5		
			4-4-3	2.0	7	
	3.5	Loose, dark-brown, moist, fine to coarse, CLAYEY SAND (SC), contains gravel/rock fragments	3-3-3	3.5	6	
				5.0		
	6.0	Firm, dark-brown, moist, LEAN CLAY (CL), contains gravel/rock fragments	1-1-3	6.5	4	
				8.0		
			2-2-2	8.5	4	
				10.0		
	12.0	Very dense, dark-brown, moist, CLAYEY SAND (SC), contains gravel/rock fragments	1-12-50/3	12.5	100+	Cave-in at 13.2'.
				14.0		
	15.0	Boring Terminated at 15'				

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Station

City/State: Roanoke, Virginia

Elevation:

Total Depth: 15.0'

Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 11/1/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.6	7" Asphalt				No subsurface water was encountered immediately upon completion of drilling.
	1.2	7" Base Stone				
		POSSIBLE FILL: Loose to dense, dark -brown, moist, fine to coarse, CLAYEY SAND (SC), contains gravel/rock fragments	12-20-24	2.0	44	
	3.5	RESIDUUM: Loose to dense, dark -brown, moist, fine to coarse, CLAYEY SAND (SC), contains gravel/rock fragments	14-14-19	3.5	33	
				5.0		
			9-10-10	6.5	20	
				8.0		
			3-4-3	8.5	7	
				10.0		
	12.0	PARTIALLY WEATHERED ROCK: Sampled as very dense, orange brown and gray, moist, CLAYEY SAND (SC) contains shale fragments	50/1	12.5	100+	Cave-in at 13'.
				14.0		
	15.0	Boring Terminated at 15'				

BORING LOG 62C-0164.GPJ F&R.GDT 1/16/25

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 24 inches in four 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



Project No: 62C-0164

Elevation:

Drilling Method: 2.25" ID HSA

Client: City of Roanoke

Total Depth: 7.0'

Hammer Type: Automatic

Project: Roanoke Public Works Wash House & Refueling Station

Boring Location: See Boring Location Plan

Date Drilled: 11/1/24

City/State: Roanoke, Virginia

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.3	3" Asphalt				No subsurface water was encountered immediately upon completion of drilling.
		14" Base Stone				
	1.4	Possible Fill: Very dense, light gray-brown, moist, fine to coarse, POORLY -GRADED SAND (SP), contains gravel/rock fragments	5-29-37	2.0	66	
	3.5	PARTIALLY WEATHERED ROCK: Sampled as very dense, orange brown and gray, moist, POORLY -GRADED SAND (SP) contains rock fragments	50/5	3.5	100+	
				5.0		
			50/3	6.5		Cave-in at 6.5'.
	7.0	Auger Refusal at 7'		7.0	100+	



Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Station

City/State: Roanoke, Virginia

Elevation:

Total Depth: 15.0'

Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 10/31/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.3	4" Surficial Soil				No subsurface water was encountered immediately upon completion of drilling.
	0.8	5" Base Stone				
		POSSIBLE FILL: Loose, light brown mottled in gray, moist, fine to coarse, POORLY -GRADED SAND (SP) with rock fragments				
			7-4-4	2.0	8	
			4-2-3	3.5	5	
				5.0		
	6.0	RESIDUUM: Medium dense, dark brown mottled in gray, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments	5-7-5	6.5	12	
				8.0		
	8.5	Stiff, dark brown mottled in gray, moist, LEAN CLAY (CL) with rock fragments	4-5-6	8.5	11	
				10.0		
	12.0	Dense, dark brown mottled in red, moist, fine to coarse, CLAYEY SAND (SC) with rock shell fragments	13-17-21	12.5	38	Cave-in at 13'.
				14.0		
	15.0	Boring Terminated at 15'				

BORING LOG 62C-0164.GPJ F&R.GDT 1/16/25

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 24 inches in four 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON

Engineering Stability Since 1881

BORING LOG

Boring: P-06 (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 15.0'

Boring Location: See Boring Location Plan

Latitude: 37.2865972222222

Longitude: 79.9381694444444

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 11/1/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.3	4" Asphalt				No subsurface water was encountered immediately upon completion of drilling.
	0.7	4" Base Stone				
		RESIDUUM: Medium dense, dark brown mottled in gray, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments				
			6-6-6	2.0	12	
	3.5	Loose, gray, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments	4-5-7	3.5	12	
				5.0		
			5-3-3	6.5	6	
				8.0		
			2-3-3	8.5	6	
				10.0		
			8-6-4	12.5	10	Cave-in at 12.9'.
				14.0		
	15.0	Boring Terminated at 15'				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON

Engineering Stability Since 1881

BORING LOG

Boring: P-07 (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 15.0'

Boring Location: Offset 30' Towards B-6

Latitude: 37.2865305555556

Longitude: 79.9383888888889

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 11/1/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.5	6" Gravel	11-14-11	0.0	25	No subsurface water was encountered immediately upon completion of drilling.
		RESIDUUM: Medium dense, light gray, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments		1.5		
	2.0	RESIDUUM: Firm to stiff, brown, moist, LEAN CLAY (CL) with rock fragments	5-4-3	2.0	7	
			4-6-7	3.5	13	
				5.0		
			8-10-13	6.5	23	
				8.0		
			4-4-10	8.5	14	
				10.0		
	12.0	Firm, dark brown, moist, LEAN CLAY (CL) with rock fragments				
			2-2-4	13.5	6	Cave-in at 13.6'.
	15.0	Boring Terminated at 15'		15.0		

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



Project No: 62C-0164
Client: City of Roanoke
Project: Roanoke Public Works Wash House & Refueling Center
City/State: Roanoke, Virginia

Elevation:
Total Depth: 6.0'
Boring Location: See Boring Location Plan
Latitude: 37.2865583333333
Longitude: 79.9379222222222

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Hammer Efficiency: 1.45
Date Drilled: 10/31/24
Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.1	1" Asphalt				No subsurface water was encountered immediately upon completion of drilling.
		12" Base Stone				
	1.1	RESIDUUM: Medium Dense, Dark brown, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments				
			7-7-8	2.0	15	
			12-9-6	3.5	15	
				5.0		Cave-in at 5'.
	6.0	Auger Refusal at 6'				



Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 15.0'

Boring Location: See Boring Location Plan

Latitude: 37.2861833333333

Longitude: 79.9383222222222

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 11/1/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.4	4.5" Asphalt				No subsurface water was encountered immediately upon completion of drilling.
		7" Base Stone				
	1.0	RESIDUUM: Very loose to loose, dark brown, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments				
			2-2-2	2.0	4	
			2-2-2	3.5	4	
				5.0		
			5-3-5	6.5	8	
				8.0		
	8.5	Firm, dark brown, moist, LEAN CLAY (CL) with shale fragments	2-3-2	8.5	5	
				10.0		
			3-4-3	12.5	7	
				14.0		Cave-in at 14'.
	15.0	Boring Terminated at 15'				

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON

Engineering Stability Since 1881

BORING LOG

Boring: P-10 (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 8.5'

Boring Location: See Boring Location Plan

Latitude: 37.286244444444

Longitude: 79.937816666667

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 11/1/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.4	5" Gravel	19-13-12	0.0	25	No subsurface water was encountered immediately upon completion of drilling.
		RESIDUUM: Medium Dense, Light brown, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments		1.5		
			9-27-21	2.0	48	
	3.5	Medium Dense, light gray, moist, POORLY-GRADED GRAVEL (GP) with clay	30-16-10	3.5	26	
	5.0	Medium Dense, Dark brown, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments		5.0		
			8-5-5	6.5	10	Cave-in at 7'.
				8.0		
	8.5	Auger Skew at 8.5'				

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON

Engineering Stability Since 1881

BORING LOG

Boring: P-11 (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 6.6'

Boring Location: See Boring Location Plan

Latitude: 37.2862305555556

Longitude: 79.9370138888889

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/30/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
		RESIDUUM: Medium Dense, Light brown, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments	8-18-14	0.0	32	No subsurface water was encountered immediately upon completion of drilling.
				1.5		
			13-7-8	2.0	15	
	3.5	Stiff, Orange, moist, CLAYEY SAND (SC) with rock fragments	2-3-6	3.5	9	
				5.0		
	6.6	Auger Refusal at 6.6'	50/2	6.5		Cave-in at 6'.
					100+	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON

Engineering Stability Since 1881

BORING LOG

Boring: T-1 (1 of 1)

Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 10.5'

Boring Location: See Boring Location Plan

Latitude: 37.2868027777778

Longitude: 79.9361916666667

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/29/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.3	3" Gravel	8-9-6	0.0	15	No subsurface water was encountered immediately upon completion of drilling.
		RESIDUUM: Medium Dense, Light brown, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments		1.5		
			50/4	2.0	100+	
	3.5	Stiff, Light brown, moist, fine to coarse, LEAN CLAY (CL) with rock fragments	50/6	3.5	100+	Cave-in at 4'.
	5.0	Dense, Dark brown mottled orange, moist, fine to coarse, CLAYEY SAND (SC) with rock and shale fragments		5.0		
	5.5	Auger Refusal at 5.5'	REC=100% RQD=35%	5.5		
		ROCK: Gray, slightly weathered, close to medium fractures, moderate angle, very fine grained, very hard, poor, LIMESTONE				
	10.5	Coring terminated at 10.5'		10.5		

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 32.5'

Boring Location: See Boring Location Plan

Latitude: 37.286658333333

Longitude: 79.936225665

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/29/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.1	1" Asphalt				No subsurface water was encountered immediately upon completion of drilling.
	0.9	10" Base Stone				
		FILL: Sampled as stiff, light brown, moist, fine to coarse, LEAN CLAY (CL) with rock fragments	10-13-8	2.0	21	
	3.5	RESIDUUM: Stiff, light brown, moist, fine to coarse, LEAN CLAY (CL) with rock fragments	3-4-9	3.5	13	
				5.0		
	6.0	Dense, light brown, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments	21-26-24	6.5	50	
				8.0		
	8.5	Very dense, dark brown, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments	2-24-23	8.5	47	
				10.0		
				13.5	61	
				15.0		
	17.0	Dense, dark brown, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments				
			28-25-16	18.5	41	
				20.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 32.5'

Boring Location: See Boring Location Plan

Latitude: 37.2866583333333

Longitude: 79.936225665

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/29/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	22.0	Very dense, dark brown, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments				
			28-31-37	23.5	68	
				25.0		
	27.0	Dense, light brown, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments				
			13-13-19	28.5	32	
				30.0		
	32.5	Auger Refusal at 32.5'				Cave-in at 32'.

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 40.0'

Boring Location: See Boring Location Plan

Latitude: 37.2865638888889

Longitude: 79.9360916666667

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/29/24

Driller: B. Maxson

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
	0.8	9" Gravel	12-9-10	0.0	19	
	1.5	RESIDUUM: Medium dense, dark brown, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments		1.5		
		Medium dense, orange, moist, fine to coarse, CLAYEY SAND (SC) with rock fragments	5-8-8	2.0	16	
	3.5	Stiff, brown, moist, fine, sandy, SILT (ML)	4-6-6	3.5	12	
	6.0	Loose, orange, moist, fine to coarse, CLAYEY SAND (SC) contains clay pockets	4-3-3	6.5	6	
			2-3-4	8.0		
				8.5	7	
	12.0	Firm, orange, moist, FAT CLAY (CH) with shell / rock fragments		10.0		
			2-2-4	13.5	6	
				15.0		
	17.0	Medium dense to dense, orange mottled gray, moist, fine to coarse, CLAYEY SAND (SC) contains rock fragments and clay pockets		18.5	29	
			3-8-21	20.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



Project No: 62C-0164

Client: City of Roanoke

Project: Roanoke Public Works Wash House & Refueling Center

City/State: Roanoke, Virginia

Elevation:

Total Depth: 40.0'

Boring Location: See Boring Location Plan

Latitude: 37.2865638888889

Longitude: 79.9360916666667

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Hammer Efficiency: 1.45

Date Drilled: 10/29/24

Driller: B. Maxson

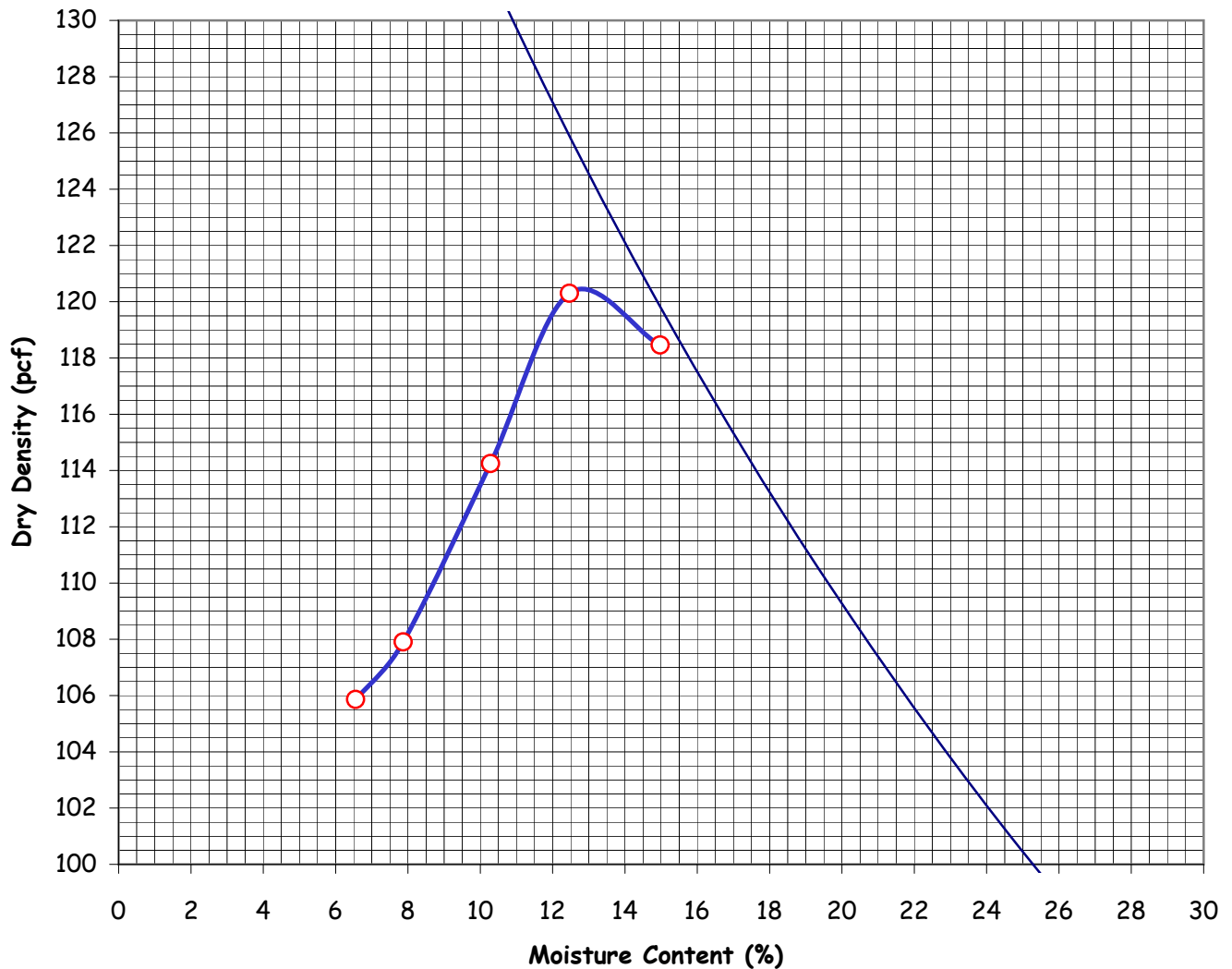
Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
			7-15-23	23.5	38	
				25.0		
			3-5-8	28.5	13	
				30.0		Subsurface water was encountered at a depth of 32' 24 hours upon completion of drilling.
	32.0	Soft, orange, moist to wet, FAT CLAY (CH) with shell / rock fragments				
			3-1-2	33.5	3	Subsurface water was encountered at a depth of 32.3' upon completion of drilling.
				35.0		
	36.0	Stiff, orange, moist to wet, FAT CLAY (CH) with shell / rock fragments				
			1-3-7	38.5	10	Cave-in at 39'.
	40.0	Boring Terminated at 40'		40.0		

BORING LOG 62C-0164.GPJ F&R.GDT 12/31/24

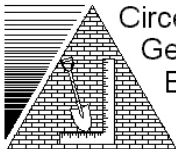
*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

APPENDIX C

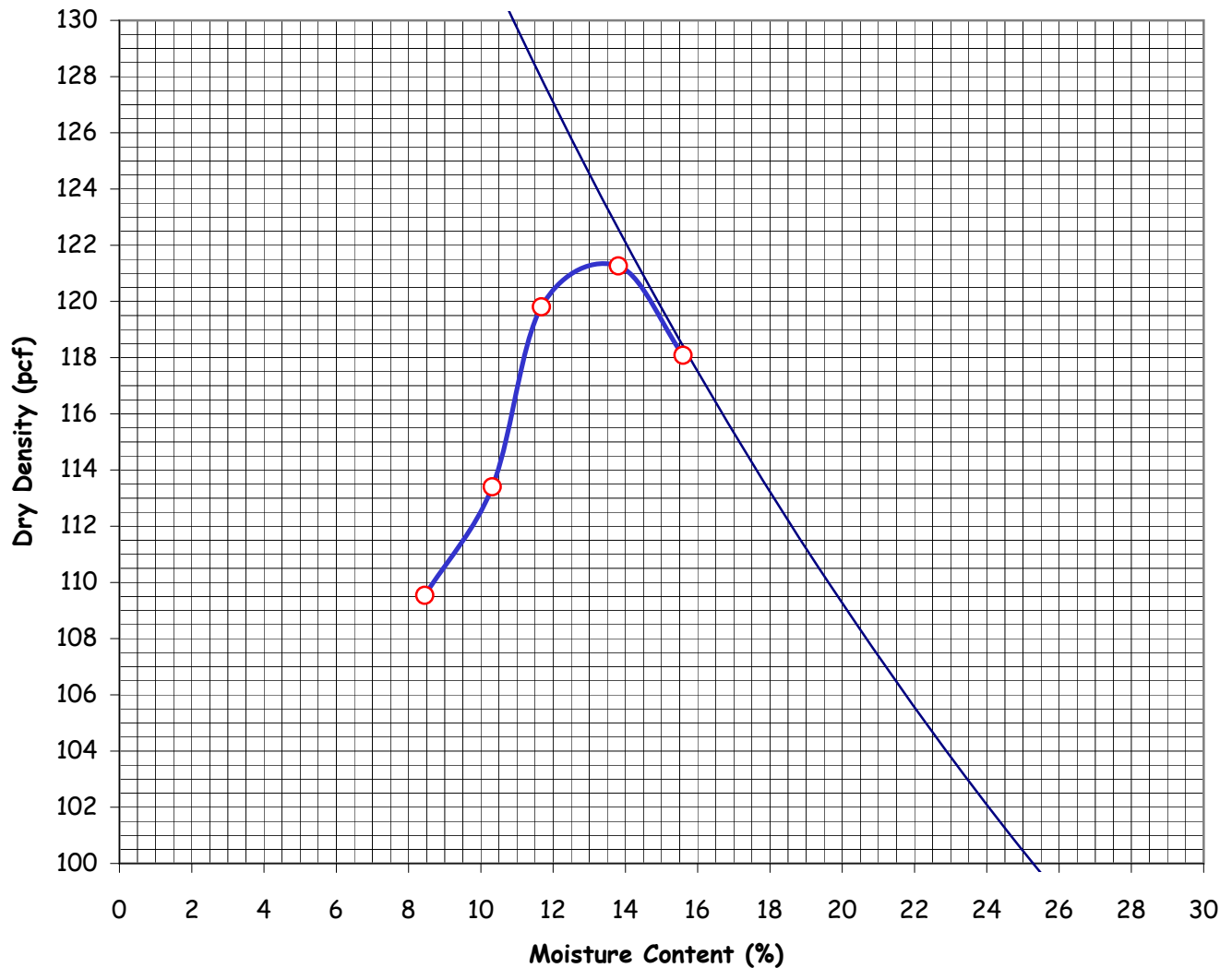
Moisture-Density Relationship



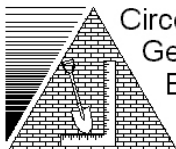
MOISTURE-DENSITY RELATIONSHIP TEST

ASTM D-698, Method B	Rammer Type: Manual	Preparation Method: Dry
Boring No.:	P-2 Bulk	Depth (ft): 0 - 10
Soil Description:	Light Brown Clayey SAND with Rock Fragments	
USCS Classification:	SC	
Liquid Limit (LL):	30	Max. Dry Density, $\gamma_{d \max}$ (pcf): 120.5
Plastic Limit (PL):	19	Optimum Moisture Content, $m_{c \text{ opt}}$ (%): 12.8
Plastic Index (PI):	11	Assumed Specific Gravity, G_s : 2.70
% Passing No. 200 Sieve:	35.4	Test Fraction, P_F (%): 86.6
Received Moisture Content (%):	17.3	Oversize Fraction, P_c (%): 13.4
 Circeo Geotechnical Engineering, P.C.	CIRCEO GEOTECH	
	5956 Buckland Mill Road	
	Roanoke, Virginia 24019	
	Phone: (540) 354-3260	
Roanoke Public Works Wash House		F&R Project No. 62C-0164
Project No.:		G-1616
Date:		12/17/2024
Sheet:		

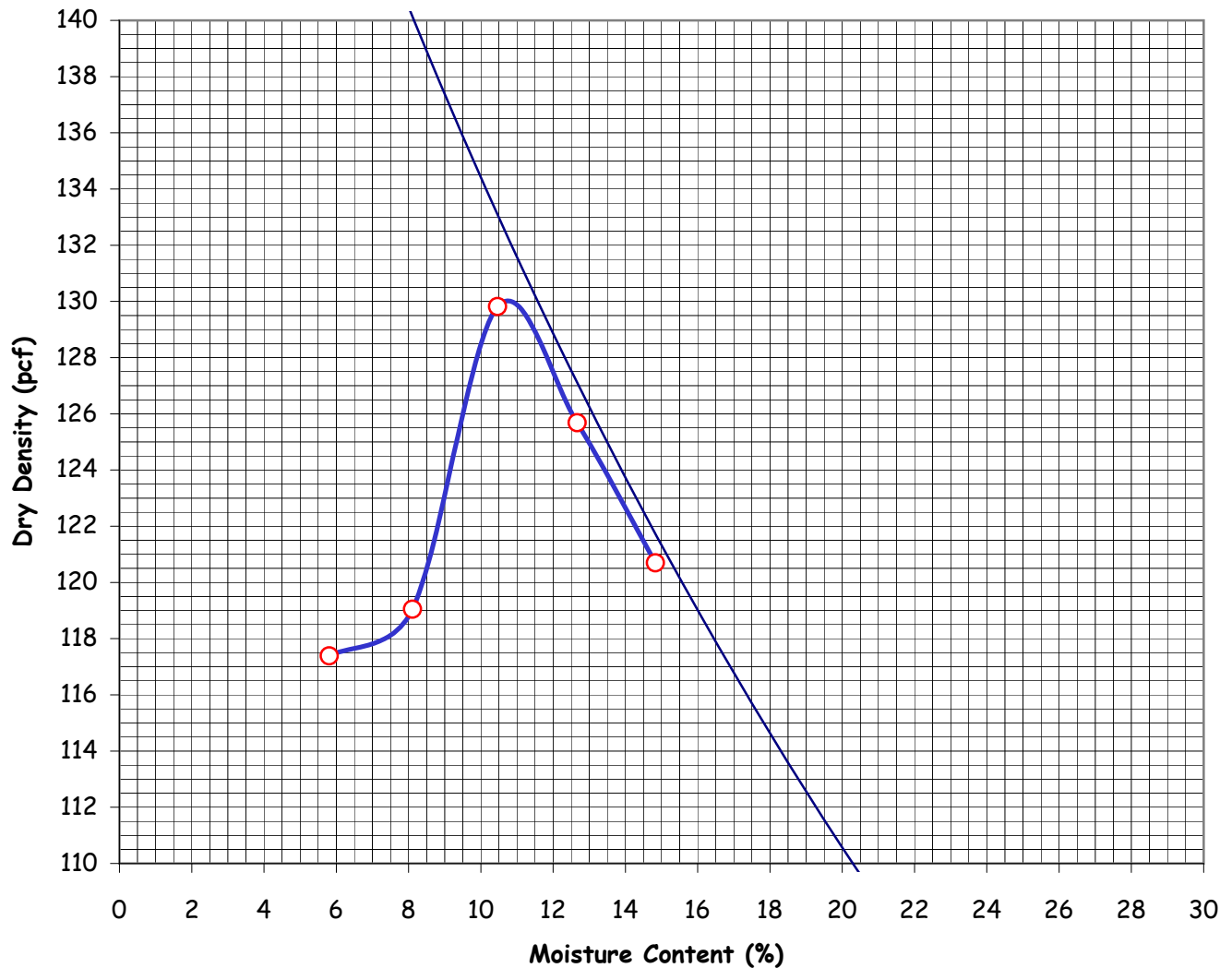
Moisture-Density Relationship



MOISTURE-DENSITY RELATIONSHIP TEST

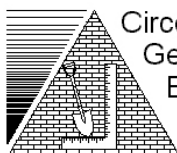
ASTM D-698, Method B		Rammer Type: Manual		Preparation Method: Dry	
Boring No.:		P-6 Bulk		Depth (ft): 0 - 10	
Soil Description:		Light Brown Clayey SAND with Rock Fragments			
USCS Classification:		SC			
Liquid Limit (LL): 33		<div>Max. Dry Density, $\gamma_{d \max}$ (pcf): 121.5</div> <div>Optimum Moisture Content, $m_{c \text{ opt}}$ (%): 13.5</div> <div>Assumed Specific Gravity, G_s: 2.70</div> <div>Test Fraction. P_F (%) 89.5</div> <div>Oversize Fraction, P_c (%) 10.5</div>			
Plastic Limit (PL): 19					
Plastic Index (PI): 14					
% Passing No. 200 Sieve: 35.6					
Received Moisture Content (%) 14.0					
<div>Circeo Geotechnical Engineering, P.C.</div>	<div>CIRCEO GEOTECH</div> <div>5956 Buckland Mill Road</div> <div>Roanoke, Virginia 24019</div> <div>Phone: (540) 354-3260</div>		Roanoke Public Works Wash House		
			F&R Project No. 62C-0164		
			Project No.: G-1616		
			Date: 12/17/2024		
				Sheet:	

Moisture-Density Relationship



MOISTURE-DENSITY RELATIONSHIP TEST

ASTM D-698, Method	B	Rammer Type:	Manual	Preparation Method:	Dry
Boring No.:		P-11 Bulk		Depth (ft):	0 - 5
Soil Description:	Light Gray to Tan Clayey SAND with Rock Fragments				
USCS Classification:	SC				
Liquid Limit (LL):	28	Max. Dry Density, $\gamma_{d \max}$ (pcf):		130.0	
Plastic Limit (PL):	17	Optimum Moisture Content, $m_{c \text{ opt}}$ (%):		10.8	
Plastic Index (PI):	11	Assumed Specific Gravity, G_s :		2.75	
% Passing No. 200 Sieve:	40.6	Test Fraction, P_F (%)		86.0	
Received Moisture Content (%)	10.8	Oversize Fraction, P_c (%)		14.0	



Circeo
Geotechnical
Engineering, P.C.

CIRCEO GEOTECH
5956 Buckland Mill Road
Roanoke, Virginia 24019
Phone: (540) 354-3260

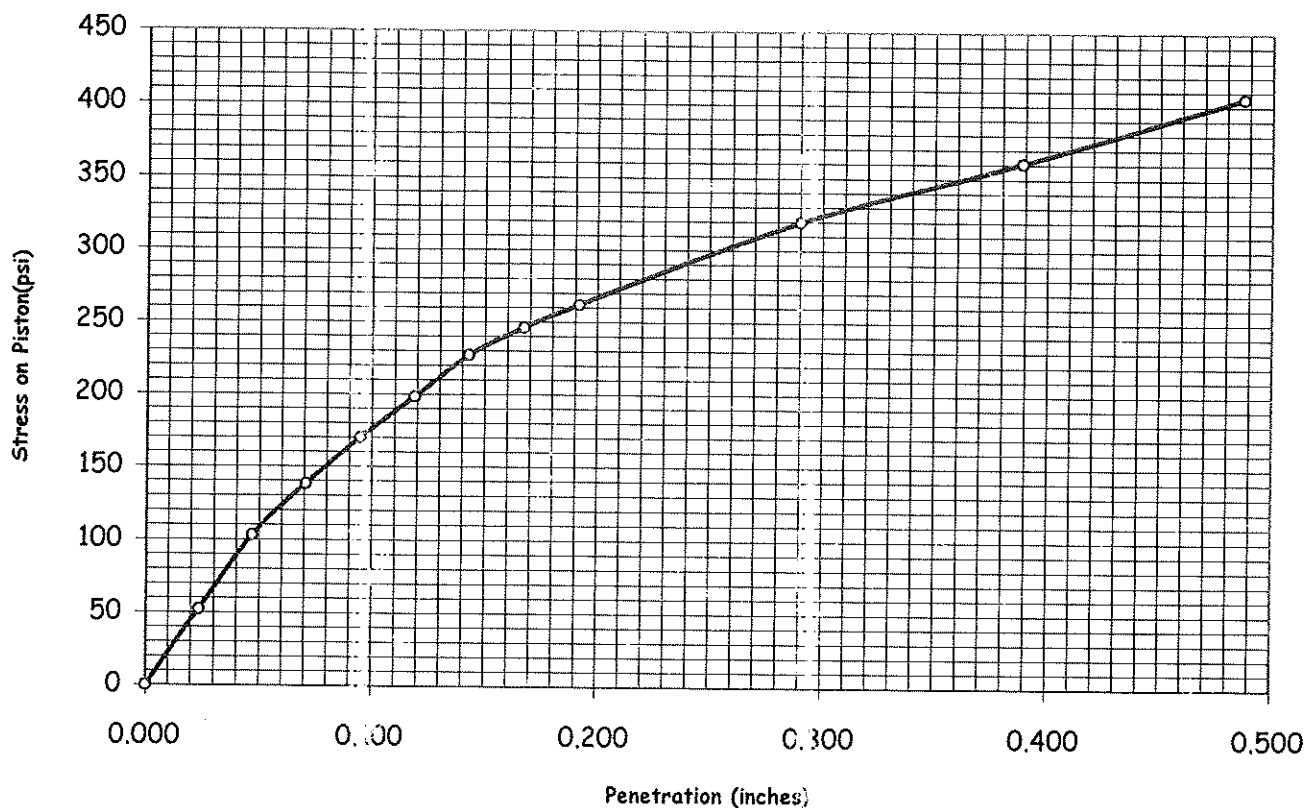
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F&R Project No. 62C-0164

Project No.: **G-1616**

Date: **12/17/2024**

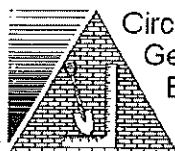
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Load-Penetration Curve



CALIFORNIA BEARING RATIO (CBR) OF COMPACTED SOIL (ASTM D-1883-99)

Boring No.:	P-2	Depth (ft):	0 - 10
Location:			
Soil Description:	Light Brown Clayey SAND with Rock Fragments		
USCS Classification:	SC	Surcharge Weight (lbs)	10
Liquid Limit (LL):	30	Soaked CBR $_{0.1"}$ =	18.0
Plastic Limit (PL):	19	Soaked CBR $_{0.2"}$ =	17.8
Plastic Index (PI):	11	% Swell	0.22
% Passing No. 200 Sieve:	35.4	Resiliency Factor, RF	3.0
Natural Moisture Content (%):	17.3	Degree of Saturation, S (%)	81
Assumed Specific Gravity, G_s :	2.70		
Initial Wet Density, γ_m (pcf):	134.3	Final Wet Density, γ_m (pcf):	137.2
Initial Dry Density, γ_d (pcf):	119.6	Final Dry Density, γ_d (pcf):	119.5
Initial Moisture Content, m_c initial (%):	12.3	Final Moisture Content, m_c Average (%):	14.8
		Final Moisture Content, m_c Top 1" (%):	14.5



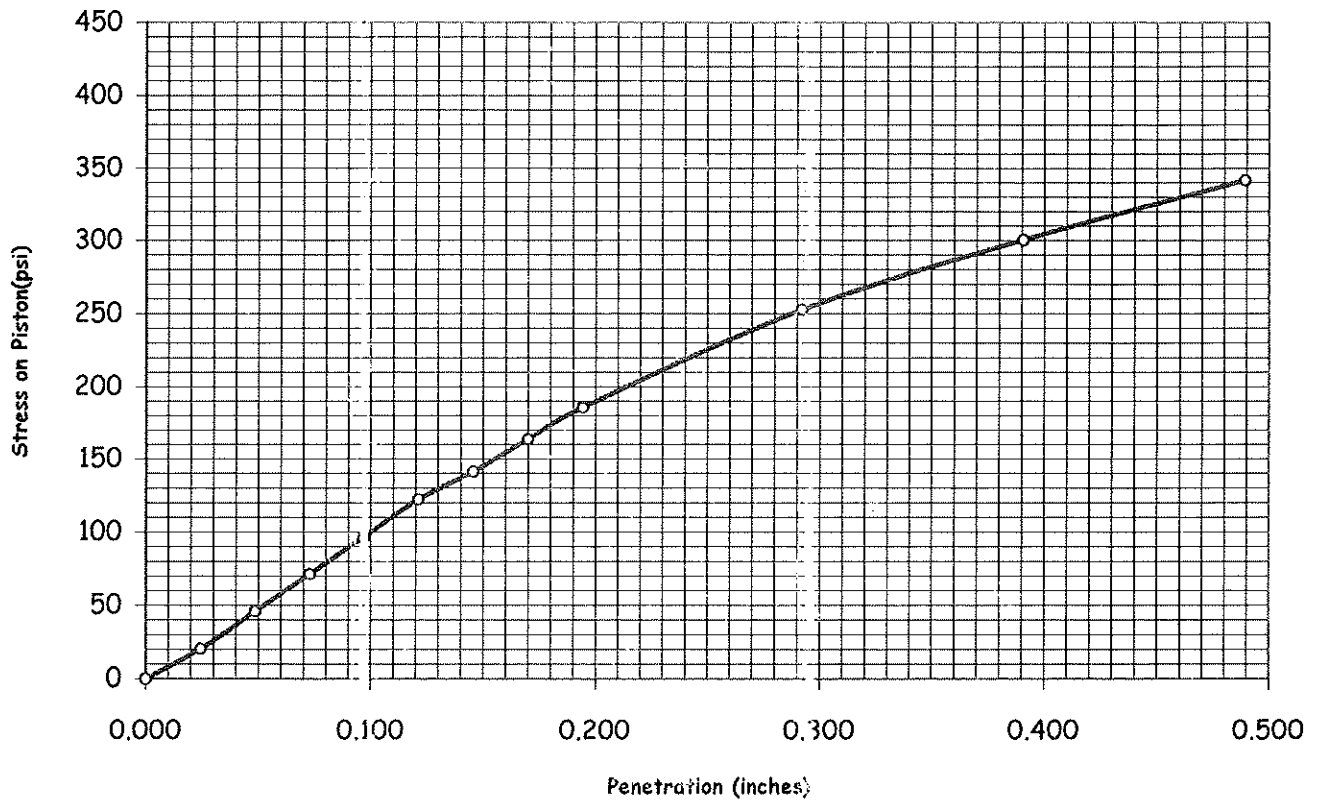
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Roanoke, Virginia 24019
Phone: (540) 354-3260

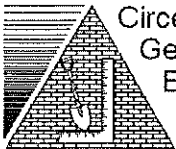
Roanoke Public Works
F&R Project No. 62C-0164

Project No.:	G-1616
Date:	12/19/24
Sheet:	

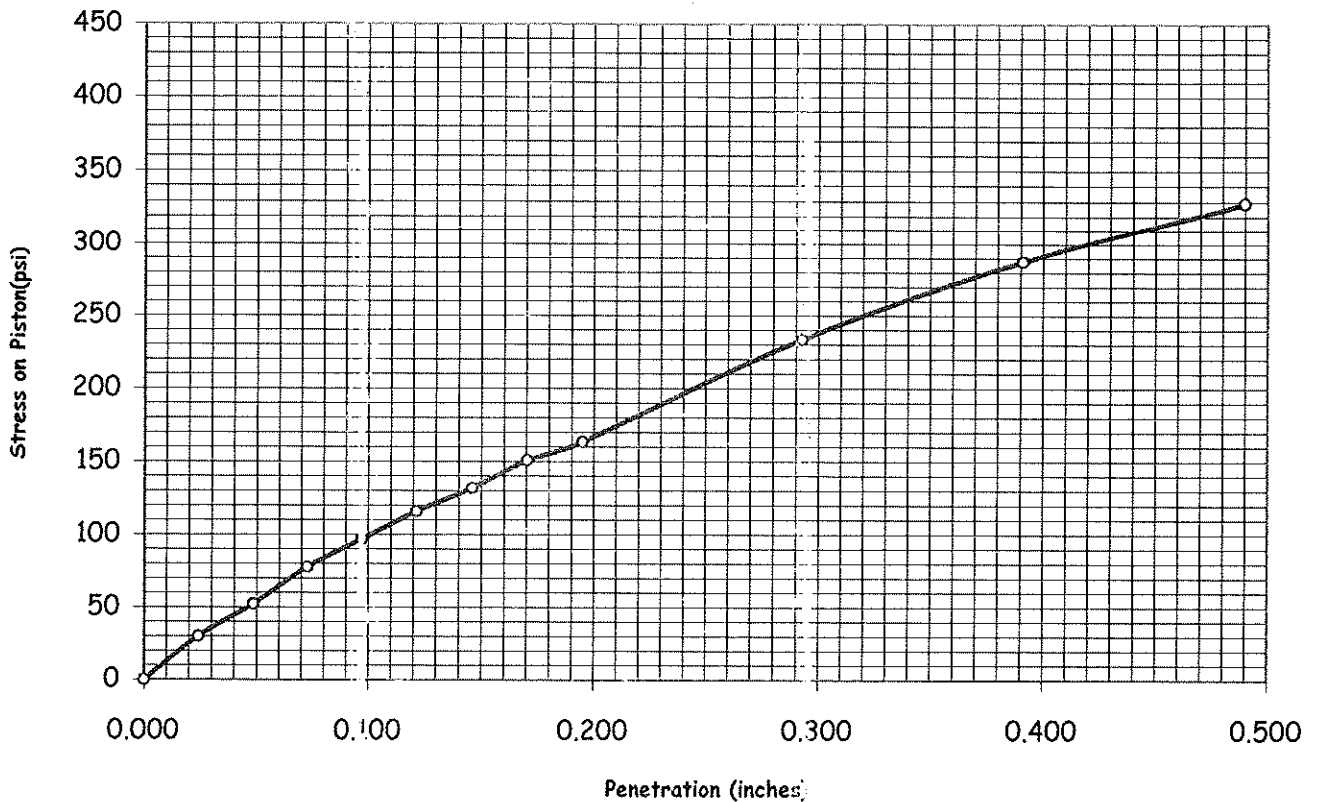
Load-Penetration Curve




CALIFORNIA BEARING RATIO (CBR) OF COMPACTED SOIL (ASTM D-1883-99)

Boring No.:	P-6	Depth (ft):	0 - 10
Location:			
Soil Description:	Light Brown Clayey SAND with Rock Fragments		
USCS Classification:	SC	Surcharge Weight (lbs)	10
Liquid Limit (LL):	33	Soaked CBR _{0.1"} =	10.3
Plastic Limit (PL):	19	Soaked CBR _{0.2"} =	12.7
Plastic Index (PI):	14	% Swell	0.13
% Passing No. 200 Sieve:	35.6	Resiliency Factor, RF	3.0
Natural Moisture Content (%):	14.0	Degree of Saturation, S (%)	93
Assumed Specific Gravity, G_s :	2.70		
Initial Wet Density, γ_m (pcf):	138.7	Final Wet Density, γ_m (pcf):	139.3
Initial Dry Density, γ_d (pcf):	123.0	Final Dry Density, γ_d (pcf):	122.2
Initial Moisture Content, $m_{c \text{ initial}}$ (%):	12.8	Final Moisture Content, $m_{c \text{ Average}}$ (%):	14.0
		Final Moisture Content, $m_{c \text{ Top 1"}}$ (%):	14.6
 Circeo Geotechnical Engineering, P.C.		Roanoke Public Works	
		F&R Project No. 62C-0164	
		Project No.:	6-1616
		Date:	12/19/24
		Sheet:	
CIRCEO GEOTECH 5956 Buckland Mill Road Roanoke, Virginia 24019 Phone: (540) 354-3260			

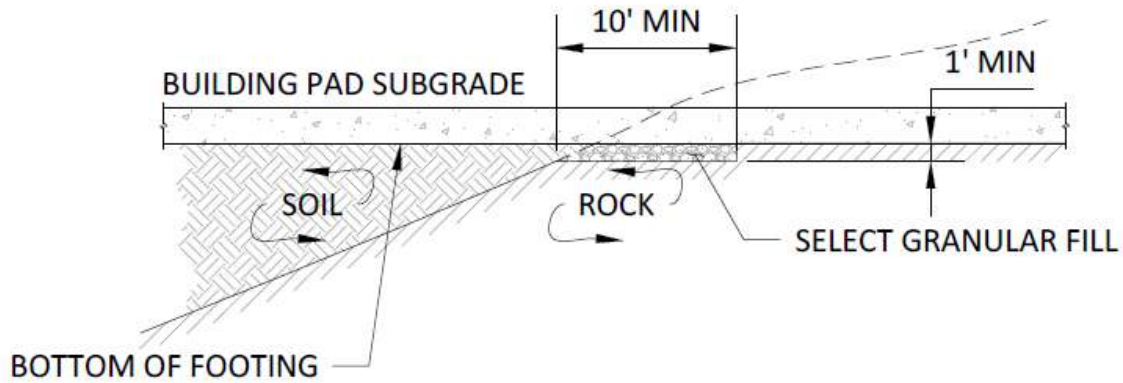
Load-Penetration Curve



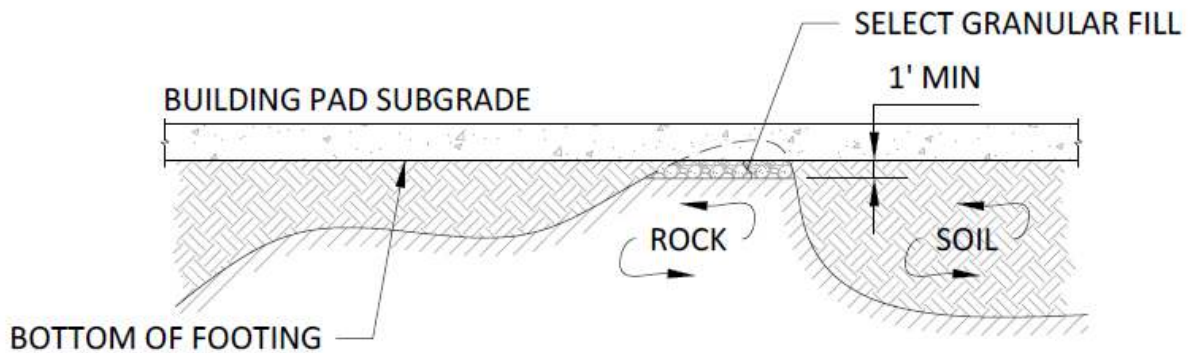
CALIFORNIA BEARING RATIO (CBR) OF COMPACTED SOIL (ASTM D-1883-99)

Boring No.:	P-11	Depth (ft):	0 - 5	
Location:				
Soil Description:	Light Gray to Tan Clayey SAND with Rock Fragments			
USCS Classification:	SC	Surcharge Weight (lbs)	10	
Liquid Limit (LL):	28	Soaked CBR _{0.1"} =	10.0	
Plastic Limit (PL):	17	Soaked CBR _{0.2"} =	11.0	
Plastic Index (PI):	11	% Swell	0.04	
% Passing No. 200 Sieve:	40.6	Resiliency Factor, RF	2.5	
Natural Moisture Content (%)	10.8	Degree of Saturation, S (%)	87	
Assumed Specific Gravity, G_s :	2.70			
Initial Wet Density, γ_m (pcf):	140.5	Final Wet Density, γ_m (pcf):	142.1	
Initial Dry Density, γ_d (pcf):	127.3	Final Dry Density, γ_d (pcf):	127.4	
Initial Moisture Content, m_c initial (%):	10.4	Final Moisture Content, m_c Average (%):	11.5	
		Final Moisture Content, m_c Top 1" (%):	11.8	
 Circeo Geotechnical Engineering, P.C.	CIRCEO GEOTECH		Roanoke Public Works	
	5956 Buckland Mill Road		F&R Project No. 62C-0164	
	Roanoke, Virginia 24019		Project No.:	G-1616
	Phone: (540) 354-3260		Date:	12/19/24
			Sheet:	

APPENDIX D



SOIL TO ROCK TRANSITION PROFILE



ISOLATED ROCK PINNACLE PROFILE



FROEHLING & ROBERTSON, INC.

Engineering Stability Since 1881

1734 Seibel Drive, NE

Roanoke, Virginia 24012-5624 | USA

T 540.344.7939 | F 540.344.3657

DATE: January 2022

SCALE: 1" = 10' (Horizontal)
1" = 1' (Vertical)

DRAWN BY: JRP

62C0164

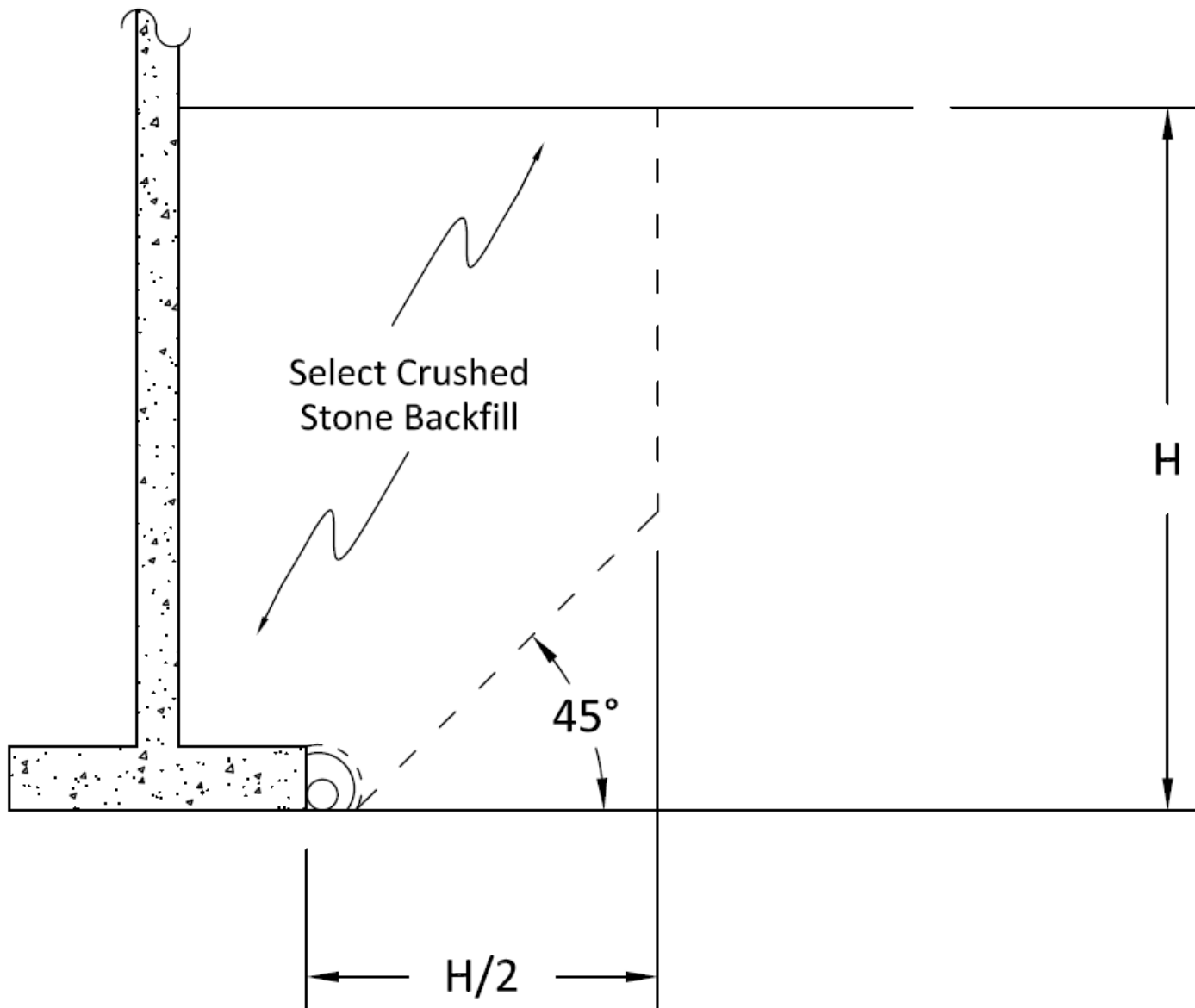
City of Roanoke Public Works Wash House & Refueling Center

CONCEPTUALIZED ROCK
SUB-EXCAVATION
DETAIL

DRAWING NO.

4

APPENDIX E



FROEHLING & ROBERTSON, INC.

Engineering Stability Since 1881
 1734 Seibel Drive, NE
 Roanoke, Virginia 24012-5624
 T 540.344.7939 | F 540.344.3657

DATE: January 2022

SCALE: As Shown

DRAWN: EKP

62C???

City of Roanoke Public Works Wash
 House & Refueling Center

REVISIONS

DRAWING NO.

2



Corporate HQ: 3015 Dumbarton Road Richmond, Virginia 23228 T 804.264.2701 F 804.264.1202 www.fandr.com

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Appendix C

Stormwater Pollution Prevention Plan

(SWPPP)



CITY OF ROANOKE REFUELING CENTERS PUBLIC WORKS SERVICE CENTER ROANOKE, VA

STORMWATER POLLUTION PREVENTION PLAN

PREPARED AUGUST 22, 2025

OWNER:

CITY OF ROANOKE
215 CHURCH AVENUE SW
ROANOKE, VA 24011

OPERATOR:

CITY OF ROANOKE
215 CHURCH AVENUE SW
ROANOKE VA 24011

PHONE:

LOCATION:

LATITUDE: 37° 17' 13.43" N
LONGITUDE: 79° 56' 09.31" W

RECEIVING WATERS:

GLADE CREEK, A TRIBUTARY TO THE ROANOKE RIVER

**City of Roanoke
Planning, Building, & Development**

COMPREHENSIVE DEVELOPMENT PLAN

APPROVED

by plkr1 10/14/2025

This plan has been prepared to be consistent with requirements specified in applicable sediment and erosion site plans or site permits, or storm water management site plans or site permits approved by state and local officials.

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STORMWATER POLLUTION PREVENTION PLAN

SWPPP DOCUMENT AND OPERATOR INFORMATION

PLAN APPROVAL DATE: 10/21/2025
REGISTRATION STATEMENT DATE: _____

OPERATOR:

Name: City of Roanoke
Address: 1802 Courtland Road NE
Roanoke, Virginia 24012
Phone: (540) 853-2953

CHANGE OF OPERATOR: Complete only when required

Name: _____
Address: _____
Phone: _____

OPERATOR CERTIFICATION

"I certify under penalty of law that I have read and understand this document and that this document and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

James Nuckles  10/28/25
PRINTED NAME SIGNATURE DATE

CHANGE OF OPERATOR CERTIFICATION: Complete only if required

"I certify under penalty of law that I have read and understand this document and that this document and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

PRINTED NAME SIGNATURE DATE

STORMWATER POLLUTION PREVENTION PLAN

PLAN LOCATION/CHANGE OF ADDRESS:

Location: _____

Contact: _____

Phone: _____

CHANGE OF LOCATION: Complete only when required

Location: _____

Contact: _____

Phone: _____

NOTE: A MODIFIED REGISTRATION STATEMENT SHOULD BE COMPLETED AND SUBMITTED TO NOTIFY DCR OF ANY ADDRESS CHANGES.

SWPPP UPDATES:

The permittee (or current operator if a change of operator has occurred) shall be responsible for maintaining all amendments pursuant to Part II, Section B of the General Permit: VAR10 found in Appendix C.

STORMWATER POLLUTION PREVENTION PLAN

PRIME CONTRACTOR RESPONSIBILITIES:

CONTRACTOR _____

ADDRESS _____

PHONE/FAX _____

EMAIL _____

CONSTRUCTION ACTIVITIES: Installation of erosion and sediment control measures, clearing and grubbing, grading, temporary or permanent seeding, permanent stormwater conveyance facilities, and utility/access infrastructure.

CONSTRUCTION REPORTS: Daily log of construction activities and weather conditions, report any changes to proposed or installed pollution measures, log of on-site equipment refueling with immediate reporting of the location and amount of any spills (with corrective action taken) to the permit operator, record of all vegetative waste debris piles with location to be shown on 30 x 42 Soil and Erosion Plan Sheets attached in Appendix 5A (along with date established, pollution control measures installed, method for processing and removal, and estimated removal date), location of required port-a-johns with identification of parties responsible for installation and maintenance, and report of any non-storm water discharges pursuant to Part I, Section D of the General Permit: VAR10 found in Appendix C.

INSPECTION REPORTS: Inspection reports shall be prepared at least once every five business days pursuant to the requirements of Part II, Section F of the General Permit: VAR10 found in Appendix C.

OTHER DUTIES ASSIGNED BY THE OPERATOR AS FOLLOWS:

TO BE COMPLETED BY THE OPERATOR AND CONTRACTOR, WITH SIGNATURES AND DATES BY BOTH PARTIES:

COMPLETE SAMPLE DELEGATION OF AUTHORITY FORM IN APPENDIX D AND ATTACH COPY HERE AND IN APPENDIX D.

STORMWATER POLLUTION PREVENTION PLAN

CONTRACTOR RESPONSIBILITIES

ELECTRIC CONTRACTOR: **COMPLETE ONLY IF REQUIRED**

CONTRACTOR _____

ADDRESS _____

PHONE/FAX _____

EMAIL _____

CONSTRUCTION ACTIVITIES:

CONSTRUCTION REPORTS: Daily log of construction activities and weather conditions, report any changes to proposed or installed improvements, log of on-site equipment refueling with immediate reporting of the location and amount of any spills (with corrective action taken) to the permit operator, and report of any non-stormwater discharges pursuant to Part I, Section D of the General Permit: VAR10 found in Appendix C.

INSPECTION REPORTS: Inspection reports shall be prepared weekly and within forty-eight hours of the end of any runoff producing storm event pursuant to the requirements of Part II, Section F of the General Permit: VAR10 found in Appendix C.

OTHER DUTIES ASSIGNED BY THE OPERATOR AS FOLLOWS:

TO BE COMPLETED BY THE OPERATOR AND PRIME CONTRACTOR, WITH SIGNATURES AND DATES BY ALL PARTIES:

COMPLETE SAMPLE DELEGATION OF AUTHORITY FORM IN APPENDIX D AND ATTACH COPY HERE AND IN APPENDIX D

STORMWATER POLLUTION PREVENTION PLAN

CONTRACTOR RESPONSIBILITIES

PHONE CONTRACTOR: **COMPLETE ONLY IF REQUIRED**

CONTRACTOR _____

ADDRESS _____

PHONE/FAX _____

EMAIL _____

CONSTRUCTION ACTIVITIES:

CONSTRUCTION REPORTS: Daily log of construction activities and weather conditions, report any changes to proposed or installed improvements, log of on-site equipment refueling with immediate reporting of the location and amount of any spills (with corrective action taken) to the permit operator, and report of any non-stormwater discharges pursuant to Part I, Section D of the General Permit: VAR10 found in Appendix C.

INSPECTION REPORTS: Inspection reports shall be prepared weekly and within forty-eight hours of the end of any runoff producing storm event pursuant to the requirements of Part II, Section F of the General Permit: VAR10 found in Appendix C.

OTHER DUTIES ASSIGNED BY THE OPERATOR AS FOLLOWS:

TO BE COMPLETED BY THE OPERATOR AND PRIME CONTRACTOR, WITH SIGNATURES AND DATES BY ALL PARTIES:

COMPLETE SAMPLE DELEGATION OF AUTHORITY FORM IN APPENDIX D AND ATTACH COPY HERE AND IN APPENDIX D

STORMWATER POLLUTION PREVENTION PLAN

CONTRACTOR RESPONSIBILITIES

CABLE CONTRACTOR: **COMPLETE ONLY IF REQUIRED**

CONTRACTOR _____

ADDRESS _____

PHONE/FAX _____

EMAIL _____

CONSTRUCTION ACTIVITIES:

CONSTRUCTION REPORTS: Daily log of construction activities and weather conditions, report any changes to proposed or installed improvements, log of on-site equipment refueling with immediate reporting of the location and amount of any spills (with corrective action taken) to the permit operator, and report of any non-stormwater discharges pursuant to Part I, Section D of the General Permit: VAR10 found in Appendix C.

INSPECTION REPORTS: Inspection reports shall be prepared weekly and within forty-eight hours of the end of any runoff producing storm event pursuant to the requirements of Part II, Section F of the General Permit: VAR10 found in Appendix C.

OTHER DUTIES ASSIGNED BY THE OPERATOR AS FOLLOWS:

TO BE COMPLETED BY THE OPERATOR AND PRIME CONTRACTOR, WITH SIGNATURES AND DATES BY ALL PARTIES:

COMPLETE SAMPLE DELEGATION OF AUTHORITY FORM IN APPENDIX D AND ATTACH COPY HERE AND IN APPENDIX D

STORMWATER POLLUTION PREVENTION PLAN

SUB CONTRACTOR RESPONSIBILITIES

TO BE COMPLETED BY THE OPERATOR AND PRIME CONTRACTOR WITH ADDITIONAL COPIES INSERTED AS REQUIRED

PRIME CONTRACTOR: _____

SUB CONTRACTOR _____

ADDRESS _____

PHONE/FAX _____

EMAIL _____

TO BE COMPLETED BY THE OPERATOR AND PRIME CONTRACTOR, WITH SIGNATURES AND DATES BY ALL PARTIES:

COMPLETE SAMPLE DELEGATION OF AUTHORITY FORM IN APPENDIX D AND ATTACH COPY HERE AND IN APPENDIX D

CONSTRUCTION REPORTS: Daily log of construction activities and weather conditions, report any changes to proposed or installed improvements and pollution measures, log of on-site equipment refueling with immediate reporting of the location and amount of any spills (with corrective action taken) to the permit operator, location of required port-a-johns with identification of parties responsible for installation and maintenance, location of required solid waste management facilities with identification of parties responsible for installation and maintenance, and report of any non-stormwater discharges pursuant to Part I, Section D of the General Permit: VAR10 found in Appendix C.

INSPECTION REPORTS: Inspection reports shall be prepared weekly and within forty-eight hours of the end of any runoff producing storm event pursuant to the requirements of Part II, Section F of the General Permit: VAR10 found in Appendix C.

STORMWATER POLLUTION PREVENTION PLAN

STORMWATER POLLUTION PREVENTION PLAN

A. SWPPP CONTENTS

1. GENERAL INFORMATION

- a. Signed copy of registration statement attached in Appendix A.
- b. Notice of coverage attached in Appendix B.
- c. General VPDES permit VAR10 attached in Appendix C.
- d. Narrative Description:

The purpose of this project is the redevelopment of the City of Roanoke Public Works Service Center. Newly constructed fuel island and tank farm are to replace those existing on site. Site work will be completed to allow for the existing fueling operations to remain in their current working condition until the new fuel island and tank farm are complete. New and relocated roadway, parking, and storage areas are to be provided to improve the efficiency of the site. The existing security system is to be upgraded in this construction. The total disturbance for these improvements is 2.22 acres, 1.32 of which are impervious in the post developed condition. The resulting construction will increase the net impervious cover of the site by 0.22 acres.

- e. Legible Site Plan
 - 1) Directions of stormwater flow and grading
See Appendix F Site/E&S/Stormwater Plans
 - 2) Limits of land disturbance
See Appendix F Site/E&S/Stormwater Plans
 - 3) Location of structural measures
See Appendix F Site/E&S/Stormwater Plans
 - 4) Location of surface waters
See Appendix F Site/E&S/Stormwater Plans
 - 5) Locations of concentrated discharge
See Appendix F Site/E&S/Stormwater Plans

STORMWATER POLLUTION PREVENTION PLAN

6) Locations of support activities

Since the location of support activities may periodically move during construction, the design plans do not contain a specific location. For each phase of work a location will be determined in the field and noted in the Site Inspection Log and added to the site plans. The Prime Contractor shall be responsible for determining or approving locations and updating the Site Inspection Log and site plans as required.

7) Inspections

Inspections are to be performed once every five business days, rain gauge or other methodology for measuring storm events not required.

2. EROSION AND SEDIMENT CONTROL PLAN

a. Plan approved by VESCP authority

See Appendix F Site/E&S/Stormwater Plans

b. Maintenance responsibilities

See Appendix F Site/E&S/Stormwater Plans

c. Properly implemented plan

See Appendix F Site/E&S/Stormwater Plans

3. STORMWATER MANAGEMENT PLAN

a. New Construction Activities

See Appendix F Site/E&S/Stormwater Plans

b. Existing Construction Activities

Not Applicable

4. POLLUTION PREVENTION PLAN

a. Potential pollutant-generating activities:

- Equipment refueling and maintenance.
- Wash water from construction materials.
- Wash water from vehicle and equipment washing.
- Concrete equipment wash and disposal.
- Storage of construction materials.
- Temporary septic facilities

STORMWATER POLLUTION PREVENTION PLAN

b. Potential pollutant-generating activities locations:

Since the location of pollutant-generating activities will periodically move during construction, the design plans do not contain a specific location. For each phase of work a location will be determined in the field and noted in the Site Inspection Log and added to the site plans. The Prime Contractor shall be responsible for determining or approving locations and updating the Site Inspection Log and site plans as required.

c. Potential comingled discharges:

- Discharges from firefighting activities
- Fire hydrant flushings
- Waters used to wash vehicles or equipment where soaps, solvents, or detergents have not been used and the wash water has been filtered, settled, or similarly treated prior to discharge
- Water used to control dust that has been filtered, settled, or similarly treated prior to discharge
- Potable water sources, including uncontaminated waterline flushings
- Routine external building wash down where soaps, solvents or detergents have not been used and the wash water has been filtered, settled, or similarly treated prior to discharge
- Pavement wash waters where spills or leaks of toxic or hazardous materials have not occurred (or where all spilled or leaked material has been removed prior to washing); where soaps, solvents, or detergents have not been used; and where the wash water has been filtered, settled, or similarly treated prior to discharge
- Uncontaminated air conditioning or compressor condensate
- Foundation or footing drains where flows are not contaminated with process materials such as solvents
- Uncontaminated excavation dewatering, including dewatering of trenches and excavations that have been filtered, settled, or similarly treated prior to discharge
- Landscape irrigation.

d. Responsibility for discharges:

SWPPP operator, Prime Contractor Qualified Personnel, or other contractor personnel as designated by the operator or Prime Contractor. See Appendix K for qualified personnel list.

e. Pollution Prevention Practices and Procedures:

1) Spills and Reporting:

Spill kits will be included with all fueling sources, maintenance activities and hazardous material storage areas. Materials and equipment necessary for oil or chemical spill cleanup will be kept onsite at designated locations to be marked on the site plan. Equipment will include, but not be limited to, brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, saw dust, and plastic or metal trash containers.

STORMWATER POLLUTION PREVENTION PLAN

Each contractor shall identify the qualified individuals responsible for the procedures for containing, diverting, isolating, and cleaning up any spills. All oil or other chemical spills will be cleaned up immediately upon discovery.

Oil, chemical or other hazardous substance spills in excess of reportable quantities, will be reported to the Department in accordance with Part III G. of the Permit as soon as the discharge is discovered, but no later than 24 hours.

A reportable quantity of oil is defined as a discharge to surface water that causes sheen, discoloration, and/or an emulsion.

Reports will be made to the following:

***Department of Environmental Quality
Roanoke Office
3019 Peters Creek Road
Roanoke, VA 24019
(540) 562-6700
(540) 562-6725 (fax)***

***Virginia Department of Emergency Management
Emergency Operations Center (EOC)
(800) 468-8892***

Roanoke City Police Department – 540-853-2212

Roanoke City Fire/EMS – 540-853-2327

2) Vehicle fueling and maintenance:

On-site vehicle refueling will be conducted in dedicated location (***TO BE DETERMINED BY THE PRIME CONTRACTOR AND MARKED ON PLAN SHEETS***) away from access to surface waters. Since the location of fueling activities may periodically move during construction, the design plans do not contain a specific location. For each phase of work a location will be determined in the field and noted in the Site Inspection Log. Containment berms will be located adjacent to the refueling area that will contain any inadvertent spills until they can be cleaned up. In the event of a spill, it will be cleaned up immediately and the material, including any contaminated soil, will be disposed of according to all federal, state, and local regulations.

All vehicles on site will be monitored for leaks and receive regular preventative maintenance to reduce the chance of leakage.

Petroleum products will be stored in tightly sealed containers which are clearly labeled.

Spill kits will be included with all fueling sources and maintenance activities.

STORMWATER POLLUTION PREVENTION PLAN

Any asphalt substances used onsite will be applied according to the manufacturer's recommendation.

All equipment refueling is to be provided by portable fuel tanks, no fuel supplies are to be stored on site. On-site maintenance shall be kept to the minimum required for daily operation, with major repairs to be performed off-site.

Each contractor shall be responsible for maintaining a log of on-site equipment refueling with immediate reporting of the location and amount of any spills (with corrective action taken) to the permit operator.

3) Construction Material Cleanup:

Designate a material wash area on the site that does not receive a substantial amount of runoff from upland areas and does not drain directly to a waterbody.

Ensure that storage containers have lids so they can be covered before periods of rain, and keep containers in a covered area whenever possible.

Clean up spills immediately. For hazardous materials, follow cleanup instructions on the package. Use an absorbent material such as sawdust or kitty litter to contain the spill.

Designate a waste storage area on the site that does not receive a substantial amount of runoff from upland areas and does not drain directly to a waterbody. Provide closed containers for the disposal of pollutant material waste.

Phosphorous- and nitrogen-containing detergents are used in wash water for cleaning. Excesses of these nutrients can be a major source of water pollution. Use detergents only as recommended, and limit their use on the site. Do not dump wash water containing detergents into storm drain systems; direct it to a sanitary sewer or contain it so that it can be treated.

Form release oil work will be applied over a pallet covered with an absorbent material to collect excess fluid. The absorbent material will be replaced and disposed of properly when saturated.

4) Vehicle and Equipment Washing:

Designate a vehicle wash area on the site that does not receive a substantial amount of runoff from upland areas and does not drain directly to a waterbody.

Direct wash water to a sediment trap or provide filtration with filter bags or sand filters. If a sediment trap is used, verify that soil bottom does not contain any hazardous material before disposal or replacement. To ensure the proper disposal of contaminated soils that have been exposed to and may contain hazardous substances, consult with state or local solid waste regulatory agencies or private firms.

STORMWATER POLLUTION PREVENTION PLAN

5) Concrete

Concrete trucks will not be allowed to washout or discharge surplus concrete or drum waste water on the site except as approved by the Design Engineer or owner. Liquid concrete wastes shall be removed and disposed of using proper procedures and shall not be discharged to surface waters.

Excess concrete or asphalt pavement supplies must be transported off site and no wash-down of delivery vehicles (excluding tire mud removal) shall be allowed on-site.

6) Material Storage

Never remove the original product label from the container because it contains important safety information. Follow the manufacturer's recommended method of disposal, which should be printed on the label.

Never mix excess products when disposing of them, unless specifically recommended by the manufacturer.

To ensure the proper disposal of contaminated soils that have been exposed to and still contain hazardous substances, consult with state or local solid waste regulatory agencies or private firms. Some landfills might accept contaminated soils, but may require laboratory tests first.

On-site material storage is to be limited to non-hazardous materials such as stone, concrete, or brick blocks, corrugated metal, concrete, or plastic pipe, untreated wood frame material, or other stable building materials.

No hazardous materials such as paints, solvents, fertilizers, or other chemicals are to be stored on-site unless enclosed in approved waterproof containers.

Post the guidelines for proper handling, storage, and disposal of construction site wastes.

Fertilizer:

- Fertilizers will be applied only in the minimum amounts recommended by the manufacturer.
- Fertilizers will be worked into the soil to limit exposure to storm water.
- Fertilizers will be stored in covered containers and partially used bags will be transferred to a sealable bin to avoid spills.

Paint and other Chemicals:

- All paint containers and curing compounds will be tightly sealed and stored when required for use. Excess paint will not be discharged to the storm sewers, but will be properly disposed of according to the manufacturer's instructions.

STORMWATER POLLUTION PREVENTION PLAN

7) Sanitary Waste

Each contractor shall be responsible for the installation and maintenance of any temporary sewer facilities (port-a-johns) required by the local health department or OSHA regulations.

A log of the proposed location of any required port-a-johns with the identification of parties responsible for installation and maintenance shall be maintained and submitted to the permit operator. All proposed port-a-john locations shall be marked on the attached Plan Sheets.

8) Construction Debris

All manmade construction debris is to be stored in approved containers and transported to an approved Solid Waste Management Facility.

Each contractor shall be responsible for the installation and maintenance of any containers required by his contract responsibilities and each contractor should instruct their employees to place construction debris only in approved containers and not allow debris to accumulate with the potential to contaminate stormwater runoff.

Collect, remove, and dispose of all construction site wastes at authorized disposal areas. Consult with local waste management authorities about the requirements for disposing of hazardous materials.

To prevent leaks, empty and clean hazardous waste containers before disposing of them.

Schedule waste collection to prevent the containers from overfilling.

All-natural vegetative waste debris is to be controlled by the grading contractor.

A record of all vegetative waste debris piles with the location to be shown on the attached Soil and Erosion Plan Sheets attached (along with date established, pollution control measures installed, method for processing and removal, and estimated removal date) is to be maintained by the contractor.

Processing and removal may be accomplished by (but not necessarily limited to) chipping for fuel supplies or grinding for mulch material to be used for soil and erosion control or mixed with soil for planting beds.

All-natural soil waste debris or stockpiles are to be controlled by the grading contractor.

A record of all soil waste debris or stockpiles with the location to be shown on the attached Soil and Erosion Plan Sheets attached (along with date established, pollution control measures installed, method for processing and removal, and estimated removal date) is to be maintained by the contractor.

STORMWATER POLLUTION PREVENTION PLAN

There are no known pollutant sources from areas other than the permitted construction activities that contribute to the permitted discharge. Procedures shall be developed for any other activities discovered during construction.

f. Awareness:

An effective waste management system requires training and signage to promote awareness of the hazards of improper storage, handling, and disposal of wastes. The only way to be sure that waste management practices are being followed is to be aware of worker habits and to inspect storage areas regularly. Extra management time may be required to ensure that all workers are following the proper procedures.

Inspect storage and use areas and identify containers or equipment that could malfunction and cause leaks or spills. Check equipment and containers for leaks, corrosion, support or foundation failure, or other signs of deterioration, and test them for soundness. Immediately repair or replace any that are found to be defective.

Waste management practices are effective only when they are regularly practiced at a construction site. In storage and use areas, post the guidelines for proper handling, storage, and disposal of construction site wastes; train workers in these practices to ensure that everyone is knowledgeable enough to participate.

5. IMPAIRED OR EXCEPTIONAL WATERS OR TMDL'S

- a. This area of the Roanoke River Watershed has been identified as a TMDL for E. Coli. It is not anticipated that construction activities will add to the TMDL's listed.

6. QUALIFIED PERSONNEL LIST

See Appendix K.

7. DELEGATION OF AUTHORITY

See Appendix L.

8. SIGNATURE

See Page 1

B. SWPPP AMENDMENTS, MODIFICATIONS, AND UPDATES

This storm water pollution prevention plans must be updated as necessary to remain consistent with any change applicable to protecting surface water resources in sediment erosion site plans or site permits, or storm water management site plans or site permits approved by state, or local

STORMWATER POLLUTION PREVENTION PLAN

officials for which the permittee receives written notice. All amendments, modifications, and updates shall comply with the requirements of Part II Section B of the General Permit in Appendix C.

C. PUBLIC NOTIFICATION

See Part II Section C of the General Permit in Appendix C.

D. SWPPP AVAILABILITY

See Part II Section D of the General Permit in Appendix C.

E. SWPPP IMPLEMENTATION

See Part II Section E of the General Permit in Appendix C.

F. SWPPP INSPECTIONS

See Part II Section F of the General Permit in Appendix C.

Inspections shall be conducted at least once every five business days.

See Appendix M for Inspection Report; complete, sign, and insert copy into SWPPP.

G. CORRECTIVE ACTIONS

See Part II Section G of the General Permit in Appendix C.

CONDITIONS APPLICABLE TO ALL VPDES PERMITS

See Part III Sections A - Z of the General Permit in Appendix C.

APPENDIX A

2024 REGISTRATION STATEMENT

**VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
GENERAL VPDES PERMIT FOR DISCHARGES OF
STORMWATER FROM CONSTRUCTION ACTIVITIES (VAR10)
REGISTRATION STATEMENT 2024**

PERMIT #: _____
PLAN/ID #: _____

Application type. ☒ **NEW PERMIT ISSUANCE**
(CHOOSE ONE) ☐ **MODIFICATION WITH ACREAGE INCREASE: Permit # _____**
☐ **MODIFICATION WITHOUT ACREAGE INCREASE: Permit # _____**
☐ **EXISTING PERMIT REISSUANCE: Permit # _____**

Section I. Operator/Permittee/Billing Information.

A. Construction Activity Operator (Permittee). The person or entity that is applying for permit coverage and will have operational control over construction activities to ensure compliance with the general permit. A person with signatory authority for this operator must sign the certification in Section V (per Part III.K of the VAR10 Permit).	
Operator Name:	City of Roanoke
Contact person:	James Nuckles
Address:	215 Church Avenue Room 350 SW
City, State and Zip Code:	Roanoke, Virginia 24011
Phone Number:	540-853-2953
Primary and CC Email(s):	james.nuckles@roanokeva.gov
State Corporation Commission Entity Number (if applicable):	
B. Electronic correspondence. To receive an emailed coverage letter or to pay by credit card, you must choose YES and include a valid email. May we transmit correspondence electronically? YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	

Section II. Construction Activity Information.

A. Include a legible site map showing the location of the existing or proposed land-disturbing activities for which the operator is seeking permit coverage, the limits of land disturbance, construction entrances, construction support activities, and all waterbodies receiving stormwater discharges from the construction site.	
B. Project site location information.	
Construction Activity Name:	Public Works Service Center Fueling Improvements
Address:	1802 Courtland Road NE
City and/or County and Zip Code:	Roanoke, Virginia 24012
Construction Activity Entrance Location (description or street address):	1802 Courtland Road NE
Latitude and Longitude (6-digit, decimal degrees format, e.g. 37.1234, -78.1234):	37.2869, -79.9368
C. Acreage totals for all land-disturbing activities to be included under this permit coverage. Report to the nearest one-hundredth of an acre.	
Total area of the construction site (including off-site area):	
Estimated area to be disturbed by the construction activity (on-site only):	2.01
Off-site estimated area to be disturbed (if applicable; please also refer to Section III):	
D. Construction Activity Status:	FEDERAL <input type="checkbox"/> STATE <input type="checkbox"/> PUBLIC <input checked="" type="checkbox"/> PRIVATE <input type="checkbox"/>
E. Nature of the Construction Activity Description (i.e. commercial, industrial, residential, agricultural, utility, solar, linear, stream restoration, etc.):	Local Government / Capital Improvements

CONSTRUCTION GENERAL PERMIT (VAR10) REGISTRATION STATEMENT 2024

F. Municipal Separate Storm Sewer System (MS4) name(s) (if the construction activity is discharging to an MS4):	City of Roanoke
G. Estimated Construction Activity Dates.	
Start Date:	February 2026
Completion Date:	November 2027
H. Is this construction activity part of a larger common Plan of development or sale?	YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>
I. 6 th Order Hydrologic Unit Code (HUC) and Receiving Water Name(s). Include additional areas on a separate page.	
HUC	NAME(S) OF RECEIVING WATER WATERBODY
RUI3	Tinker Creek - Glade Creek

Section III. Off-site Support Activity Location Information.

List all off-site support activities and excavated material disposal areas being utilized for this project. Include additional areas on a separate page.	
Off-site Activity Name:	N/A
Address:	
City or County:	
Off-site Activity Entrance Location (description or street address):	
Latitude and Longitude (6-digit, decimal degrees format, e.g., 37.1234, -78.1234):	
Is this off-site activity an excavated material disposal area?	YES <input type="checkbox"/> NO <input type="checkbox"/>
If this off-site activity is an excavated material disposal area, list the contents of the excavated fill material:	
Will a separate VPDES permit cover this off-site activity?	YES <input type="checkbox"/> Permit # _____ NO <input type="checkbox"/>

Section IV. Other Information.

A. A Stormwater Pollution Prevention Plan (SWPPP) must be prepared in accordance with the requirements of the General VPDES Permit for Discharges of Stormwater from construction activities <u>prior to</u> submitting the registration statement. By signing the registration statement, the operator certifies the SWPPP has been prepared.	
B. Has an Erosion and Sediment Control Plan been submitted to the VESC Authority for review?	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
Erosion and Sediment Control Plan Approval Date: (for the estimated area to be disturbed; MM/DD/YYYY)	10/21/2025
C. Has land-disturbance commenced?	YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>
D. Standards and Specifications. If this project is utilizing approved Standards and Specifications (S&S), attach the completed S&S Entity Form.	
E. Will nutrient credits be used to comply with the water quality design criteria requirements (9VAC25-875-580)? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> (If yes, please include a copy of the letter of availability from an appropriate nutrient bank that nonpoint source nutrient credits are available.)	

CONSTRUCTION GENERAL PERMIT (VAR10) REGISTRATION STATEMENT 2024

Section V. Certification. A person representing the operator as identified in Section I.A and meeting the requirements of Part III.K of 9VAC25-880-70 must physically sign this certification. A typed signature is not acceptable. Please note that operator is defined in 9VAC25-875-20 as follows:

"Operator" means the owner or operator of any facility or activity subject to the VESMA and this chapter. In the context of stormwater associated with a large or small construction activity, "operator" means any person associated with a construction project that meets either of the following two criteria: (i) the person has direct operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications or (ii) the person has day-to-day operational control of those activities at a project that are necessary to ensure compliance with a stormwater pollution prevention plan for the site or other permit or VESMP authority permit conditions (i.e., the person is authorized to direct workers at a site to carry out activities required by the stormwater pollution prevention plan or comply with other permit conditions). In the context of stormwater discharges from an MS4, "operator" means the operator of the regulated MS4 system.

9VAC25-880-70. Part III.K. Signatory requirements. All registration statements shall be signed as follows:

- a. "For a corporation: by a responsible corporate officer. For the purpose of this chapter, a responsible corporate officer means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy-making or decision-making functions for the corporation; or (ii) the manager of one or more manufacturing, production, or operating facilities, provided the manager is authorized to make management decisions that govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;
- b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or
- c. For a municipality, state, federal, or other public agency: by either a principal executive officer or ranking elected official. For purposes of this chapter, a principal executive officer of a public agency includes (i) the chief executive officer of the agency or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency."

Certification: "I certify under penalty of law that I have read and understand this registration statement and that this document and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations."

Printed Name:

James Nuckles

Signature (signed in ink):

James Nuckles

Date Signed:

10/28/2025

Section VI. Submittal Instructions. Submit this form to the VESMP Authority. If the locality is the VESMP Authority, please send your registration statement submittal directly to the locality; do NOT send this form to DEQ. A list of local VESMP Authorities is available here: [VESMP Authorities](#).

If DEQ is the VESMP Authority, please send to:

Department of Environmental Quality
Office of Stormwater Management Suite 1400
PO Box 1105
Richmond VA 23218
constructiongp@deq.virginia.gov

If the locality is the VESMP Authority, please send to:

The Local VESMP Authority (insert address below):

APPENDIX B
2024 NOTICE OF COVERAGE
(TO BE INSERTED WHEN RECEIVED)

APPENDIX C

2024 GENERAL CONSTRUCTION PERMIT VAR10



Commonwealth of Virginia

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

www.deq.virginia.gov

General Permit No.: VAR10

Effective Date: July 1, 2024

Expiration Date: June 30, 2029

**GENERAL VPDES PERMIT FOR DISCHARGES OF STORMWATER FROM
CONSTRUCTION ACTIVITIES**

**AUTHORIZATION TO DISCHARGE UNDER THE VIRGINIA EROSION AND
STORMWATER MANAGEMENT PROGRAM AND THE VIRGINIA EROSION AND
STORMWATER MANAGEMENT ACT**

In compliance with the provisions of the Clean Water Act, as amended, and pursuant to the Virginia Erosion and Stormwater Management Act and regulations adopted pursuant thereto, operators of construction activities are authorized to discharge to surface waters within the boundaries of the Commonwealth of Virginia, except those specifically named in State Water Control Board regulations that prohibit such discharges.

The authorized discharge shall be in accordance with the registration statement filed with the Department of Environmental Quality, this cover page, Part I - Discharge Authorization and Special Conditions, Part II - Stormwater Pollution Prevention Plan, and Part III - Conditions Applicable to All VPDES Permits as set forth in this general permit.

For stormwater discharge associated with a small construction activity of a single-family detached residential structure, within or outside a common plan of development or sale, the authorized discharge shall be in accordance with this cover page, Part I - Discharge Authorization and Special Conditions, Part II - Stormwater Pollution Prevention Plan, and Part III - Conditions Applicable to All VPDES Permits as set forth in this general permit.

PART I

DISCHARGE AUTHORIZATION AND SPECIAL CONDITIONS

A. Coverage under this general permit.

1. During the period beginning with the date of coverage under this general permit and lasting until the general permit's expiration date, the operator is authorized to discharge stormwater from construction activities.
2. This general permit also authorizes stormwater discharges from construction support activities located on-site or off-site provided that:
 - a. The support activity is directly related to the construction site that is required to have general permit coverage for discharges;
 - b. The support activity is neither a commercial operation nor serves multiple unrelated construction sites;
 - c. The support activity does not operate beyond the completion of the last construction activity it supports;
 - d. The support activity is identified in the registration statement at the time of general permit coverage or reported in a modified registration statement once the need for the support activity is known;
 - e. Appropriate control measures are identified in a stormwater pollution prevention plan and implemented to address the discharges from the support activity; and
 - f. All applicable state, federal, and local approvals are obtained for the support activity.

B. Limitations on coverage.

1. Post-construction discharges. This general permit does not authorize stormwater discharges that originate from the construction site after construction activities have been completed and the construction site, including any construction support activity covered under the general permit registration, has undergone final stabilization. Post-construction industrial stormwater discharges may need to be covered by a separate VPDES permit.
2. Discharges mixed with nonstormwater. This general permit does not authorize discharges that are mixed with sources of nonstormwater, other than those discharges that are identified in Part I E (Authorized nonstormwater discharges) and are in compliance with this general permit.
3. Discharges covered by another permit. This general permit does not authorize discharges of stormwater from construction activities that are covered under an individual permit or required to obtain coverage under an alternative general permit.

4. Impaired waters and total maximum daily load (TMDL) limitation.

a. Nutrient and sediment impaired waters. Discharges of stormwater from construction activities to surface waters identified as impaired in the 2022 § 305(b)/303(d) Water Quality Assessment Integrated Report for Benthic Macroinvertebrates Bioassessments or for which a TMDL wasteload allocation has been established and approved prior to the term of this general permit for (i) sediment or a sediment-related parameter (i.e., total suspended solids or turbidity) or (ii) nutrients (i.e., nitrogen or phosphorus), including all surface waters within the Chesapeake Bay Watershed, are not eligible for coverage under this general permit unless the operator develops, implements, and maintains a stormwater pollution prevention plan (SWPPP) in accordance with Part II B 5 of this permit that minimizes the pollutants of concern and, when applicable, is consistent with the assumptions and requirements of the approved TMDL wasteload allocations and implements an inspection frequency consistent with Part II G 2 a.

b. Polychlorinated biphenyl (PCB) impaired waters. Discharges of stormwater from construction activities that include the demolition of any structure with at least 10,000 square feet of floor space built or renovated before January 1, 1980, to surface waters identified as impaired in the 2022 § 305(b)/303(d) Water Quality Assessment Integrated Report or for which a TMDL wasteload allocation has been established and approved prior to the term of this general permit for PCB are not eligible for coverage under this general permit unless the operator develops, implements, and maintains a SWPPP in accordance with Part II B 6 of this permit that minimizes the pollutants of concern and, when applicable, is consistent with the assumptions and requirements of the approved TMDL wasteload allocations and implements an inspection frequency consistent with Part II G 2 a.

5. Exceptional waters limitation. Discharges of stormwater from construction activities not previously covered under the general permit effective on July 1, 2019, to exceptional waters identified in 9VAC25-260-30 A 3 c are not eligible for coverage under this general permit unless the operator develops, implements, and maintains a SWPPP in accordance with Part II B 7 of this permit and implements an inspection frequency consistent with Part II G 2 a.

6. There shall be no discharge of floating solids or visible foam in other than trace amounts.

C. Commingled discharges. Discharges authorized by this general permit may be commingled with other sources of stormwater that are not required to be covered under a permit, so long as the commingled discharge is in compliance with this general permit. Discharges authorized by a separate state or VPDES permit may be commingled with discharges authorized by this general permit so long as all such discharges comply with all applicable state and VPDES permit requirements.

D. Prohibition of nonstormwater discharges. Except as provided in Part I A 2, C, and E, all discharges covered by this general permit shall be composed entirely of stormwater associated with construction activities. All other discharges, including the following, are prohibited:

1. Wastewater from washout of concrete;

2. Wastewater from the washout or cleanout of stucco, paint, form release oils, curing compounds, and other construction materials;
3. Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance;
4. Oils, toxic substances, or hazardous substances from spills or other releases; and
5. Soaps, solvents, or detergents used in equipment and vehicle washing.

E. Authorized nonstormwater discharges. The following nonstormwater discharges from construction activities are authorized by this general permit:

1. Discharges from emergency firefighting activities;
2. Fire hydrant flushings, managed to avoid an instream impact;
3. Waters used to wash vehicles or equipment, provided no soaps, solvents, or detergents are used and the wash water is filtered, settled, or similarly treated prior to discharge;
4. Water used to control dust that is filtered, settled, or similarly treated prior to discharge;
5. Potable water, including uncontaminated waterline flushings, managed in a manner to avoid an instream impact;
6. Routine external building wash down provided no soaps, solvents or detergents are used, external building surfaces do not contain hazardous substances, and the wash water is filtered, settled, or similarly treated prior to discharge;
7. Pavement wash waters, provided spills or leaks of toxic or hazardous materials have not occurred, unless all spilled or leaked material has been removed prior to washing; soaps, solvents, or detergents are not used; and where the wash water is filtered, settled, or similarly treated prior to discharge;
8. Uncontaminated air conditioning or compressor condensate;
9. Uncontaminated ground water or spring water;
10. Foundation or footing drains, provided flows are not contaminated with process materials such as solvents or contaminated groundwater;
11. Uncontaminated excavation dewatering, including dewatering of trenches and excavations that are filtered, settled, or similarly treated prior to discharge; and
12. Landscape irrigation.

F. Termination of general permit coverage.

1. The operator of the construction activity shall submit a notice of termination in accordance with 9VAC25-880-60, unless a registration statement was not required to be

submitted in accordance with 9VAC25-880-50 A 1 c or A 2 b for single-family detached residential structures, to the Virginia Erosion and Stormwater Management (VESMP) authority after one or more of the following conditions have been met:

- a. Necessary permanent control measures included in the SWPPP for the construction site are in place and functioning effectively and final stabilization has been achieved on all portions of the construction site for which the operator has operational control. When applicable, long-term responsibility and maintenance requirements for permanent control measures shall be recorded in the local land records prior to the submission of a complete and accurate notice of termination and the construction record drawing prepared;
 - b. Another operator has assumed control over all areas of the construction site that have not been finally stabilized and obtained coverage for the ongoing discharge;
 - c. Coverage under an alternative VPDES permit or other applicable permit has been obtained; or
 - d. For individual lots in residential construction only, final stabilization as defined in 9VAC25-880-1 has been completed, including providing written notification to the homeowner and incorporating a copy of the notification and signed certification statement into the SWPPP, and the residence has been transferred to the homeowner.
2. The notice of termination shall be submitted no later than 30 days after one of the conditions in subdivision 1 of this subsection is met.
3. Termination of authorization to discharge shall be effective upon notification from the department that the provisions of subdivision 1 of this subsection have been met or 90 days after submittal of a complete and accurate notice of termination in accordance with 9VAC25-880-60 C, whichever occurs first, unless otherwise notified by the VESMP or the department.
4. The notice of termination shall be signed in accordance with Part III K 1 and include the required certification in accordance with Part III K 4 of this general permit.

G. Water quality protection.

1. The operator shall select, install, implement, and maintain control measures as identified in the SWPPP at the construction site that minimize pollutants in the discharge as necessary to ensure that the operator's discharge does not cause or contribute to an excursion above any applicable water quality standard.
2. If it is determined by the department that the operator's discharges are causing, have reasonable potential to cause, or are contributing to an excursion above any applicable water quality standard, the department, in consultation with the VESMP authority, may take appropriate enforcement action and require the operator to:
 - a. Modify or implement additional control measures in accordance with Part II C to adequately address the identified water quality concerns;

b. Submit valid and verifiable data and information that are representative of ambient conditions and indicate that the receiving water is attaining water quality standards; or

c. Submit an individual permit application in accordance with 9VAC25-875-980 B 3.

H. All written responses required under this general permit shall include a signed certification consistent with Part III K.

PART II

STORMWATER POLLUTION PREVENTION PLAN

A. Stormwater pollution prevention plan.

1. A stormwater pollution prevention plan (SWPPP) shall be developed prior to the submission of a registration statement and implemented for the construction activity, including any construction support activity, covered by this general permit. For a small construction activity of a single-family detached residential structure, within or outside a common plan of development or sale, a SWPPP shall be developed and implemented prior to the initiation of the construction activity, including any construction support activity covered by this general permit.

2. SWPPPs shall be prepared in accordance with good engineering practices. Construction activities that are part of a larger common plan of development or sale and disturb less than one acre may utilize a SWPPP template provided by the department and need not provide a separate stormwater management plan if one has been prepared and implemented for the larger common plan of development or sale.

3. The SWPPP requirements of this general permit may be fulfilled by incorporating by reference other plans such as a spill prevention control and countermeasure (SPCC) plan developed for the construction site under § 311 of the federal Clean Water Act or best management practices (BMP) programs otherwise required for the construction site provided that the incorporated plan meets or exceeds the SWPPP requirements of Part II B. All plans incorporated by reference into the SWPPP become enforceable under this general permit. If a plan incorporated by reference does not contain all of the required elements of the SWPPP, the operator shall develop the missing elements and include them in the SWPPP.

4. Any operator that was authorized to discharge under the general permit effective July 1, 2019, and that intends to continue coverage under this general permit shall update its stormwater pollution prevention plan to comply with the requirements of this general permit no later than 60 days after the date of coverage under this general permit.

B. Contents. The SWPPP shall include the following items:

1. General information.

a. A signed copy of the registration statement, if required, for coverage under this general permit;

- b. Upon receipt, a copy of the notice of coverage under this general permit (i.e., notice of coverage letter);
 - c. Upon receipt, a copy of the general VPDES permit for discharges of stormwater from construction activities;
 - d. A narrative description of the nature of the construction activity, including the function of the project (e.g., low density residential, shopping mall, highway);
 - e. A legible map of the construction site identifying:
 - (1) Existing and proposed drainage patterns on the construction site and approximate slopes before and after major grading activities;
 - (2) Limits of clearing and grading (i.e., land disturbance), including steep slopes and natural buffers around surface waters that will remain undisturbed;
 - (3) Locations of major structural and nonstructural control measures, including sediment basins and traps, perimeter dikes and diversions, sediment barriers, and other measures intended to filter, settle, or similarly treat sediment that will be installed between disturbed areas and the undisturbed vegetated areas in order to increase sediment removal and maximize stormwater infiltration;
 - (4) Locations of surface waters;
 - (5) Locations where concentrated stormwater is discharged;
 - (6) Locations of any construction support activities, including (i) areas where equipment and vehicle washing, wheel wash water, and other wash water is to occur; (ii) storage areas for chemicals such as acids, fuels, fertilizers, and other lawn care chemicals; (iii) concrete wash out areas; (iv) vehicle fueling and maintenance areas; (v) sanitary waste facilities, including those temporarily placed on the construction site; (vi) construction waste storage; and (vii) areas where polymers, flocculants, or other stormwater treatment chemicals will be used or stored; and
 - (7) When applicable, the location of the on-site rain gauge or the methodology established in consultation with the VESMP authority used to identify measurable storm events for inspection as allowed by Part II G 2 a (1) (ii) or 2 b (2).
2. Erosion and sediment control plan for the construction activity authorized by this general permit.
- a. An erosion and sediment control plan designed and approved in accordance with the Virginia Erosion and Stormwater Management Regulations (9VAC25-875), an "agreement in lieu of a plan" as defined in 9VAC25-875-20, or an erosion and sediment control plan prepared in accordance with department-approved standards and specifications.

b. All erosion and sediment control plans shall include a statement describing the maintenance responsibilities required for the erosion and sediment controls used.

c. An approved erosion and sediment control plan, "agreement in lieu of a plan," or erosion and sediment control plan prepared in accordance with department-approved standards and specifications shall be implemented to:

(1) Control the volume and velocity of stormwater runoff within the construction site to minimize soil erosion;

(2) Control stormwater discharges, including peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion;

(3) Minimize the amount of soil exposed during the construction activity;

(4) Minimize the disturbance of steep slopes;

(5) Minimize sediment discharges from the construction site in a manner that addresses (i) the amount, frequency, intensity, and duration of precipitation; (ii) the nature of resulting stormwater runoff; and (iii) soil characteristics, including the range of soil particle sizes present on the construction site;

(6) Provide and maintain natural buffers around surface waters, direct stormwater to vegetated areas to increase sediment removal, and maximize stormwater infiltration, unless infiltration would be inadvisable due to the underlying geology (e.g., karst topography) and groundwater contamination concerns or infeasible due to site conditions;

(7) Minimize soil compaction. Minimizing soil compaction is not required where the intended function of a specific area of the construction site dictates that it be compacted;

(8) Unless infeasible, preserve topsoil. Preserving topsoil is not required where the intended function of a specific area of the construction site dictates that the topsoil be disturbed or removed;

(9) Ensure the initiation of stabilization activities of disturbed areas occurs immediately whenever any clearing, grading, excavating, or other land-disturbing activities have permanently ceased on any portion of the construction site, or temporarily ceased on any portion of the construction site and will not resume for a period exceeding 14 days; and

(10) Utilize outlet structures that withdraw stormwater from the surface (i.e., above the permanent pool or wet storage water surface elevation), unless infeasible, when discharging from sediment basins or sediment traps.

3. Stormwater management plan for the construction activity authorized by this general permit.

- a. Except for those projects identified in Part II B 3 b, a stormwater management plan approved in accordance with the Virginia Erosion and Stormwater Management Regulation (9VAC25-875) or an "agreement in lieu of a plan" as defined in 9VAC25-875-20 or a stormwater management plan prepared in accordance with department-approved standards and specifications.
 - b. For any operator meeting the conditions of 9VAC25-875-480 B of the Virginia Erosion and Stormwater Management Regulation, an approved stormwater management plan is not required. In lieu of an approved stormwater management plan, the SWPPP shall include a description of and all necessary calculations supporting all post-construction stormwater management measures that will be installed prior to the completion of the construction process to control pollutants in stormwater discharges after construction operations have been completed. Structural measures should be placed on upland soils to the degree possible. Such measures must be designed and installed in accordance with applicable VESCP authority, VESMP authority, state, and federal requirements, and any necessary permits must be obtained.
4. Pollution prevention plan for the construction activity authorized by this general permit. A pollution prevention plan that addresses potential pollutant-generating activities that may reasonably be expected to affect the quality of stormwater discharges from the construction activity, including any support activity. The pollution prevention plan shall:
- a. Identify the potential pollutant-generating activities and the pollutant that is expected to be exposed to stormwater;
 - b. Describe the location where the potential pollutant-generating activities will occur, or if identified on the site plan, reference the site plan;
 - c. Identify all nonstormwater discharges, as authorized in Part I E of this general permit, that are or will be commingled with stormwater discharges from the construction activity, including any applicable support activity;
 - d. Identify the person responsible for implementing the pollution prevention practices for each pollutant-generating activity (if other than the person listed as the qualified personnel);
 - e. Describe the pollution prevention practices and procedures that will be implemented to:
 - (1) Prevent and respond to leaks, spills, and other releases, including (i) procedures for expeditiously stopping, containing, and cleaning up spills, leaks, and other releases; and (ii) procedures for reporting leaks, spills, and other releases in accordance with Part III G;
 - (2) Prevent the discharge of spilled and leaked fuels and chemicals from vehicle fueling and maintenance activities (e.g., providing secondary containment such as spill berms, decks, spill containment pallets, providing cover where appropriate, and having spill kits readily available);

(3) Prevent the discharge of soaps, solvents, detergents, and wash water from construction materials, including the clean-up of stucco, paint, form release oils, and curing compounds (e.g., providing (i) cover (e.g., plastic sheeting or temporary roofs) to prevent contact with stormwater; (ii) collection and proper disposal in a manner to prevent contact with stormwater; and (iii) a similarly effective means designed to prevent discharge of these pollutants);

(4) Minimize the discharge of pollutants from vehicle and equipment washing, wheel wash water, and other types of washing (e.g., locating activities away from surface waters and storm drain inlets and constructed or natural site drainage features and directing wash waters to sediment basins or traps, using filtration devices such as filter bags or sand filters, or using similarly effective controls);

(5) Direct concrete wash water into a leak-proof container or leak-proof settling basin designed so that no overflows can occur due to inadequate sizing or precipitation. Hardened concrete wastes shall be removed and disposed of in a manner consistent with the handling of other construction wastes. Liquid concrete wastes shall be removed and disposed of in a manner consistent with the handling of other construction wash waters and shall not be discharged to surface waters, disposed of through infiltration, or otherwise disposed of on the ground;

(6) Minimize the discharge of pollutants from storage, handling, and disposal of construction products, materials, and wastes, including (i) building products such as asphalt sealants, copper flashing, roofing materials, adhesives, and concrete admixtures; (ii) pesticides, herbicides, insecticides, fertilizers, and landscape materials; and (iii) construction and domestic wastes such as packaging materials, scrap construction materials, masonry products, timber, pipe and electrical cuttings, plastics, Styrofoam, concrete, and other trash or building materials;

(7) Prevent the discharge of fuels, oils, and other petroleum products, hazardous or toxic wastes, waste concrete, and sanitary wastes;

(8) Address any other discharge from the potential pollutant-generating activities not addressed in this subdivision 4; and

(9) Minimize the exposure of waste materials to precipitation by closing or covering waste containers during precipitation events and at the end of the business day or implementing other similarly effective practices. Minimization of exposure is not required in cases where the exposure to precipitation will not result in a discharge of pollutants; and

f. Describe procedures for providing pollution prevention awareness of all applicable wastes, including any wash water, disposal practices, and applicable disposal locations of such wastes, to personnel in order to comply with the conditions of this general permit. The operator shall implement the procedures described in the SWPPP.

5. SWPPP requirements for discharges to nutrient and sediment impaired waters. For discharges to surface waters (i) identified as impaired in the 2022 § 305(b)/303(d) Water Quality Assessment Integrated Report for Benthic Macroinvertebrates Bioassessments or (ii) with an applicable TMDL wasteload allocation established and approved prior to the

term of this general permit for sediment or a sediment-related parameter (i.e., total suspended solids or turbidity) or nutrients (i.e., nitrogen or phosphorus), including all surface waters within the Chesapeake Bay Watershed, the operator shall:

a. Identify the impaired waters, approved TMDLs, and pollutants of concern in the SWPPP; and

b. Provide documentation in the SWPPP that:

(1) Permanent or temporary soil stabilization shall be applied to denuded areas within seven days after final grade is reached on any portion of the construction site;

(2) Nutrients shall be applied in accordance with manufacturer's recommendations or an approved nutrient management plan and shall not be applied during rainfall events; and

(3) A modified inspection schedule shall be implemented in accordance with Part II G 2 a.

6. SWPPP requirements for discharges to polychlorinated biphenyl (PCB) impaired waters. For discharges from construction activities that include the demolition of any structure with at least 10,000 square feet of floor space built or renovated before January 1, 1980, to surface waters (i) identified as impaired in the 2022 § 305(b)/303(d) Water Quality Assessment Integrated Report or (ii) with an applicable TMDL wasteload allocation established and approved prior to the term of this general permit for PCB, the operator shall:

a. Identify the impaired waters, approved TMDLs, and pollutant of concern in the SWPPP;

b. Implement the approved erosion and sediment control plan in accordance with Part II B 2;

c. Dispose of waste materials in compliance with applicable state, federal, and local requirements; and

d. Implement a modified inspection schedule in accordance with Part II G 2 a.

7. SWPPP requirements for discharges to exceptional waters. For discharges to surface waters identified in 9VAC25-260-30 A 3 c as an exceptional water, the operator shall:

a. Identify the exceptional surface waters in the SWPPP; and

b. Provide documentation in the SWPPP that:

(1) Permanent or temporary soil stabilization shall be applied to denuded areas within seven days after final grade is reached on any portion of the construction site;

(2) Nutrients shall be applied in accordance with manufacturer's recommendations or an approved nutrient management plan and shall not be applied during rainfall events; and

(3) A modified inspection schedule shall be implemented in accordance with Part II G 2 a.

8. SWPPP requirements for construction dewatering discharges to sediment impaired waters or exceptional waters. Dewatering discharges of uncontaminated stormwater or groundwater from footers or foundations of a single-family detached residential structure are exempt from the requirements of this subdivision 8, provided that such discharges are not discharged directly to surface waters. For construction dewatering discharges to surface waters (i) identified as impaired in the 2022 § 305(b)/303(d) Water Quality Assessment Integrated Report for Benthic Macroinvertebrates Bioassessments; (ii) with an applicable TMDL wasteload allocation established and approved prior to the term of this general permit for sediment or a sediment-related parameter (i.e., total suspended solids or turbidity), including all surface waters within the Chesapeake Bay Watershed; or (iii) identified in 9VAC25-260-30 A 3 c as an exceptional water, the operator shall undertake one of the following methods for controlling and documenting construction dewatering discharges:

a. Turbidity benchmark option 1:

(1) Identify the location of all construction dewatering discharges in the SWPPP;

(2) Select, install, implement, and maintain control measures at each dewatering location that minimize pollutants, including suspended solids, in construction dewatering discharges prior to discharging into a stormwater conveyance system or surface water; and

(3) Provide documentation in the SWPPP that:

(a) Sample frequency. At least one grab sample shall be collected from each construction dewatering discharge when the first discharge at that location occurs, daily thereafter until the dewatering discharge stops, and after any installation of new controls or routine maintenance activity of existing controls. An upstream grab sample shall be collected from the receiving stream;

(b) Sample timing. Grab samples of the construction dewatering discharge shall be collected during the first 15 minutes of the construction dewatering discharge and daily thereafter until the dewatering discharge stops. Upstream grab samples of the receiving stream shall be collected within 15 minutes of the corresponding construction dewatering discharge sample;

(c) Sample location. Grab samples shall be collected after the construction dewatering water has been filtered, settled, or similarly treated and prior to its discharge into a stormwater conveyance system or surface water;

(d) Test methods. Grab samples taken as required by this subdivision 8 shall be measured using a turbidity meter that reports results in nephelometric

turbidity units (NTUs) or formazin turbidity units (FTUs), and a turbidity meter calibration verification shall be conducted prior to each day's use, consistent with manufacturer recommendations;

(e) Visual monitoring. All dewatering discharges shall be visually monitored for changes in the characterization of effluent discharge;

(f) Corrective action. If (i) any turbidity measurement of the construction dewatering discharge exceeds the upstream grab sample of the receiving stream by more than 50 NTUs/FTUs or (ii) visual monitoring indicates a change in the characterization of effluent discharge, corrective action shall be taken in accordance with Part II H 2 of this general permit; and

(g) Recordkeeping. Turbidity monitoring information (i.e., location, date, sample collection time, and turbidity measurement) and any necessary corrective actions taken shall be recorded in the SWPPP; or

b. Turbidity benchmark option 2:

(1) Identify the location of all construction dewatering discharges in the SWPPP;

(2) Select, install, implement, and maintain control measures at each dewatering location that minimize pollutants, including suspended solids, in construction dewatering discharges prior to discharging into a stormwater conveyance system or surface water; and

(3) Provide documentation in the SWPPP that:

(a) Sample frequency. At least one grab sample shall be collected from each construction dewatering discharge when the first discharge at that location occurs, daily thereafter until the dewatering discharge stops, and after any installation of new controls or routine maintenance activity of existing controls. Grab samples shall be tested to confirm a turbidity measurement of equal to or less than 150 NTUs/FTUs from the construction dewatering discharge;

(b) Sample timing. Grab samples of the construction dewatering discharge shall be collected during the first 15 minutes of the construction dewatering discharge and daily thereafter until the dewatering discharge stops;

(c) Sample location. Grab samples shall be collected after the construction dewatering water has been filtered, settled, or similarly treated and prior to its discharge into a stormwater conveyance system or surface water;

(d) Test methods. Grab samples taken as required by this subdivision 8 shall be measured using a turbidity meter that reports results in nephelometric turbidity units (NTUs) or formazin turbidity unit (FTUs), and a turbidity meter calibration verification shall be conducted prior to each day's use, consistent with manufacturer recommendations;

(e) Visual monitoring. All dewatering discharges shall be visually monitored for changes in the characterization of effluent discharge;

(f) Corrective action. If (i) any turbidity measurement of the construction dewatering discharge exceeds 150 NTUs/FTUs or (ii) visual monitoring indicates a change in the characterization of effluent discharge, corrective action shall be taken in accordance with Part II H 2 of this general permit; and

(g) Recordkeeping. Turbidity monitoring information (i.e., location, date, sample collection time, and turbidity measurement) and any necessary corrective actions taken shall be recorded in the SWPPP ; or

c. Turbidity benchmark option 3:

(1) Identify the location of all construction dewatering discharges in the SWPPP;

(2) Select, install, implement, and maintain control measures at each dewatering location that minimize pollutants, including suspended solids, in construction dewatering discharges prior to discharging into a stormwater conveyance system or surface water; and

(3) Provide documentation in the SWPPP that:

(a) Sample frequency. At least one grab sample shall be collected from each construction dewatering discharge when the first discharge at that location occurs, daily thereafter until the dewatering discharge stops, and after any installation of new controls or routine maintenance activity of existing controls. Grab samples shall be tested to confirm a turbidity measurement of equal to or less than 50 NTUs/FTUs, based on a weekly average, from the construction dewatering discharge;

(b) Sample timing. Grab samples of the construction dewatering discharge shall be collected during the first 15 minutes of the construction dewatering discharge and daily thereafter until the dewatering discharge stops;

(c) Sample location. Grab samples shall be collected after the construction dewatering water has been filtered, settled, or similarly treated and prior to its discharge into a stormwater conveyance system or surface water;

(d) Test methods. Grab samples taken as required by this subdivision 8 shall be measured using a turbidity meter that reports results in NTUs or FTUs, and a turbidity meter calibration verification shall be conducted prior to each day's use, consistent with manufacturer recommendations;

(e) Visual monitoring. All dewatering discharges shall be visually monitored for changes in the characterization of effluent discharge;

(f) Corrective action. If (i) the weekly average of the turbidity measurements of the construction dewatering discharge exceeds 50 NTUs/FTUs or (ii) visual monitoring indicates a change in the characterization of effluent discharge,

corrective action shall be taken in accordance with Part II H 2. The weekly average is the sum of all turbidity samples taken during a monitoring week (starting on Monday and ending on Sunday) divided by the number of samples measures during that week; and

(g) Recordkeeping. Turbidity monitoring information (i.e., location, date, sample collection time, and turbidity measurement) and any necessary corrective actions taken shall be recorded in the SWPPP.

d. Request for alternative benchmark threshold:

(1) At any time prior to or during coverage under this permit, a request may be submitted to the department to approve a benchmark that is higher than turbidity benchmark options 1, 2, and 3 if information is available demonstrating the higher number is the same as the receiving water's water quality standard for turbidity. To request approval of an alternate benchmark, the operator must submit the following to the department:

(a) The current turbidity water quality standard that applies to the receiving water; and

(b) Information on the natural or background turbidity level to determine the specific standard for the receiving water, including available data that can be used to establish the natural turbidity levels of the receiving water.

(2) The department will notify the operator of its decision on whether to approve the requested alternate benchmark within 30 days. Until the department approves an alternate benchmark, the operator is required to use the option 1, option 2, or option 3 turbidity benchmark and take any required corrective actions if an exceedance occurs.

9. Identification of qualified personnel. The name, telephone number, and qualifications of the qualified personnel conducting inspections required by this general permit.

10. Duly authorized representatives. The SWPPP shall include the names of individuals or positions duly authorized to sign inspection reports or modify the SWPPP on behalf of the operator. Any authorization shall be signed and dated in accordance with Part III K 2 and shall include the required certification in accordance with Part III K 4.

11. SWPPP signature and certification. The SWPPP shall be signed and dated in accordance with Part III K 2 of this general permit and shall include the required certification in accordance with Part III K 4 of this general permit.

C. SWPPP amendments, modification, and updates.

1. The operator shall amend the SWPPP whenever there is a change in the design, construction, operation, or maintenance that has a significant effect on the discharge of pollutants to surface waters and that has not been previously addressed in the SWPPP.

2. The SWPPP shall be amended if during inspections or investigations by the operator's qualified personnel or by local, state, or federal officials, it is determined that the existing control measures are ineffective in minimizing pollutants in discharges from the construction activity. Revisions to the SWPPP shall include additional or modified control measures designed and implemented to correct problems identified. If approval by the VESCP authority, VESMP authority, or department is necessary for the control measure, revisions to the SWPPP shall be completed no later than five business days following approval. Implementation of these additional or modified control measures shall be accomplished as described in Part II H.

3. The SWPPP shall clearly identify the contractors that will implement and maintain each control measure identified in the SWPPP. The SWPPP shall be amended to identify any new contractor that will implement and maintain a control measure.

4. The operator shall update the SWPPP as soon as possible but no later than five business days following any modification to its implementation. All modifications or updates to the SWPPP shall be noted and shall include the following items:

a. A record of dates when:

(1) Major grading activities occur;

(2) Construction activities temporarily or permanently cease on a portion of the construction site; and

(3) Stabilization measures are initiated;

b. Documentation of replaced or modified controls where periodic inspections or other information have indicated that the controls have been used inappropriately or incorrectly and were modified;

c. Areas that have reached final stabilization and where no further SWPPP or inspection requirements apply;

d. All properties that are no longer under the legal control of the operator and the dates on which the operator no longer had legal control over each property;

e. The date of any prohibited discharges, the discharge volume released, and what actions were taken to minimize the impact of the release;

f. Measures taken to prevent the reoccurrence of any prohibited discharge; and

g. Measures taken to address any evidence identified as a result of an inspection required under Part II G.

5. Amendments, modifications, or updates to the SWPPP shall be signed in accordance with Part III K 2 and shall include the required certification in accordance with Part III K 4.

D. Public notification. Upon commencement of construction activities, the operator shall post a copy of the notice of coverage letter at a publicly accessible location near the main entrance of

the construction site. For linear projects, the operator shall post a copy of the notice of coverage letter at a publicly accessible location near an active part of the construction site (e.g., where a pipeline crosses a public road). The copy of the notice of coverage letter shall be visible such that it can be readily viewed from a public right-of-way. The operator shall maintain the posted information until termination of general permit coverage as specified in Part I F.

E. SWPPP availability.

1. Operators with day-to-day operational control over SWPPP implementation shall have a copy of the SWPPP available at a central location on-site for use by those identified as having responsibilities under the SWPPP whenever they are on the construction site.
2. The operator shall make the SWPPP and all amendments, modifications, and updates available upon request to the department, the VESMP authority, the EPA, the VESCP authority, local government officials, or the operator of a municipal separate storm sewer system receiving discharges from the construction activity. If an on-site location is unavailable to store the SWPPP when no personnel are present, notice of the SWPPP's location shall be posted near the main entrance of the construction site.
3. The operator shall make the SWPPP available for public review in an electronic format or in hard copy. Information for public access to the SWPPP shall be posted and maintained in accordance with Part II D. If not provided electronically, public access to the SWPPP may be arranged upon request at a time and at a publicly accessible location convenient to the operator or the operator's designee but shall be no less than once per month and shall be during normal business hours. Information not required to be contained within the SWPPP by this general permit is not required to be released.

F. SWPPP implementation. The operator shall implement the SWPPP and subsequent amendments, modifications, and updates from commencement of land disturbance until termination of general permit coverage as specified in Part I F.

1. All control measures shall be properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications.
2. If a site inspection required by Part II G identifies a control measure that is not operating effectively or needs routine maintenance, corrective actions or routine maintenance shall be completed as soon as practicable, but no later than five business days after discovery or a longer period as established by the VESMP authority, to maintain the continued effectiveness of the control measures.
3. If the operator must make the same repairs more than two times to the same control at the same location, even if the fix can be completed by the close of the next business day, the operator shall either:
 - a. Complete work to fix any subsequent repeat occurrences of this same problem under the corrective action procedures in Part II H, including keeping any records of the condition and how it was corrected under Part II C; or

b. Document in the inspection report under Part II G why the specific reoccurrence of this same problem should still be addressed as a routine maintenance fix.

4. If site inspections required by Part II G identify an existing control measure that needs to be modified or if an additional or alternative control measure is necessary for any reason, implementation shall be completed prior to the next anticipated measurable storm event. If implementation prior to the next anticipated measurable storm event is impracticable, then additional or alternative control measures shall be implemented as soon as practicable, but no later than five business days after discovery or a longer period as established by the VESMP authority.

G. SWPPP Inspections.

1. Personnel responsible for on-site and off-site inspections. Inspections required by this general permit shall be conducted by the qualified personnel identified by the operator in the SWPPP. The operator is responsible for ensuring that the qualified personnel conduct the inspection. Qualified personnel may be a person on the operator's staff or a third party hired to conduct such inspections.

2. Inspection schedule.

a. For construction activities that discharge to a surface water identified in Part II B 5 and B 6 as impaired or having an approved TMDL or Part II B 7 as exceptional, the following inspection schedule requirements apply:

(1) Inspections shall be conducted at a frequency of (i) at least once every four business days or (ii) at least once every five business days and no later than 24 hours following a measurable storm event. In the event that a measurable storm event occurs when there are more than 24 hours between business days, the inspection shall be conducted on the next business day; and

(2) Representative inspections as authorized in Part II G 2 d shall not be allowed.

b. Except as specified in Part II G 2 a, inspections shall be conducted at a frequency of:

(1) At least once every five business days; or

(2) At least once every 10 business days and no later than 24 hours following a measurable storm event. In the event that a measurable storm event occurs when there are more than 24 hours between business days, the inspection shall be conducted on the next business day.

(a) A storm event that produces 0.25 inches or more of rain within a 24-hour period on the first day of the storm and continues to produce 0.25 inches or more of rain on subsequent days. The operator is required to conduct an inspection within 24 hours of the first day of the storm and within 24 hours after the last day of the storm that produces 0.25 inches or more of rain.

(b) A discharge caused by snowmelt from a snow event producing 3.25 inches or more of snow within a 24-hour period. The operator is required to conduct one inspection once the discharge of snowmelt occurs. Additional inspections are only required if, following the discharge from the first snowmelt, there is a discharge from a separate storm event.

c. Where areas have been temporarily stabilized or construction activities will be suspended due to continuous frozen ground conditions and stormwater discharges are unlikely, the inspection frequency described in Part II G 2 a and 2 b may be reduced to once per month. If weather conditions (such as above freezing temperatures or rain or snow events) make discharges likely, the operator shall immediately resume the regular inspection frequency.

d. Except as prohibited in Part II G 2 a (2), representative inspections may be utilized for utility line installation, pipeline construction, or other similar linear construction activities provided that:

(1) Temporary or permanent soil stabilization has been installed and vehicle access may compromise the temporary or permanent soil stabilization and potentially cause additional land disturbance increasing the potential for erosion;

(2) Inspections occur on the same frequency as other construction activities;

(3) Control measures are inspected along the construction site 0.25 miles above and below each access point (i.e., where a roadway, undisturbed right-of-way, or other similar feature intersects the construction activity and access does not compromise temporary or permanent soil stabilization); and

(4) Inspection locations are provided in the inspection report required by Part II G.

e. If adverse weather causes the safety of the inspection personnel to be in jeopardy, the inspection may be delayed until the next business day on which it is safe to perform the inspection. Any time inspections are delayed due to adverse weather conditions, evidence of the adverse weather conditions shall be included in the SWPPP with the dates of occurrence.

3. Inspection requirements. As part of the inspection, the qualified personnel shall at a minimum:

a. Record the date and time of the inspection and, when applicable, the date and rainfall or snowfall amount of the last measurable storm event;

b. Record the information and a description of any discharges occurring at the time of the inspection or evidence of discharges occurring prior to the inspection;

c. Record any construction activities that have occurred outside of the approved erosion and sediment control plan;

d. Inspect all stormwater discharge locations at the construction site. If a stormwater discharge is occurring during the inspection, observe and document the visual quality

and characteristics of the discharge, including color; odor; floating, settled, or suspended solids; foam; oil sheen; and other indicators of stormwater pollutants;

e. Inspect all construction dewatering discharge locations at the construction site, if applicable. If a construction dewatering discharge is occurring during the inspection, observe and document the visual quality and the characteristics of the discharge, including color; odor; floating, settled, or suspended solids; foam; oil sheen; and other indicators of pollutants;

f. Inspect the following for installation in accordance with the approved erosion and sediment control plan, identification of any maintenance needs, and evaluation of effectiveness in minimizing sediment discharge, including whether the control has been inappropriately or incorrectly used:

- (1) All perimeter erosion and sediment controls, such as silt fence;
- (2) Soil stockpiles, when applicable, and borrow areas for stabilization or sediment trapping measures;
- (3) Completed earthen structures, such as dams, dikes, ditches, and diversions for stabilization and effective impoundment or flow control;
- (4) Cut and fill slopes;
- (5) Sediment basins and traps, sediment barriers, and other measures installed to control sediment discharge from stormwater;
- (6) Temporary or permanent channels, flumes, or other slope drain structures installed to convey concentrated runoff down cut and fill slopes;
- (7) Storm inlets that have been made operational to ensure that sediment laden stormwater does not enter without first being filtered or similarly treated; and
- (8) Construction vehicle access routes that intersect or access paved or public roads for minimizing sediment tracking;

g. Inspect areas that have reached final grade or that will remain dormant for more than 14 days to ensure:

- (1) Initiation of stabilization activities have occurred immediately, as defined in 9VAC25-880-1; and
- (2) Stabilization activities have been completed within seven days of reaching grade or stopping work;

h. Inspect for evidence that the approved erosion and sediment control plan, "agreement in lieu of a plan," or erosion and sediment control plan prepared in accordance with department-approved standards and specifications has not been properly implemented. This includes:

(1) Concentrated flows of stormwater in conveyances such as rills, rivulets, or channels that have not been filtered, settled, or similarly treated prior to discharge, or evidence thereof;

(2) Sediment laden or turbid flows of stormwater that have not been filtered or settled to remove sediments prior to discharge;

(3) Sediment deposition in areas that drain to unprotected stormwater inlets or catch basins that discharge to surface waters. Inlets and catch basins with failing sediment controls due to improper installation, lack of maintenance, or inadequate design are considered unprotected;

(4) Sediment deposition on any property (including public and private streets) outside of the construction activity covered by this general permit;

(5) Required stabilization has not been initiated or completed or is not effective on portions of the construction site;

(6) Sediment basins without adequate wet or dry storage volume or sediment basins that allow the discharge of stormwater from below the surface of the wet storage portion of the basin;

(7) Sediment traps without adequate wet or dry storage or sediment traps that allow the discharge of stormwater from below the surface of the wet storage portion of the trap; and

(8) Land disturbance or sediment deposition outside of the approved area to be disturbed;

i. Inspect pollutant generating activities identified in the pollution prevention plan for the proper implementation, maintenance, and effectiveness of the procedures and practices;

j. Identify and report any pollutant generating activities not identified in the pollution prevention plan; and

k. Identify and document the presence of any evidence of the discharge of pollutants prohibited by this general permit.

4. Inspection report. Each inspection report shall include the following items:

a. The date and time of the inspection and, when applicable, the date and rainfall or snowfall amount of the last measurable storm event;

b. Summarized findings of the inspection;

c. The locations, visual quality, and characteristics of all stormwater discharges, when occurring;

- d. The locations, visual quality, and characteristics of all construction dewatering discharges, if applicable;
 - e. The locations of prohibited discharges;
 - f. The locations of control measures that require routine maintenance;
 - g. The locations of control measures that failed to operate as designed or proved inadequate or inappropriate for a particular location;
 - h. The locations where any evidence identified under Part II G 3 h exists;
 - i. The locations where any additional control measure is needed;
 - j. A list of corrective actions required (including any changes to the SWPPP that are necessary) as a result of the inspection or to maintain permit compliance;
 - k. Documentation of any corrective actions required from a previous inspection that have not been implemented;
 - l. Any incidents of noncompliance. If none, the report shall contain a certification that the construction activity is in compliance with the SWPPP and this general permit;
 - m. The required certification in accordance with Part III K 4 of this general permit; and
 - n. The date and signature of the qualified personnel and the operator or its duly authorized representative in accordance with Part III K 2 of this general permit.
5. The inspection report shall be included into the SWPPP no later than four business days after the inspection is complete.
6. The inspection report and any actions taken in accordance with Part II shall be retained by the operator as part of the SWPPP for at least three years from the date that general permit coverage expires or is terminated.

H. Corrective actions.

1. Except as required in Part II H 2, the operator shall implement the corrective actions identified as a result of an inspection as soon as practicable but no later than five business days after discovery or a longer period as approved by the VESMP authority. If approval of a corrective action by a regulatory authority (e.g., VESMP authority, VESCP authority, or the department) is necessary, additional control measures shall be implemented to minimize pollutants in stormwater discharges until such approvals can be obtained.
2. When any turbidity measurement of the construction dewatering discharge exceeds the selected benchmark option or visual monitoring indicates a change in the characteristics of effluent discharge, as outlined in Part II B 8, the operator shall :

- a. Immediately cease the construction dewatering discharge at the location that exceeds the turbidity benchmark or where visual monitoring indicates a change in the characterization of effluent discharge;
- b. Determine whether the construction dewatering controls are operating effectively or need routine maintenance or if an additional or alternate control measure is necessary; and
- c. Make any necessary adjustments, additions, repairs, or replacements to the construction dewatering controls.

Once these corrective action steps are completed and any necessary adjustments, additions, repairs, or replacements are made, the operator may resume its construction dewatering discharge and shall sample for turbidity within 15 minutes of the construction dewatering discharge commencing. No additional corrective action items are required beyond recording the results in the SWPPP.

3. The operator may be required to remove accumulated sediment deposits located outside of the construction site covered by this general permit as soon as practicable in order to minimize environmental impacts.

4. The operator shall notify the VESMP authority and the department as well as obtain all applicable federal, state, and local authorizations, approvals, and permits prior to the removal of sediments accumulated in surface waters, including wetlands.

PART III

CONDITIONS APPLICABLE TO ALL VPDES PERMITS

Discharge monitoring is not required for this general permit. If the operator chooses to monitor stormwater discharges or control measures, the operator shall comply with the requirements of Part III A, B, and C, as appropriate.

A. Monitoring.

1. Samples and measurements taken for the purpose of monitoring shall be representative of the monitoring activity.
2. Monitoring shall be conducted according to procedures approved under 40 CFR Part 136 or alternative methods approved by the U.S. Environmental Protection Agency, unless other procedures have been specified in this general permit. Analyses performed according to test procedures approved under 40 CFR Part 136 shall be performed by an environmental laboratory certified under regulations adopted by the Department of General Services (1VAC30-45 or 1VAC30-46).
3. The operator shall periodically calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals that will ensure accuracy of measurements.

B. Records.

1. Monitoring records and reports shall include:

- a. The date, exact place, and time of sampling or measurements;
- b. The individuals who performed the sampling or measurements;
- c. The dates and times analyses were performed;
- d. The individuals who performed the analyses;
- e. The analytical techniques or methods used; and
- f. The results of such analyses.

2. The operator shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this general permit, and records of all data used to complete the registration statement for this general permit, for a period of at least three years from the date of the sample, measurement, report, or request for coverage. This period of retention shall be extended automatically during the course of any unresolved litigation regarding the regulated activity or regarding control standards applicable to the operator, or as requested by the department.

C. Reporting monitoring results.

1. The operator shall update the SWPPP to include the results of the monitoring as may be performed in accordance with this general permit, unless another reporting schedule is specified elsewhere in this general permit.

2. Monitoring results shall be reported on a discharge monitoring report (DMR); on forms provided, approved, or specified by the department; or in any format provided that the date, location, parameter, method, and result of the monitoring activity are included.

3. If the operator monitors any pollutant specifically addressed by this general permit more frequently than required by this general permit using test procedures approved under 40 CFR Part 136 or using other test procedures approved by the U.S. Environmental Protection Agency or using procedures specified in this general permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR or reporting form specified by the department.

4. Calculations for all limitations that require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in this general permit.

D. Duty to provide information. The operator shall furnish, within a reasonable time, any information that the department may request to determine whether cause exists for terminating this general permit coverage or to determine compliance with this general permit. The department, EPA, or VESMP authority may require the operator to furnish, upon request, such plans, specifications, and other pertinent information as may be necessary to determine the effect of the

wastes from the operator's discharge on the quality of surface waters, or such other information as may be necessary to accomplish the purposes of the Clean Water Act and the Virginia Erosion and Stormwater Management Act. The operator shall also furnish to the department, EPA, or VESMP authority, upon request, copies of records required to be kept by this general permit.

E. Compliance schedule reports. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this general permit shall be submitted no later than 14 days following each schedule date.

F. Unauthorized stormwater discharges. Pursuant to § 62.1-44.5 of the Code of Virginia, except in compliance with a permit issued by the department, it shall be unlawful to cause a stormwater discharge from a construction activity.

G. Reports of unauthorized discharges. Any operator who discharges or causes or allows a discharge of sewage, industrial waste, other wastes, any noxious or deleterious substance, a hazardous substance, or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110, 40 CFR Part 117, 40 CFR Part 302, or § 62.1-44.34:19 of the Code of Virginia that occurs during a 24-hour period into or upon surface waters or that discharges or causes or allows a discharge that may reasonably be expected to enter surface waters shall notify the department and the VESMP authority of the discharge immediately upon discovery of the discharge, but in no case later than within 24 hours after said discovery. A written report of the unauthorized discharge shall be submitted to the department and the VESMP authority within five calendar days of discovery of the discharge. The written report shall contain:

1. A description of the nature and location of the discharge;
2. The cause of the discharge;
3. The date on which the discharge occurred;
4. The length of time that the discharge continued;
5. The volume of the discharge;
6. If the discharge is continuing, how long it is expected to continue;
7. If the discharge is continuing, what the expected total volume of the discharge will be; and
8. Any steps planned or taken to reduce, eliminate, and prevent a recurrence of the present discharge or any future discharges not authorized by this general permit.

Discharges reportable to the department and the VESMP authority under the immediate reporting requirements of other regulations are exempted from this requirement.

H. Reports of unusual or extraordinary discharges. If any unusual or extraordinary discharge, including a "bypass" or "upset," as defined in this general permit, should occur from a construction site and the discharge enters or could be expected to enter surface waters, the operator shall promptly notify, in no case later than within 24 hours, the department and the VESMP authority after the discovery of the discharge. This notification shall provide all available details of the

incident, including any adverse effects on aquatic life and the known number of fish killed. The operator shall reduce the report to writing and shall submit it to the department and the VESMP authority within five calendar days of discovery of the discharge in accordance with Part III I 2. Unusual and extraordinary discharges include any discharge resulting from:

1. Unusual spillage of materials resulting directly or indirectly from processing operations;
2. Breakdown of processing or accessory equipment;
3. Failure or taking out of service of some or all of the facilities; and
4. Flooding or other acts of nature.

I. Reports of noncompliance. The operator shall report any noncompliance that may adversely affect state waters or may endanger public health.

1. A report to the department and the VESMP authority shall be provided within 24 hours from the time the operator becomes aware of the circumstances. The following shall be included as information that shall be reported within 24 hours under this subsection:

- a. Any unanticipated bypass; and
- b. Any upset that causes a discharge to surface waters.

2. A written report shall be submitted within five days and shall contain:

- a. A description of the noncompliance and its cause;
- b. The period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and
- c. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

The department may waive the written report on a case-by-case basis for reports of noncompliance under Part III I if the oral report has been received within 24 hours and no adverse impact on surface waters has been reported.

3. The operator shall report all instances of noncompliance not reported under Part III I 1 or 2 in writing as part of the SWPPP. The reports shall contain the information listed in Part III I 2.

4. The immediate (within 24 hours) reports required in Part III G, H, and I may be made to the department and the VESMP authority. Reports may be made by telephone, email, or online at <https://www.deq.virginia.gov/our-programs/pollution-response>. For reports outside normal working hours, leaving a recorded message shall fulfill the immediate reporting requirement. For emergencies, the Virginia Department of Emergency Management maintains a 24-hour telephone service at 1-800-468-8892.

5. Where the operator becomes aware of a failure to submit any relevant facts, or submittal of incorrect information in any report, including a registration statement, to the department or the VESMP authority, the operator shall promptly submit such facts or correct information.

J. Notice of planned changes.

1. The operator shall give notice to the department and the VESMP authority as soon as possible of any planned physical alterations or additions to the permitted facility or activity. Notice is required only when:

- a. The operator plans an alteration or addition to any building, structure, facility, or installation that may meet one of the criteria for determining whether a facility is a new source in 9VAC25-875-990; or
- b. The operator plans an alteration or addition that would significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants that are not subject to effluent limitations in this general permit.

2. The operator shall give advance notice to the department and VESMP authority of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.

3. The operator may continue construction activities based on the information provided in the original registration statement and SWPPP but must wait until the review period has ended before commencing or continuing construction activities on any portion of the construction site that would be affected by any of the planned changes or modifications. Any operator that chooses to proceed with unapproved construction activities while plans are being reviewed is proceeding at its own risk and subject to compliance actions if the plan is determined to be inadequate.

K. Signatory requirements.

1. Registration statement and notice of termination. All registration statements and notices of termination shall be signed as follows:

- a. For a corporation: by a responsible corporate officer. For the purpose of this chapter, a responsible corporate officer means (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy-making or decision-making functions for the corporation; or (ii) the manager of one or more manufacturing, production, or operating facilities, provided the manager is authorized to make management decisions that govern the operation of the regulated facility, including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

- b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or
 - c. For a municipality, state, federal, or other public agency: by either a principal executive officer or ranking elected official. For purposes of this chapter, a principal executive officer of a public agency includes (i) the chief executive officer of the agency or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.
2. Reports and other information. All reports required by this general permit, including SWPPPs, and other information requested by the department shall be signed by a person described in Part III K 1 or by a duly authorized representative of that person. A person is a duly authorized representative only if:
- a. The authorization is made in writing by a person described in Part III K 1;
 - b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the operator. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and
 - c. The signed and dated written authorization is included in the SWPPP. A copy shall be provided to the department and VESMP authority, if requested.
3. Changes to authorization. If an authorization under Part III K 2 is no longer accurate because a different individual or position has responsibility for the overall operation of the construction activity, a new authorization satisfying the requirements of Part III K 2 shall be submitted to the VESMP authority as the administering entity for the department prior to or together with any reports or information to be signed by an authorized representative.
4. Certification. Any person signing a document under Part III K 1 or 2 shall make the following certification:
- "I certify under penalty of law that I have read and understand this document and that this document and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."
- L. Duty to comply. The operator shall comply with all conditions of this general permit. Any noncompliance with this general permit constitutes a violation of the Virginia Erosion and Stormwater Management Act and the Clean Water Act, except that noncompliance with certain provisions of this general permit may constitute a violation of the Virginia Erosion and Stormwater Management Act but not the Clean Water Act. Permit noncompliance is grounds for enforcement

action; for permit coverage, termination, revocation, and reissuance, or modification of permit coverage; or denial of a permit renewal application.

The operator shall comply with effluent standards or prohibitions established under § 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions or standards for sewage sludge use or disposal, even if this general permit has not yet been modified to incorporate the requirement.

M. Duty to reapply. If the operator wishes to continue an activity regulated by this general permit after the expiration date of this general permit, the operator shall submit a new registration statement at least 90 days before the expiration date of the existing general permit, unless permission for a later date has been granted by the department. The department shall not grant permission for registration statements to be submitted later than the expiration date of the existing general permit.

N. Effect of a permit. This general permit neither conveys any property rights in either real or personal property or any exclusive privileges nor authorizes any injury to private property or invasion of personal rights, or any infringement of federal, state, or local law or regulations.

O. State law. Nothing in this general permit shall be construed to preclude the institution of any legal action under or relieve the operator from any responsibilities, liabilities, or penalties established pursuant to any other state law or regulation or under authority preserved by § 510 of the Clean Water Act. Except as provided in general permit conditions on bypassing under Part III U and upset under Part III V, nothing in this general permit shall be construed to relieve the operator from civil and criminal penalties for noncompliance.

P. Oil and hazardous substance liability. Nothing in this general permit shall be construed to preclude the institution of any legal action or relieve the operator from any responsibilities, liabilities, or penalties to which the operator is or may be subject under §§ 62.1-44.34:14 through 62.1-44.34:23 of the State Water Control Law or § 311 of the Clean Water Act.

Q. Proper operation and maintenance. The operator shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances), which are installed or used by the operator to achieve compliance with the conditions of this general permit. Proper operation and maintenance also includes effective plant performance, adequate funding, adequate staffing, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems, which are installed by the operator only when the operation is necessary to achieve compliance with the conditions of this general permit.

R. Disposal of solids or sludges. Solids, sludges, or other pollutants removed in the course of treatment or management of pollutants shall be disposed of in a manner so as to prevent any pollutant from such materials from entering surface waters and in compliance with all applicable state and federal laws and regulations.

S. Duty to mitigate. The operator shall take all steps to minimize or prevent any discharge in violation of this general permit that has a reasonable likelihood of adversely affecting human health or the environment.

T. Need to halt or reduce activity not a defense. It shall not be a defense for an operator in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this general permit.

U. Bypass.

1. "Bypass," as defined in 9VAC25-875-850, means the intentional diversion of waste streams from any portion of a treatment facility. The operator may allow any bypass to occur that does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to ensure efficient operation. These bypasses are not subject to the provisions of Part III U 2 and U 3.

2. Notice.

a. Anticipated bypass. If the operator knows in advance of the need for a bypass, the operator shall submit prior notice to the department, if possible at least 10 days before the date of the bypass.

b. Unanticipated bypass. The operator shall submit notice of an unanticipated bypass as required in Part III I.

3. Prohibition of bypass.

a. Except as provided in Part III U 1, bypass is prohibited, and the department may take enforcement action against an operator for bypass unless:

(1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage. Severe property damage means substantial physical damage to property, damage to the treatment facilities that causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production;

(2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventive maintenance; and

(3) The operator submitted notices as required under Part III U 2.

b. The department may approve an anticipated bypass, after considering its adverse effects, if the department determines that it will meet the three conditions listed in Part III U 3 a.

V. Upset.

1. An "upset," as defined in 9VAC25-875-850, means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent

limitations because of factors beyond the reasonable control of the operator. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

2. An upset constitutes an affirmative defense to an action brought for noncompliance with technology-based permit effluent limitations if the requirements of Part III V 3 are met. A determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is not a final administrative action subject to judicial review.

3. An operator who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that:

- a. An upset occurred and that the operator can identify the cause of the upset;
- b. The permitted facility was at the time being properly operated;
- c. The operator submitted notice of the upset as required in Part III I; and
- d. The operator complied with any remedial measures required under Part III S.

4. In any enforcement proceeding, the operator seeking to establish the occurrence of an upset has the burden of proof.

W. Inspection and entry. The operator shall allow the department, the VESMP authority, EPA, or an authorized representative of either entity (including an authorized contractor), upon presentation of credentials and other documents as may be required by law, to:

1. Enter upon the operator's premises where a regulated facility or activity is located or conducted or where records shall be kept under the conditions of this general permit;
2. Have access to and copy, at reasonable times, any records that shall be kept under the conditions of this general permit;
3. Inspect and photograph at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this general permit; and
4. Sample or monitor at reasonable times, for the purposes of ensuring permit compliance or as otherwise authorized by the Clean Water Act or the Virginia Erosion and Stormwater Management Act, any substances or parameters at any location.

For purposes of this section, the time for inspection shall be deemed reasonable during regular business hours and whenever the facility is discharging. Nothing contained in this general permit shall make an inspection unreasonable during an emergency.

X. Permit actions. Permit coverage may be modified, revoked and reissued, or terminated for cause. The filing of a request by the operator for a permit modification, revocation and reissuance,

or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

Y. Transfer of permit coverage.

1. Permits are not transferable to any person except after notice to the department. Except as provided in Part III Y 2, a permit may be transferred by the operator to a new operator only if the permit has been modified or revoked and reissued, or a minor modification made, to identify the new operator and incorporate such other requirements as may be necessary under the Virginia Erosion and Stormwater Management Act and the Clean Water Act.

2. As an alternative to transfers under Part III Y 1, this permit may be automatically transferred to a new operator if:

a. The current operator notifies the department at least 30 days in advance of the proposed transfer of the title to the facility or property;

b. The notice includes a written agreement between the existing and new operators containing a specific date for transfer of permit responsibility, coverage, and liability between them; and

c. The department does not notify the existing operator and the proposed new operator of its intent to modify or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in Part III Y 2 b.

3. For ongoing construction activity involving a change of operator, the new operator shall accept and maintain the existing SWPPP, or prepare and implement a new SWPPP prior to taking over operations at the construction site.

Z. Severability. The provisions of this general permit are severable, and if any provision of this general permit or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances and the remainder of this general permit shall not be affected thereby.

APPENDIX D

TRANSFER OF OWNERSHIP

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
GENERAL VPDES PERMIT FOR DISCHARGES OF STORMWATER
FROM CONSTRUCTION ACTIVITIES (VAR10)
TRANSFER OF OWNERSHIP AGREEMENT 2024

Permit Coverage Number (VAR10####): _____

Construction Activity Name: _____

Section I. Current Construction Activity Operator/Permittee Information. Operator information as it appears on the current, active permit coverage.

Operator Name: _____

Contact Person: _____

Address: _____

City, State and Zip Code: _____

Phone Number: _____

Primary Email: _____

CC Email: _____

“I (We) hereby agree to the transfer of ownership modification to the referenced General VPDES Permit for Discharges of Stormwater from Construction Activities (VAR10).”

Printed Name: _____

Signature: _____

Date: _____

Section II. New Construction Activity Operator/Permittee Information. Permit coverage will be transferred to this person or entity.

Construction Activity Operator Name (NEW): _____

Contact Person: _____

Address: _____

City, State and Zip Code: _____

Phone Number: _____

Primary Email: _____

CC Email: _____

“I (We) hereby agree to the transfer of ownership modification to the referenced General VPDES Permit for Discharges of Stormwater from Construction Activities (VAR10).”

Printed Name: _____

Signature: _____

Date: _____

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
GENERAL VPDES PERMIT FOR DISCHARGES OF STORMWATER
FROM CONSTRUCTION ACTIVITIES (VAR10)
TRANSFER OF OWNERSHIP AGREEMENT 2024

Section III. New Construction Activity Operator/Permittee Billing Information. This entity will receive Annual Permit Maintenance and Permit Modification Fee invoices (if applicable). Leave this section blank if same as the New Operator as identified in Section II.

Billing Entity Name: _____

Contact Person: _____

Address: _____

City, State and Zip Code: _____

Phone Number: _____

Primary Email: _____

CC Email: _____

May we transmit correspondence electronically? You must choose **YES** and include a valid email in order to pay by credit card and to receive your transfer approval letter via email: ☐ **YES** ☐ **NO**

Section IV. Instructions.

A properly authorized individual as specified in the General VPDES Permit for Stormwater Discharges from Construction Activities (VAR10), Part III K (Signatory Requirements) must physically sign this Transfer of Ownership Agreement.

Please retain a copy of this agreement form for your records and include a copy in your Stormwater Pollution Prevention Plan (SWPPP).

Submit this form to the VESMP Authority. If the locality is the VESMP Authority, please submit your Transfer of Ownership Agreement directly to the locality; do NOT send this form to DEQ. A list of local VESMP Authorities is available here: [VESMP Authorities](#).

If DEQ is the VSMP Authority, please send to:

**Department of Environmental Quality
Office of Stormwater Management Suite 1400
PO Box 1105
Richmond VA 23218
constructiongp@deq.virginia.gov**

If the locality is the VESMP Authority, please send to:

The Local VESMP Authority (*insert address below*)

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APPENDIX E

2024 NOTICE OF TERMINATION

**VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
GENERAL VPDES PERMIT FOR DISCHARGES OF
STORMWATER FROM CONSTRUCTION ACTIVITIES (VAR10)
NOTICE OF TERMINATION 2024**

Permit Coverage Number (VAR10#####): _____

Section I. Operator/Permittee Information. The person or entity that has active permit coverage approval and operational control over construction activities to ensure compliance with the general permit. A person with signatory authority for this operator must sign the certification in Section VII (per Part III K of the VAR10 Permit).

Construction Activity Operator Name: _____

Contact Person: _____

Address: _____

City, State, Zip Code: _____

Phone Number: _____

Primary Email: _____

Section II. Construction Activity Location Information. Project site information.

Construction Activity Name: _____

Address: _____

City and/or County and Zip Code: _____

Latitude and Longitude (6-digit, decimal degrees format): _____

Section III. Requirements for Termination of general permit coverage. The operator of the construction activity shall submit a complete and accurate notice of termination, unless a registration statement was not required to be submitted in accordance with 9VAC25-880-50 A 1 c or A 2 b for a stormwater discharge associated with a small construction activity of a single family detached residential structure, within or outside of a common plan of development or sale, to the VESMP authority after one or more of the following conditions have been met:

- ☐ Necessary permanent control measures included in the SWPPP for the construction site are in place and functioning effectively **and** final stabilization has been achieved on all portions of the construction site for which the operator has operational control. When applicable, long-term responsibility and maintenance requirements for permanent control measures shall be recorded in the local land records prior to the submission of a complete and accurate notice of termination, and the construction record drawing prepared.
- ☐ Another operator has assumed control over all areas of the construction site that have not been finally stabilized and obtained coverage for the ongoing discharge.
- ☐ Coverage under an alternative VPDES permit or other applicable permit has been obtained.
- ☐ For individual lots in residential construction only, final stabilization as defined in 9VAC25-880-1 has been completed, including providing written notification to the homeowner and incorporating a copy of the notification and signed certification statement into the SWPPP, and the residence has been transferred to the homeowner.

CONSTRUCTION GENERAL PERMIT (VAR10) NOTICE OF TERMINATION 2024

Section IV. Participation in a Regional Stormwater Management Plan. If your site discharges to a regional stormwater management facility, provide information related to the regional stormwater management plan. Attach a separate list if discharging to multiple regional facilities.

Regional Stormwater Management Facility Type: _____

Address: _____

City, State, Zip Code: _____

Latitude and Longitude (6-digit, decimal degrees format): _____

Total Site Acres Treated by Regional Facility (report to one-hundredth of an acre): _____

Impervious Site Acres Treated by Regional Facility (report to one-hundredth of an acre): _____

Section V. Perpetual Nutrient Credits. If your site is utilizing nutrient credits, provide information related to the perpetual nutrient credits that were acquired in accordance with § 62.1-44.15:35 of the Code of Virginia. Attach a separate list if needed.

Nonpoint Nutrient Credit Generating Entity (Bank Name): _____

Perpetual Nutrient Credits Acquired (pounds/acres/year): _____

*An affidavit of sale is required for all nutrient credits acquired.

Section VI. Permanent Control Measures. If applicable, list the permanent stormwater management facilities or best management practices (BMPs) that were constructed and installed as part of this activity to comply with the stormwater management water quality and water quantity technical criteria (structural and nonstructural, on-site and off-site). Attach a separate list if needed.

Was a permanent control measure constructed and installed to comply with the stormwater management water quality and water quantity technical criteria? ☐ YES ☐ NO

If you have permanent control measures, the following items are required to be submitted with this form to complete your Notice of Termination submittal:

- ☐ A. [Engineer's Certification Statement](#)
- ☐ B. As-built plans (construction record drawings) – digital
- ☐ C. Stormwater Management Plans - digital
- ☐ D. [BMP Maintenance Agreement](#) (notarized original for projects where DEQ is the VSMP Authority)
- ☐ E. BMP Maintenance Agreement Court Receipt
- ☐ F. Affidavit of Sale for any nutrient credit purchases

CONSTRUCTION GENERAL PERMIT (VAR10) NOTICE OF TERMINATION 2024

Stormwater Management Facility Types (please choose from the following bmp types):

Part V, Article 4 (previously Part IIC) BMPs

Bioretention basin
Bioretention filter
Constructed wetlands
Extended detention (2 x WQ Vol)
Extended detention basin-enhanced
Grassed swale
Infiltration (1 x WQ Vol)
Infiltration (2 x WQ Vol)
Retention basin I (3 x WQ Vol)
Retention basin II (4 x WQ Vol)
Retention basin III (4 x WQ Vol with aquatic bench)
Sand filter
Vegetated filter strip
Other:

- Detention Only BMP
- Forest/Open Space
- Manufactured Treatment Device – Filtering
- Manufactured Treatment Device – Hydrodynamic
- Etc.

Part V, Article 3 (previously Part IIB) BMPs

Bioretention 1
Bioretention 2
Constructed Wetland 1
Constructed Wetland 2
Dry Swale 1
Dry Swale 2
Extended Detention Pond
Extended Detention Pond 2
Filtering Practice 1
Filtering Practice 2
Grass Channel
Infiltration 1
Infiltration 2
Permeable Pavement 1
Permeable Pavement 2
Rooftop Disconnection
Sheet flow to Vegetated Filter or Conserved Open Space 1
Sheet flow to Vegetated Filter or Conserved Open Space 2
Urban Bioretention
Vegetated Roof 1
Vegetated Roof 2
Wet Pond 1
Wet Pond 2
Wet Swale 1
Wet Swale 2
Other:

- Detention Only BMP
- Forest
- Manufactured Treatment Device – Biofilter
- Manufactured Treatment Device – Filtering
- Manufactured Treatment Device – Hydrodynamic
- Regenerative Stormwater Conveyance 1
- Regenerative Stormwater Conveyance 2
- Tree BMP over Impervious
- Tree BMP over Pervious, A/B Soils
- Tree BMP over Pervious, C/D Soils
- Etc.

CONSTRUCTION GENERAL PERMIT (VAR10) NOTICE OF TERMINATION 2024

Stormwater Management Facility #1 BMP Type:	
Date BMP Became Functional:	
Address (if available):	
City and/or County and Zip Code:	
Latitude and Longitude (6-digit, decimal degrees format):	
Receiving Water(s) (outfall discharge):	
Total Acres Treated (report to one-hundredth of an acre):	
Impervious Acres Treated (report to one-hundredth of an acre):	
Stormwater Management Facility #2 BMP Type:	
Date BMP Became Functional:	
Address (if available):	
City and/or County and Zip Code:	
Latitude and Longitude (6-digit, decimal degrees format):	
Receiving Water(s) (outfall discharge):	
Total Acres Treated (report to one-hundredth of an acre):	
Impervious Acres Treated (report to one-hundredth of an acre):	
Stormwater Management Facility #3 BMP Type:	
Date BMP Became Functional:	
Address (if available):	
City and/or County and Zip Code:	
Latitude and Longitude (6-digit, decimal degrees format):	
Receiving Water(s) (outfall discharge):	
Total Acres Treated (report to one-hundredth of an acre):	
Impervious Acres Treated (report to one-hundredth of an acre):	

CONSTRUCTION GENERAL PERMIT (VAR10) NOTICE OF TERMINATION 2024 INSTRUCTIONS
PLEASE DO NOT PRINT OR SUBMIT

A complete and accurate notice of termination is required for terminating coverage under the General VPDES Permit for Discharges of Stormwater from Construction Activities. Termination shall become effective upon notification from the department that the provisions of termination have been met or 90 days after receipt of a complete and accurate notice of termination, whichever occurs first, unless otherwise notified by the VESMP authority or the department. With terminating coverage, the operator shall submit all permit fees including all outstanding permit maintenance fees in accordance with 9VAC25-875-1290 unless not required.

Permit Coverage Number. Include your existing, active permit coverage number. Example: VAR10####.

Section I. Operator/Permittee Information. The construction activity operator (permittee). The permittee with active permit coverage and that has operational control over the construction activities to ensure compliance with the general permit. For companies, use the complete, active, legal entity name as registered with a state corporation commission. Entities that are considered operators commonly consist of the property owner, developer of a project (the party with direct operational control of construction plans and specifications), or general contractor (the party with day-to-day operational control of the activities at the project site that are necessary to ensure compliance with the general permit). If an individual person is named as the operator, that person (or a representative of) must sign the certification in Section VII.

Section II. Construction Activity Location Information. Project site information. Complete this section with the same information as listed on the current registration statement. A list of active permits and location information is available on the DEQ website.

Section III. Reason for Terminating Coverage under the General Permit. The operator shall submit the notice of termination in accordance with 9VAC25-880-60, unless a registration statement was not required to be submitted in accordance with 9VAC25-880-50 A 1 c or A 2 b for single-family detached residential structures, to the VESMP authority after one or more of the following conditions being met:

1. Necessary permanent control measures included in the SWPPP for the construction site are in place and functioning effectively and final stabilization has been achieved on all portions of the construction site for which the operator has operational control. When applicable, long-term responsibility and maintenance requirements for permanent control measures shall be recorded in the local land records prior to the submission of a complete and accurate notice of termination and the construction record drawing prepared;
2. Another operator has assumed control over all areas of the construction site that have not been finally stabilized and obtained coverage for the ongoing discharge;
3. Coverage under an alternative VPDES permit or other applicable permit has been obtained; or
4. For individual lots in residential construction only, final stabilization as defined in 9VAC25-880-1 has been completed, including providing written notification to the homeowner and incorporating a copy of the notification and signed certification statement into the SWPPP, and the residence has been transferred to the homeowner.

The notice of termination shall be submitted no later than 30 days after one of the above conditions is met. Termination of authorization to discharge shall become effective upon notification of the department of the provisions of this section have been met or 90 days after receipt of a complete and accurate notice of termination, in accordance with 9VAC25-880-60 C, whichever occurs first, unless otherwise notified by the VESMP authority or the department.

Section IV. Participation in a Regional Stormwater Management Plan. Where applicable, include information for each regional stormwater management facility to which this site contributes. If your site is contributing to more than one regional facility, please include the information for each facility in a separate list.

CONSTRUCTION GENERAL PERMIT (VAR10) NOTICE OF TERMINATION 2024 INSTRUCTIONS
PLEASE DO NOT PRINT OR SUBMIT

The following information shall be included for each regional stormwater management facility installed:

- The type of regional facility to which the site contributes (see the list of facility types on page 3 of the notice of termination).
- The location of the facility, including city or county, and latitude and longitude in decimal degrees.
- The number of total and impervious site acres treated by the regional facility to the nearest one-hundredth of an acre.

Section V. Perpetual Nutrient Credits. Where application, the following information related to perpetual nutrient credits that were acquired in accordance with § 62.1-44.15:35 of the Code of Virginia:

- The name of the nonpoint nutrient credit generating entity from which perpetual nutrient credits were acquired, and
- The number of perpetual nutrient credits acquired (pounds per acre per year).

Attach the affidavit(s) of sale for the purchase of all nutrient credits acquired for this activity.

Section VI. Permanent Control Measures. Where applicable, a list of the on-site and off-site permanent control measures (both structural and nonstructural) that were installed to comply with the stormwater management water quality and water quantity technical criteria. Clearly indicate if a permanent control measure was constructed and installed by selecting yes or no. For each permanent measure that was installed, the following information shall be included. Choose the type from the list provided in the notice of termination form Section VI. If you have multiple BMPs, attach a separate list if needed.

The following information shall be included for each permanent control measure installed:

- the type of permanent control measure installed and the date that it became functional as a permanent control measure;
- the location of the permanent control measure, including city or county, and latitude and longitude in decimal degrees (i.e., 37.1234, -77.1234);
- the receiving water(s) to which the permanent control measure discharges; and
- the number of total and impervious acres treated by the permanent control measures to the nearest one-hundredth of an acre.

The following items are required to be submitted with the Notice of Termination if you have permanent control measures:

- [Engineer's Certification Statement](#): Signed by a professional registered in the Commonwealth of Virginia, certifying that the stormwater management facilities were constructed in accordance with the approved plan;
- Construction record drawing(s) (as-built plan) in a format as specified by the VESMP authority for long-term stormwater management facilities in accordance with 9VAC25-875-535 appropriately sealed and signed by a professional registered in the Commonwealth of Virginia, certifying that the stormwater management facilities have been constructed in accordance with the approved plan;
- Stormwater management plans (digital); and
- [BMP Maintenance Agreement](#). Where applicable, evidence that the signed Stormwater Maintenance Agreement has been recorded in an instrument within the local land records; *Termination is not final until you submit the local court record of receipt to DEQ showing that the signed Stormwater Management Maintenance Agreement was recorded with the land deed.*

Section VII. Certification. This Certification must be signed by a person representing the operator identified in Section I and meeting the requirements of Part III K of 9VAC25-880-70.

CONSTRUCTION GENERAL PERMIT (VAR10) NOTICE OF TERMINATION 2024 INSTRUCTIONS
PLEASE DO NOT PRINT OR SUBMIT

Section VIII. Submittal Instructions. Submit this form to the VESMP authority that has jurisdiction for your construction activity. Depending on the location and type of project, the appropriate authority may be either your locality or DEQ where DEQ serves as the VSMP authority. If your project is under the jurisdiction of a local VESMP authority, please contact the locality for additional submittal instructions. A blank area is provided for the local VESMP authority to include their mailing address.

Who is the appropriate stormwater management authority for my project? DEQ or the locality?

DEQ: DEQ is the VSMP Authority and administers permit coverage for land-disturbing activities that are:

- within a locality that is not a VESMP Authority;
- owned by the State or Federal government; or
- utilizing approved Standards and Specifications.

Email the completed and signed form to: constructiongp@deq.virginia.gov

The Locality: The local government (locality) is the VESMP Authority and administers permit coverage for all other projects not covered by DEQ as listed above. For these projects, please submit permit forms directly to the Local VESMP Authority. A list of Local VESMP Authorities is available on DEQ's website here: [Local VESMP Authority List](#).

For assistance or questions about the termination process, email constructiongp@deq.virginia.gov.

APPENDIX F

QUALIFIED PERSONNEL LIST

APPENDIX F

QUALIFIED PERSONNEL LIST

[illegible]

APPENDIX G
DELEGATION OF AUTHORITY

Appendix D – *Sample* Delegation of Authority Form

Delegation of Authority

I, _____ (name), hereby designate the person or specifically described position below to be a duly authorized representative for the purpose of overseeing compliance with environmental requirements, including the Construction General Permit, at the _____ construction site. The designee is authorized to sign any reports, stormwater pollution prevention plans and all other documents required by the permit.

(name of person or position)
(company)
(address)
(city, state, zip)
(phone)

By signing this authorization, I confirm that I meet the requirements to make such a designation as set forth in _____ (Reference State Permit), and that the designee above meets the definition of a “duly authorized representative” as set forth in _____ (Reference State Permit).

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: _____

Company: _____

Title: _____

Signature: _____

Date: _____

APPENDIX H
INSPECTION REPORT

Stormwater Construction Site Inspection Report

General Information				
Project Name Commercial Entrance Permit				
NPDES Tracking No.		Location		
Date of Inspection		Start/End Time		
Inspector's Name(s)				
Inspector's Title(s)				
Inspector's Contact Information				
Describe present phase of construction				
Type of Inspection <input type="checkbox"/> Regular <input type="checkbox"/> Pre-storm event <input type="checkbox"/> During storm event <input type="checkbox"/> Post-storm event				
Weather Information				
Has it rained since the last inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No				
If yes, provide: Storm Start Date & Time: Storm Duration (hrs): Approximate Rainfall (in):				
Weather at time of this inspection?				
Do you suspect that discharges may have occurred since the last inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No				
Are there any discharges at the time of inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No				
	BMP Description	BMP Installed and Operating Properly?	Corrective Action Needed	Date for corrective action/responsible person
1	Safety Fence	<input type="checkbox"/> Yes <input type="checkbox"/> No		
2	Construction Entrance	<input type="checkbox"/> Yes <input type="checkbox"/> No		
3	Silt Fence	<input type="checkbox"/> Yes <input type="checkbox"/> No		
4	Storm Drain Inlet Protection	<input type="checkbox"/> Yes <input type="checkbox"/> No		

5	Topsoiling	<input type="checkbox"/> Yes <input type="checkbox"/> No		
6	Temporary Seeding	<input type="checkbox"/> Yes <input type="checkbox"/> No		
7	Permanent Seeding	<input type="checkbox"/> Yes <input type="checkbox"/> No		
8	Mulching	<input type="checkbox"/> Yes <input type="checkbox"/> No		
9	Tree Preservation and Protection	<input type="checkbox"/> Yes <input type="checkbox"/> No		
10		<input type="checkbox"/> Yes <input type="checkbox"/> No		
11		<input type="checkbox"/> Yes <input type="checkbox"/> No		
12		<input type="checkbox"/> Yes <input type="checkbox"/> No		
13		<input type="checkbox"/> Yes <input type="checkbox"/> No		
14		<input type="checkbox"/> Yes <input type="checkbox"/> No		
15		<input type="checkbox"/> Yes <input type="checkbox"/> No		
16		<input type="checkbox"/> Yes <input type="checkbox"/> No		
17		<input type="checkbox"/> Yes <input type="checkbox"/> No		
18		<input type="checkbox"/> Yes <input type="checkbox"/> No		
19		<input type="checkbox"/> Yes <input type="checkbox"/> No		
20		<input type="checkbox"/> Yes <input type="checkbox"/> No		
21		<input type="checkbox"/> Yes <input type="checkbox"/> No		

OVERALL SITE ISSUES

	BMP/activity	Implemented?	Maintained?	Corrective Action	Date for corrective action/responsible person
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
4	Are discharge points and receiving waters free of sediment deposits?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
5	Are storm drain inlets properly protected?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
6	Is there evidence of sediment being tracked into the street?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
7	Is trash/litter from work areas collected and placed in covered dumpsters?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		

	BMP/activity	Implemented?	Maintained?	Corrective Action	Date for corrective action/responsible person
	any other deleterious material?				
10	Are materials that are potential stormwater contaminants stored inside or under cover?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
12	(Other)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
13	(Other)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		

Certification statement:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name: _____

Signature: _____

Date: _____

APPENDIX I

SWPPP FACT SHEET

FACT SHEET

REISSUANCE OF THE GENERAL VPDES PERMIT FOR DISCHARGES OF STORMWATER FROM CONSTRUCTION ACTIVITIES

The Virginia State Water Control Board has under consideration the reissuance of the general Virginia Pollutant Discharge Elimination System (VPDES) permit for point source discharges of stormwater from construction activities to surface waters.

Permit Number: VAR10

Name of Permittee: Any operator in the Commonwealth of Virginia agreeing to be regulated under the terms of this general permit.

Facility Location: Commonwealth of Virginia

Receiving Waters: Surface waters within the boundaries of the Commonwealth of Virginia except waters specifically named in Board regulations which prohibit such discharges.

On the basis of preliminary review and application of lawful standards and regulations, the State Water Control Board (Board) proposes to reissue the general permit subject to certain conditions and has prepared a draft permit. The category of discharges to be included involves stormwater discharges from construction activities with the same or similar types of operations and discharging the same or similar types of wastes. The Board has determined that this category of discharges is appropriately controlled under a general permit. The draft general permit requires that all covered construction activities meet standardized permit conditions including the development and implementation of a stormwater pollution prevention plan (SWPPP). This general permit will maintain the water quality standards adopted by the Board. This general permit will replace the general permit VAR10 which expires on June 30, 2024. Operators covered under the expiring general permit who wish to continue to discharge under a general permit must register for coverage under the new permit.

Public involvement in permit reissuance

A public hearing was held at the following location on September 7, 2023: Department of Environmental Quality, Piedmont Regional Office, 4949-A Cox Road, Glen Allen Virginia 23060. The notice of the public comment period/public hearing was published in the Richmond Times Dispatch and the Virginia Register. The public comment period opened on August 14, 2023, and closed on December 6, 2023. During the public comment period, DEQ staff reviewed comments received, drafted responses, and revised the final permit regulation as appropriate. The State Water Control Board adopted the general permit regulation on INSERT DATE. The regulation is effective for all covered facilities on July 1, 2024. Every authorization to discharge under this general permit will expire June 30, 2029.

DEQ Staff Contact

All pertinent information is on file and may be inspected, and arrangements made for copying by contacting Rebecca Rochet at:

Virginia Department of Environmental Quality
P.O. Box 1105
Richmond, Virginia 23218
Tel: (804) 801-2950
E-mail: Rebecca.Rochet@deq.virginia.gov

Administrative

The general permit will have a fixed term of five (5) years effective, upon Board approval, July 1, 2024. Every authorization to discharge under this general permit will expire at the same time and all authorizations

to discharge will be renewed on the same date. Discharges will be covered under the general permit upon approval of the Registration Statement and delivery of a copy of the general permit to the applicant. However, in accordance with § 62.1-44.15:28 9 e of the Code of Virginia, the submission of a registration statement for the construction of single-family detached residential structures associated with small construction activity within or outside a common plan of development or sale is not required. A registration statement is required for a large construction activity associated with the construction of a single family detached residential structure within or outside a common plan of development or sale; however, the Department's portion of the permit fee continues to be waived.

The submission of a registration statement is required for the overall construction of a residential common plan of development or sale. As single-family detached residential properties are transferred to new owners/operators within a common plan of development or sale, the new owners/operators are authorized to discharge under the general permit provided that they comply with the terms and conditions of the general permit including the development and implementation of a stormwater pollution prevention plan for each new single-family detached residential structure.

This general permit does not apply to any new or increased discharge that will result in significant effects to the receiving waters. That determination is made in accordance with the State Water Control Board's Antidegradation Policy contained in the Virginia Water Quality Standards, 9VAC25-260-30. Anti-backsliding will also be considered prior to granting coverage under this general permit to construction activities currently discharging stormwater under another applicable or VPDES permit. If a discharge appears to qualify for this general permit, the operator must submit a general permit Registration Statement to apply for general permit coverage. The Department will either send a copy of the general permit to those applicants that qualify or send a copy of the Virginia Erosion and Stormwater Management Program (VESMP) individual permit application to those that do not qualify.

Considerations

U.S. EPA Construction General Permit (CGP)

The U.S. EPA CGP became effective on February 17, 2022. In this CGP, the EPA added new requirements for dewatering discharge. The EPA CGP uses a weekly average benchmark of 50 nephelometric turbidity units (NTUs). Prior to finalizing the revised draft permit, DEQ performed extensive research on dewatering discharge requirements in existing approved and/or adopted construction general permits across the U.S. As a result of this research, DEQ proposed three options for monitoring construction dewatering discharge, in order to provide flexibility, but still remain equally as protective of water quality as the EPA CGP. In addition, DEQ has included the language allowing the permittee to request an alternative benchmark threshold that is also included in the EPA CGP. This change is reflected in permit language found in the flowing sections of the permit; 9VAC25-880-1, Part II.B.8, Part II.G.3.(e), Part II.G.4.d, and Part II.H.2.

Commonwealth of Virginia Chapter 356 of the 2022 Acts of Assembly (Senate Bill 657)

SB 657 was passed during the 2022 Session of the General Assembly. This bill limits the authority of the State Water Control Board under Chapters 3.1 (State Water Control Law) and 24 (Surface Water Management Areas) of Title 62.1 of the Code of Virginia to the issuance of regulations and transfers the Board's existing authority to issue permits and orders to DEQ. The Governor signed this bill into law on April 11, 2022 (SB657 – Chapter 356 of the 2022 Acts of Assembly) and these changes became effective July 1, 2022. The State Water Control Board adopted regulatory amendments to 9VAC25-890 on August 25, 2022, and affirmed changes to be incorporated into 9VAC25-890 resulting from Chapter 356 of the 2022 Acts of Assembly (Senate Bill 657). Revisions to the regulations include those necessary to address changes to the authority of the State Water Control Board to issue and enforce permits. Changes to the regulations included changing designations from “board” to “department” where appropriate; adding definitions of “Board” and “Department”; and the repeal of the delegation of authority provisions.

Commonwealth of Virginia Chapters 68 and 758 of the 2016 Acts of Assembly (“Consolidation Bill”)

House Bill 2390 and Senate Bill 1168 were passed during the 2016 Session of the General Assembly. These bills combined requirements in the Erosion and Sediment Control Law and Stormwater Management

Act into the Virginia Erosion and Stormwater Management Act (VESMA). One of the enactment clauses directed the State Water Control Board adopt regulations to implement the requirements of the VESMA. The Virginia Erosion and Stormwater Management Regulation was adopted by the State Water Control Board at its June 22, 2023 meeting. It becomes effective on July 1, 2024. Revisions were made throughout the general permit to update citations and references to the Erosion and Sediment Control Regulations (9VAC25-840), Erosion and Sediment Control and Stormwater Management Certification Regulations (9VAC25-850), and Virginia Stormwater Management Program Regulation (9VAC25-870) to reflect the consolidation of these three chapters into the Virginia Erosion and Stormwater Management Regulation (9VAC25-875).

Commonwealth of Virginia Chapters 48 (House Bill 1848) and 49 (Senate Bill 1376) of the 2023 Acts of Assembly

House Bill 1848 and Senate Bill 1168 were passed during the 2023 Session of the General Assembly. These bills added a definition for “small construction activity” to the Stormwater Management Act (and VESMA, effective July 1, 2024) and revised the provisions about submitting registration statements for the general permit. The changes bring the Virginia Stormwater Management Program Regulation (and Virginia Erosion and Stormwater Management Regulation) into conformity with federal law. Specifically, the bills included provisions for DEQ to establish a procedure by which a registration statement shall not be required for coverage under the CGP for small construction activity involving a single-family detached residential structure. This change is reflected in permit language found in the following sections of the permit; 9VAC25-880-10, 9VAC25-880-50. A.1.c and A.2.b, 9VAC25-880-60.A, 9VAC25-880-70 General permit, and Part II.A.1.

Summary of Changes from the 2019 Construction General Permit (CGP)

This general permit replaces the 2019 CGP which was issued for a five-year term on July 1, 2019. Revisions were made throughout to update citations and references to the Erosion and Sediment Control Regulations (9VAC25-840), Erosion and Sediment Control and Stormwater Management Certification Regulations (9VAC25-850), and Virginia Stormwater Management Program Regulation (9VAC25-870) to reflect the consolidation of these three chapters into the Virginia Erosion and Stormwater Management Regulation (9VAC25-875). In addition, DEQ finalized several minor changes throughout the general permit to ensure consistent use of terminology and improve readability. These changes did not modify the underlying requirement from the 2019 CGP and are only intended to make the original objective easier to understand. The following is a list of substantial changes included in the general permit as compared to the 2019 CGP:

Section 1 – Definitions

- Revised the introductory paragraph to improve readability and incorporate the correct title and citation of the Virginia Erosion and Stormwater Management Program (VESMP) Regulation.
- Minor changes were made to terms throughout this section to ensure consistent use of terminology, improve readability, and correct grammatical errors. These minor changes did not alter, narrow, or expand the meaning of terms.
- Revised definition of “*impaired waters*” to reflect 2022 § 305(b)/303(d) Water Quality Assessment Integrated Report.
- Added definition of “*construction dewatering*,” based on the definition included in EPA’s 2022 CGP and input from the Technical Advisory Committee, to mean the act of draining or pumping stormwater or ground water from building foundations, vaults, and trenches, or other similar points of accumulation, including from sediment basins or similar impoundments for maintenance or decommissioning purposes. Construction dewatering does not include temporary pump arounds associated with instream construction activities.
- Revised definition of “*construction site*” to include water area, which conforms with the EPA’s definition. In addition, added clarity regarding construction support activities located on-site or off-site.
- Added definition of “*construction support activity*,” based on the definition included in EPA’s 2022 CGP, to mean a construction-related activity that specifically supports construction and involves land disturbance or pollutant-generating activities of its own and can include activities associated with concrete or asphalt batch plants, equipment staging yards, materials storage areas, excavated

material disposal areas, and borrow areas. This term was previously used but was not defined in the general permit.

- Revised definition of “*final stabilization*” to provide clarity on the required minimum percentage of vegetative cover and allowable bare area size to be classified as uniform for the purposes of final stabilization for consistency with EPA’s 2022 CGP. Also, removed the word “final” in front of stabilization in subdivisions 2.a, 2.b, and 3 to remove redundancy.
- Revised definition of “*measurable storm event*” to include snow melt for consistency with EPA’s 2022 CGP.
- Added definition of “*qualified personnel*” to address new stormwater team requirements in EPA’s 2022 CGP. Qualified personnel is defined as a person knowledgeable in the principles and practices of erosion and sediment and stormwater management controls who possesses the skills to assess conditions at the construction site for the operator that could impact stormwater quality and quantity and to assess the effectiveness of any sediment and erosion control measures or stormwater management facilities selected to control the quality and quantity of stormwater discharges from the construction activity. On or after July 1, 2025, “*qualified personnel*” shall hold an unexpired certificate of competence for Project Inspector for Erosion and Sediment Control and an unexpired certificate of competence for Project Inspector for Stormwater Management, both issued by the department, a Construction General Permit Qualified Personnel Certificate issued by the department or the Virginia Department of Transportation, or an equivalent certification provided by EPA (currently titled Construction Inspection Training Course). This definition is based on language in the Virginia Stormwater Management Program Regulation with additional certification options.

Section 10 – Purpose

- Revised language to improve the clarity and readability of this section. These changes did not alter the requirements of this section.

Section 15 – Applicability of incorporated references based on the dates that they became effective

- Updated the applicable date of Code of Federal Regulation (CFR) references used in the general permit; now July 1, 2022 updates.

Section 20 – Effective date of general permit

- Updated the effective date and expiration date of the general permit.

Section 30 – Authorization to discharge

- Minor changes were made to terms throughout this section to ensure consistent use of terminology, improve readability, and correct grammatical errors. These minor changes did not alter the requirements of this section.
- Added language to clarify that permit fees includes all outstanding permit maintenance fees. This revision was made to ensure general maintenance fees are paid for the continuation of general permit coverage.
- Added language to allow for reporting of new support activities in a modified registration statement once the need for the additional support activity is known.
- Added language to clarify that off-site construction support activities not authorized under the CGP shall not be included in calculating the total land area of the construction site and estimated area to be disturbed in the registration statement.
- Updated the list of nonstormwater authorized discharges for consistency with other recently issued VPDES permits.
- Revised the timeline for submitting a completed registration statement from 60 days to 90 days prior to the expiration date of the permit. This change is meant to grant more time in reviewing registration statements for continuation of general permit coverage.
- Added a requirement that all past due general maintenance fees must be paid prior to continuation of a CGP. This revision was made to ensure general maintenance fees are paid for the continuation of general permit coverage.

Section 40 – Delegation of authorities to state and local programs

- Minor changes were made to terms throughout this section to ensure consistent use of terminology, improve readability, and correct grammatical errors. These minor changes did not alter the requirements of this section.

Section 50 – General permit application (registration statement)

- Minor changes were made to terms throughout this section to ensure consistent use of terminology, improve readability, and correct grammatical errors. These minor changes did not alter the requirements of this section.
- Updated the registration statement submission deadline for existing construction activities seeking continued coverage under this general permit; now 90 days prior to expiration. This change is meant to grant more time in reviewing registration statements for continuation of general permit coverage.
- Updated the title of Subsection A 3 to “*Transfer of ownership*” for clarify and readability.
- Added the requirement to include a State Corporation Commission entity identification number to ensure consistency with other recently issued VPDES permits.
- Revised the requirement for submitting an 8.5-inch by 11-inch format site map to a legible site map to grant flexibility for submitting site maps while still ensuring the contents are readable.
- Included “*erosion and sediment control plans*” for construction activities approved by an entity with approved standards and specifications for consistency with the consolidation of 9VAC25-840 and 9VAC25-870.
- Reformatted Subsections B10, B11, and B13 to improve readability and clarify.
- Moved the requirement for a stormwater pollution prevention plan (SWPPP) from the registration statement specific requirements as the language is more reflective of preparing a SWPPP rather than the contents of a registration statement. This change was made to provide clarity and reduce redundancy.

Section 60 – Termination of general permit coverage

- Minor changes were made to terms throughout this section to ensure consistent use of terminology, improve readability, and correct grammatical errors. These minor changes did not alter the requirements of this section.
- Clarified the termination and reference to the registration statement requirement for a small construction activity of a single-family detached residential structure. The revision was due to 2023 legislative changes.
- Updated the timeline for which the termination of authorization shall become effective; now 90 days after receipt of a complete and accurate notice of termination. This revision was made to comply with § 62.1-44.15:26.1 of the Code of Virginia. In addition, added language to clarify that the timeline for the termination of the permit coverage does not apply if the operator is notified of an issue by the VESMP authority or the department.

Section 70 – General permit

- Minor changes were made to terms throughout this section to ensure consistent use of terminology, improve readability, and correct grammatical errors. These minor changes did not alter the requirements of this section.
- Added a statement to clarify that stormwater discharge associated with a small construction activity of a single-family detached residential structure, within or outside a common plan of development or sale, is authorized to discharge under the general permit and shall comply with the requirements contained in the general permit and be subject to all requirements of 9VAC25-875. This revision a result of 2023 legislative changes for conformity with federal law.
- Updated the effective date to July 1, 2024 and the expiration date to June 30, 2029. Updated the regulation language for clarity and consistency with other general VPDES permits adopted by the Board.

Part I – Discharge Authorization and Special Conditions

- Coverage under this Permit: Added language to allow for reporting new support activities in a modified registration statement once the need for the additional support activity is known. This change was needed to clarify how to obtain coverage for a construction support activity if the activity is identified a general permit coverage is issued.
- Limitations on Coverage: Updated the Water Quality Assessment Integrated Report date from 2016 to 2022.
- Authorized nonstormwater discharges: Updated the list of nonstormwater authorized discharges for consistency with other recently issued VPDES permits.
- Termination of general permit coverage: Revised the timeline for the termination of authorization to discharge from 60 days to 90 days after receipt of a notice of termination. This change was made to comply with § 62.1-44.15:26.1 of the Code of Virginia. In addition, added language to clarify the timeline for the termination of permit coverage does not apply if the operator is notified of an issue by the VESMP authority or the department. Finally, language was added to improve clarity about which sections of the permit must be followed when submitted a notice of termination.

Part II – Stormwater Pollution Prevention Plan

- Minor changes were made to terms throughout this section to ensure consistent use of terminology, improve readability, and correct grammatical errors. These minor changes did not alter the requirements of this section.
- Added a statement to clarify that stormwater discharge associated with a small construction activity of a single-family detached residential structure, within or outside a common plan of development or sale, a Stormwater Pollution Prevention Plan must be developed and implemented prior to the initiation of the construction activity, including any construction support activity. This revision a result of 2023 legislative changes for conformity with federal law, as well as in response to comments received from EPA.
- Updated the effective date of the general permit.
- Contents, General: Revised existing language to improve readability and add additional detail and clarify as to what must be included in the construction site map. Added new language that requires listing the locations of areas where polymers, flocculants, or other stormwater treatment chemicals are used or stored. This language is from previous EPA permits; however, it is new to Virginia's CGP.
- Contents, Erosion and Sediment Control Plan: Revisions were made to improve readability, provide clarity, and incorporate new defined terms. In addition, new language was added to provide additional clarity on when directing stormwater to vegetated areas, minimizing soil compaction, and preserving topsoil would be considered infeasible. The new language in these subsections comes from EPA's CGP.
- Contents, Stormwater Management Plan: Revisions were made to improve readability and provide clarity.
- Contents, Pollution Prevention Plan: Revisions were made to improve readability and provide clarity. Also, revised to incorporate changes in terms from EPA's 2022 CGP. Added new language to clarify that concrete wash water cannot be disposed of through infiltration or otherwise disposed of on the ground. This new language is in response to issues raised through NOIRA public comments and during the Technical Advisory Committee meetings.
- Established SWPPP requirements for turbidity benchmark monitoring requirements for construction dewatering discharges to sensitive waters in response to new EPA requirements for controlling construction dewatering discharges. The department followed EPA's concept of creating a turbidity benchmark that is not an effluent limitation.
- Revised "*delegation of authority*" to "*duly authorized representative*" for consistency with other sections of the permit, as well as clarifies whose information needs to be included in the SWPPP. In addition, added language directing permittees to the provisions in the permit detailing signature and certification requirements.
- Added language clarifying that the SWPPP must contain a signature and certification and directing permittees to the provisions in the permit detailing signature and certification requirements. This was done to add clarity around requirements and to make the permit easier to navigate.

- SWPPP amendments, modification, and updates: Added language directing permittees to the provisions in the permit detailing signature and certification requirements. This revision was done to provide clarity.
- Public notification: Revised and added new language to clarify requirements for where a notice of coverage letter must be posted.
- SWPPP implementation: With regards to implementing corrective actions or routine maintenance, “seven days” replaced with “five business days” to create consistency throughout the permit. In addition, revised to add the need for routine maintenance as a trigger for this subsection. This is a new subsection incorporating new EPA requirements for what an operator must do if they must repeatedly repair the same stormwater control at the same location.
- SWPPP Inspections: Added language to clarify that the qualified personnel conducting inspections may be a person on the operator’s staff or a third party hired to conduct inspections. Added new language from EPA’s 2022 CGP that adds more detail around when an inspection must take place in the event of a measurable storm event. Revised to fix numbering issues that existed in past permits and to account for new defined terms. Added subsections to incorporate language from EPA’s permit stating that all stormwater discharge locations and all construction dewatering discharge locations must be inspected, and documented when an inspection indicates that pollutants are being discharged. In addition, new language was added to require reporting of incidents of noncompliance or a certification that the construction activity is in compliance with the SWPPP, as well as language directing permittees to the provisions in the permit detailing signature and certification requirements.
- Corrective Actions: Revised the number of days to implement corrective actions from “seven days” to “five business days” to create consistency throughout the permit. Added requirement to detail corrective actions that must be taken if required by the new construction dewatering turbidity benchmark.

Part III – Conditions Applicable to All VPDES Permits

- Minor changes were made to terms throughout this section to ensure consistent use of terminology, improve readability, and correct grammatical errors. These minor changes did not alter the requirements of this section.
- Reports of unusual or extraordinary discharges: Revised the number of days to report in writing to the department and the VESMP authority from “five days” to “five calendar days” to create a clear distinction from the use of “five business days” in other parts of the permit.
- Reports of noncompliance: Updated to ensure consistency with other recently reissued general VPDES permits in Virginia. The changes from this section come from the recently reissued General Permit for Vehicle Wash Facilities and Laundry Facilities (9VAC25-194-70). The revisions include changing “surface waters” to “state waters,” minor linguistic and number revisions, and changes to the subsection dealing with making reports to the department or VESMP authority.
- Notice of planned changes: Updated to provide clarification in instances where the permittee has requested a planned change and is awaiting a response from the review authority. This new language is in response to issues raised through NOIRA public comments and during the Technical Advisory Committee meetings.
- Signatory requirements: Revised to add notices of termination to the types of documents requiring signatures. This revision was done to provide clarity.
- Duty to reapply: Revised the timeline for submitting a completed registration statement from 60 days to 90 days prior to the expiration date of the permit for consistency with the requirements outlined in previous sections of the CGP. This change is meant to grant more time in reviewing registration statements for continuation of general permit coverage.

Activities Covered under this General Permit

This general permit covers point source discharges of stormwater from construction activities to surface waters of the Commonwealth, including discharges through municipal or non-municipal separate storm sewer systems. The term “construction activity” is defined in 9VAC25-875-20 as “...any clearing, grading or excavation associated with large construction activity or associated with small construction activity.” The

terms "*large construction activity*" and "*small construction activity*" are likewise defined in that section as follows:

"*Large construction activity*" means construction activity including clearing, grading and excavation, except operations that result in the disturbance of less than five acres of total land area. Large construction activity also includes the disturbance of less than five acres of total land area that is a part of a larger common plan of development or sale if the larger common plan will ultimately disturb five acres or more. Large construction activity does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of the facility.

"*Small construction activity*" means:

1. Construction activities including clearing, grading, and excavating that results in land disturbance of equal to or greater than one acre, and less than five acres. Small construction activity also includes the disturbance of less than one acre of total land area that is part of a larger common plan of development or sale if the larger common plan will ultimately disturb equal to or greater than one and less than five acres. Small construction activity does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of the facility. The department may waive the otherwise applicable requirements in a general permit for a stormwater discharge from construction activities that disturb less than five acres where stormwater controls are not needed based on a "total maximum daily load" (TMDL) that addresses the pollutant(s) of concern or, for nonimpaired waters that do not require TMDLs, an equivalent analysis that determines allocations for small construction sites for the pollutants of concern or that determines that such allocations are not needed to protect water quality based on consideration of existing in-stream concentrations, expected growth in pollutant contributions from all sources, and a margin of safety. For the purpose of this subdivision, the pollutants of concern include sediment or a parameter that addresses sediment (such as total suspended solids, turbidity or siltation) and any other pollutant that has been identified as a cause of impairment of any water body that will receive a discharge from the construction activity. The operator must certify to the department that the construction activity will take place, and stormwater discharges will occur, within the drainage area addressed by the TMDL or equivalent analysis. As of the start dates in Table 1 of 9VAC25-31-1020, all certifications submitted in support of the waiver shall be submitted electronically by the owner or operator to the department in compliance with this subdivision and 40 CFR Part 3 (including, in all cases, 40 CFR Part 3 Subpart D), 9VAC25-875-940, and Part XI (9VAC25-31-950 et seq.) of the Virginia Pollutant Discharge Elimination (VPDES) Permit Regulation. Part XI of 9VAC25-31 is not intended to undo existing requirements for electronic reporting. Prior to this date, and independent of Part XI of 9VAC25-31, permittees may be required to report electronically if specified by a particular permit.
2. Any other construction activity designated by the either the department or the EPA regional administrator, based on the potential for contribution to a violation of a water quality standard or for significant contribution of pollutants to surface waters.

Coverage under this general permit applies to the "*Estimated Area To Be Disturbed*" as reported by the operator on the registration statement. For projects that are planned in sections over an extended period of time exceeding the 5-year term of this permit, coverage is only required for those sections of the project where land disturbance will be occurring prior to June 30, 2029. If during the term of this permit the operator determines additional land disturbance is necessary as part of the project, a permit registration modification is required to be submitted.

This general permit also covers point source discharges of stormwater from construction support activities (e.g., concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas) located on-site or off-site provided that:

- (1) the support activity is directly related to a construction activity that is required to have general permit coverage for stormwater discharges;
- (2) the support activity is not a commercial operation, nor does it serve multiple unrelated construction sites;

- (3) the support activity does not operate beyond the completion of the last construction activity it supports;
- (4) the support activity is reported in the registration statement at the time of general permit coverage or reported in a modified registration statement once the need for the support activity is known;
- (5) appropriate control measures are identified in a stormwater pollution prevention plan and implemented to address the discharges from the support activity; and
- (6) all applicable, state, federal, and local approvals are obtained for the support activity.

Operators applying for coverage under this general permit are not required to include on-site or off-site support activities for which they do not have operational control. Any on-site or off-site support activity not included with an operators' general permit coverage may be required to obtain separate VDPPS permit coverage. On-site or off-site support activities that require land disturbance are required to obtain construction general permit coverage regardless of the extent of the land disturbing activity (i.e., even if less than one acre).

This general permit covers stormwater discharges from a wide variety of construction activities. The conditions which affect the presence of pollutants in stormwater at construction sites vary significantly. Therefore, the general permit contains SWPPP requirements that apply to all construction activities and does not specify erosion and sediment controls or stormwater management controls that are appropriate or can be implemented by all operators. The volume and quality of stormwater discharges associated with construction activity will depend on a number of factors, including the land-disturbing activities occurring at the site and the nature of precipitation. Pollutants in stormwater discharges from construction activities may be reduced using the following methods: eliminating pollution sources, implementing Best Management Practices (BMPs) to prevent pollution, and using traditional erosion and sediment controls.

The draft general permit follows the basic framework of the U.S. EPA final 2022 Construction General Permit (CGP) published in the Federal Register (FR) on January 24, 2022 (87 FR 3522). Readers are also referred to EPA's final 2022 CGP Fact Sheet (available on EPA's website at <https://www.epa.gov/system/files/documents/2022-01/2022-cgp-final-fact-sheet.pdf> for additional details.

Limitations on Coverage

Because of the broad scope of this general permit, most construction activities currently regulated under the VESMP are eligible to be covered under the general permit. There are, however, several types of stormwater discharges not covered under this general permit. If an operator has been required to obtain an individual VSMP permit for their stormwater discharges pursuant to 9VAC25-875-980 B (VESMP Regulation), they are not authorized for coverage under this general permit. Discharges to surface waters where a discharge is specifically prohibited by another regulation of the State Water Control Board are not authorized by this general permit. Discharges from VPDES permitted industrial activities are also not eligible for coverage under this general permit.

Other discharges of stormwater that are not authorized under the general permit are:

- (1) discharges that originate from the construction site after construction activities have been completed and the construction site, including any construction support activity covered under the general permit registration, has undergone final stabilization;
- (2) discharges that are mixed with sources of nonstormwater, other than those discharges that are identified in Part I E (Authorized nonstormwater discharges) of the general permit;
- (3) discharges of stormwater from construction activities that are covered under an individual permit or required to obtain coverage under an alternative general permit;
- (4) discharges that cause, or may reasonably be expected to cause, or contribute to a violation of the Virginia Water Quality Standards (9VAC25-260);
- (5) discharges that violate or would violate the antidegradation policy in the Virginia Water Quality Standards (9VAC25-260-30); and
- (6) discharges that are not consistent with the assumptions and requirements of an applicable Total Maximum Daily Load (TMDL) approved prior to the term of this general permit.

In addition, there shall be no discharge of floating solids or visible foam in other than trace amounts.

Impaired Waters and TMDL Limitation

Stormwater discharges from construction activities to surface waters identified as impaired in the [2022 § 305\(b\)/303\(d\) Water Quality Assessment Integrated Report](#) for Benthic Macroinvertebrates Bioassessments or for which a TMDL wasteload allocation has been established and approved prior to the term of this general permit, including all surface waters within the Chesapeake Bay Watershed, for the following: (i) sediment or a sediment related parameter (i.e., total suspended solids or turbidity), (ii) nutrients (i.e., nitrogen or phosphorus), or (iii) polychlorinated biphenyls (PCBs) are not eligible for coverage under this general permit unless the operator develops, implements, and maintains a SWPPP in accordance with Parts II B 5 and II B 6 of the general permit that minimizes the pollutants of concern and, when applicable, is consistent with the assumptions and requirements of the approved TMDL wasteload allocations. In addition, for impairments for (i) sediment or a sediment related parameter (i.e., total suspended solids or turbidity), or (ii) nutrients (i.e., nitrogen or phosphorus), the operator must perform the following:

- (i) identify the impaired water(s), approved TMDL(s), and pollutant(s) of concern, when applicable, in the SWPPP;
- (ii) apply permanent or temporary soil stabilization to denuded areas within seven days after final grade is reached on any portion of the site;
- (iii) apply nutrients in accordance with manufacturer's recommendations or an approved nutrient management plan and not during rainfall events; and
- (iv) implement a more frequent SWPPP inspection schedule.

For PCB impairments, the operator must perform the following:

- (i) identify the impaired water(s), approved TMDL(s), and pollutant(s) of concern, when applicable, in the SWPPP;
- (ii) apply permanent or temporary soil stabilization to denuded areas within seven days after final grade is reached on any portion of the site;
- (iii) implement proper waste disposal in accordance with local, state, and federal requirements; and
- (iv) implement a more frequent SWPPP inspection schedule consistent with Part II G 2 a of the general permit.

Exceptional Waters Limitation

Discharges of stormwater from construction activities to exceptional waters identified in 9VAC25-260-60 A 3 c (Virginia Water Quality Standards) are not eligible for coverage under this general permit unless the operator (i) identifies the exceptional water(s) in the SWPPP, (ii) applies permanent or temporary soil stabilization to denuded areas within seven days after final grade is reached on any portion of the site, (iii) applies nutrients in accordance with manufacturer's recommendations or an approved nutrient management plan and not during rainfall events, and (iv) implements a more frequent SWPPP inspection schedule consistent with Part II G 2 a of the general permit.

Permit Special Conditions

Commingled Discharges

Discharges covered by this general permit may be commingled with other sources of stormwater that are not required to be covered under a permit, so long as the commingled discharge is in compliance with this general permit. Discharges authorized by a separate VPDES permit may be commingled with discharges authorized by this general permit so long as all such discharges comply with all applicable VPDES permit requirements.

Authorized Nonstormwater Discharges

The following nonstormwater discharges from construction activities are also covered by this general permit:

- (1) discharges from emergency firefighting activities;
- (2) fire hydrant flushings, managed to avoid an instream impact;
- (3) water used to wash vehicles or equipment provided no soaps, solvents, or detergents are used and the wash water is filtered, settled, or similarly treated prior to discharge;
- (4) water used to control dust that is filtered, settled, or similarly treated prior to discharge;

- (5) potable water, including uncontaminated waterline flushings, managed in a manner to avoid an instream impact;
- (6) routine external building wash down provided no soaps, solvents, or detergents are been used and the wash water is filtered, settled, or similarly treated prior to discharge;
- (7) pavement wash water provided spills or leaks of toxic or hazardous materials have not occurred, unless all spilled or leaked material has been removed prior to washing; soaps, solvents, or detergents are not used; and where the wash water is filtered, settled, or similarly treated prior to discharge;
- (8) uncontaminated air conditioning or compressor condensate;
- (9) uncontaminated groundwater or spring water;
- (10) foundation or footing drains provided flows are not contaminated with process materials such as solvents or contaminated groundwater;
- (11) uncontaminated, excavation dewatering, including dewatering of trenches and excavations that are filtered, settled, or similarly treated prior to discharge; and
- (12) landscape irrigations.

Potable water sources may contain chlorine or other chemicals commonly added to disinfect and prepare the water for public use. These chemicals may be toxic to fish and other aquatic life. When discharges of potable water at construction site is necessary, operators should consider the use of dichlorination measures or direct discharges to vegetated areas prior to discharging to surface waters.

Prohibition of Nonstormwater Discharges

All discharges covered by this general permit shall be composed entirely of stormwater associated with construction activities except as noted above. All other nonstormwater discharges including the following, which have been adapted from 40 Code of Federal Regulations (CFR) Part 450, are prohibited:

- (1) wastewater from the washout of concrete;
- (2) wastewater from the washout and cleanout of stucco, paint, form release oils, curing compounds, and other construction materials;
- (3) fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance;
- (4) oils, toxic substances, or hazardous substances from spills or other releases; and
- (5) soaps, solvents, or detergents used in equipment and vehicle washing.

All nonstormwater discharges not covered under this general permit shall either be eliminated or covered under a separate VDPES permit.

Termination of General Permit Coverage

Operators of construction activities are required to submit a notice of termination after one or more of the following conditions have been met:

- (1) necessary permanent control measures identified in the SWPPP for the construction site are in place and functioning effectively and final stabilization as defined in 9VAC25-880-1 has been achieved on all portions of the construction site for which the operator has operational control. When applicable, long term responsibility and maintenance requirements for permanent control measures shall be recorded in the local land records prior to the submission of a complete and accurate notice of termination and the construction record drawing prepared;
- (2) another operator has assumed control over all areas of the construction site that have not been finally stabilized and obtained coverage for the ongoing discharge;
- (3) coverage under an alternate VPDES permit has been obtained; or
- (4) for individual lots in residential construction only, final stabilization as defined in 9VAC25-880-1 has been completed, including providing written notification to the homeowner and incorporating a copy of the notification and signed statement into the SWPPP, and the residence has been transferred to the homeowner.

The notice of termination should be submitted no later than 30 days after once of the above conditions being met and must be signed in accordance with Part III K of the general permit and include the required certification in accordance with Part III K 4 of the general permit. Notice of termination is not required for a small construction activity of a single-family detached residential structure that is not required to submit a registration statement.

For construction activities on land used for agricultural purposes (e.g., pipelines across crop or range land or staging areas for highway construction) construction activity operators may accomplish final stabilization by returning the disturbed land to its preconstruction agricultural use.

Water Quality Protection

Construction activity operators must select, install, implement, and maintain control measures as identified in the SWPPP at the construction site that minimize pollutants in the discharge as necessary to ensure that the operator's discharge does not cause or contribute to an excursion above any applicable water quality standard. If the department determines that the operator's discharges are causing, have reasonable potential to cause, or are contributing to an excursion above any applicable water quality standard, the department, in consultation with the VESMP authority, may take appropriate enforcement action and require the operator to:

- (1) modify or implement additional control measures in accordance with Part IIC of the general permit to adequately address the identified water quality concerns;
- (2) submit valid and verifiable data and information that are representative of ambient conditions and indicate that the receiving water is attaining water quality standards; or
- (3) cease discharges of pollutants from the construction activity and submit an individual permit application according to 9VAC25-875-980 B 3.

Stormwater Pollution Prevention Plan (SWPPP)

EPA established effluent limitation guidelines (ELGs) and new source performance standards (NSPS) to control the discharge of pollutants from construction activities; see 40 CFR Part 450. These requirements, known as the "*Construction and Development Rule*" or "*C&D Rule*", were published in the Federal Register on December 1, 2009 (74 FR 62996) and became effective on February 1, 2010. On November 5, 2010, EPA finalized a stay (75 FR 68215), effective January 4, 2011, for 40 CFR Parts 450.22 (a) and (b). EPA published amendments to the C&D Rule (79 FR 12661) on March 6, 2014, and May 4, 2014 (80 FR 25235) with an effective date of May 5, 2014. The amendments lifted the indefinite stay, withdrew the numeric discharge standards, and changed several of the non-numeric provisions of the original rule.

Effluent limitation guidelines for the Best Practicable Technology Currently Available (BPT), Best Available Technology Economically Achievable (BAT), and Best Conventional Pollutant Control Technology (BCT), which are codified at 40 CFR Parts 450.21 through 450.23, respectively, apply to all existing sources (i.e., construction activities which commenced land disturbance prior to February 1, 2010). The New Source Performance Standards codified in 40 CFR Part 450.24 apply to all new sources (i.e., construction activities which commenced land disturbance on or after February 1, 2010). This general permit establishes BPT/BCT/BAT/NSPS requirements in terms of requirements to develop and implement stormwater pollution prevention plans and thus, is consistent with the requirements of the Clean Water Act (CWA).

This general permit requires operators to develop and implement a site-specific stormwater pollution prevention plan. In doing so, this adequately addresses the variable stormwater management/pollution prevention opportunities available at a construction site. Stormwater pollution prevention plans are required to achieve BPT/BCT/BAT/NSPS requirements, and pollution prevention measures are the most practicable and cost-effective approach to minimizing pollutants in stormwater discharges. They also provide for flexibility in developing tailored plans and strategies. This general permit identifies specific components that the SWPPP must include; all the components of the plan are essential for minimizing pollutants in stormwater discharges. A specific list of erosion and sediment controls or stormwater management controls are not established in this general permit because the variability in covered construction activities precludes the identification of universal standards or practices that are appropriate or can be implemented by all operators.

Stormwater Pollution Prevention Plan Requirements

The SWPPP is intended to identify potential sources of pollutants which may reasonably be expected to affect the quality of stormwater discharges from the construction activity and describe control measures which will be used to minimize pollutant discharges and comply with the terms and conditions of the general permit. All SWPPPs shall be prepared in accordance with good engineering practices. SWPPP requirements of this general permit may be fulfilled by incorporating by reference other plans such as a spill

prevention control and countermeasure plan developed for the construction site under § 311 of the federal Clean Water Act or BMP programs otherwise required for the facility provided that the incorporated plan meets or exceeds the SWPPP requirements of this general permit. All plans incorporated by reference into the SWPPP are enforceable under this general permit. If a plan incorporated by reference does not contain all of the required elements of the SWPPP, the operator must develop the missing elements and include them in the SWPPP.

1. Deadlines for SWPPP Preparation

To be covered under the general permit, the stormwater pollution prevention plan must be developed prior to the submission of a registration statement to the department. This SWPPP preparation requirement does not apply to the submission of a registration statement to a local VESMP authority; operators of private construction activities are required to submit registration statements for initial permit coverage or reissuance of permit coverage, as well as transfer and modification of coverage, to local VESMP authorities for review and acceptance on the department's behalf. It is the department's expectation that all components of the SWPPP, including any necessary approved plans, will be prepared by the operator prior to any local VESMP authority forwarding the complete registration statement to the department for issuance of general permit coverage.

For a small construction activity of a single-family detached residential structure, within or outside a common plan of development or sale, a SWPPP shall be developed and implemented prior to the initiation of the construction activity. A registration statement is now required for a large construction activity of a single-family detached residential structure, including those that were previously automatically covered prior to July 1, 2024. To be covered under the general permit, the large construction activity of a single-family detached residential structure, the SWPPP must be developed prior to the submission of a registration statement to the department. As previously mentioned, This SWPPP preparation requirement does not apply to the submission of a registration statement to a local VESMP authority; operators of private construction activities are required to submit registration statements for initial permit coverage or reissuance of permit coverage, as well as transfer and modification of coverage, to local VESMP authorities for review and acceptance on the department's behalf. It is the department's expectation that all components of the SWPPP, including any necessary approved plans, will be prepared by the operator prior to any local VESMP authority forwarding the complete registration statement to the department for issuance of general permit coverage.

For ongoing construction activities involving a change of operator, the new operator must accept and maintain the existing SWPPP or prepare and implement a new SWPPP prior to taking over operations at the construction activity.

2. Stormwater Pollution Prevention Plan Contents

Stormwater pollution prevention plans must include the following:

- (1) general information;
- (2) erosion and sediment controls;
- (3) stormwater management controls;
- (4) pollution prevention practices for any applicable nonstormwater discharge(s); and
- (5) measures to address stormwater discharges to impaired waters, surface waters with a TMDL approved prior to the term of this general permit, and exceptional waters.

a. General Information

Stormwater pollution prevention plans are based on an understanding of the pollution potential of the construction activity. The SWPPP identifies potential sources of pollution that may reasonably be expected to affect the quality of stormwater discharges. In addition, SWPPPs provide a description of the site and the construction activities. This information is intended to provide a better understanding of construction site runoff and major pollutant sources. The general information section of the SWPPP must include a copy of the signed Registration Statement; a copy of the Notice of Coverage letter upon receipt; a copy of the Construction General Permit upon receipt; a narrative description of the nature of the construction activity, including the function of the project (e.g., low density residential, shopping mall, highway); and a legible map of the construction site identifying the following:

- (1) existing and proposed drainage patterns on the construction site and approximate slopes before and after major grading activities;
- (2) limits of clearing and grading (i.e., land disturbance) including steep slopes and natural buffers around surface waters that will remain undisturbed;
- (3) locations of major structural and nonstructural control measures, including sediment basins and traps, perimeter dikes and diversions, sediment barriers, and other measures intended to filter, settle, or similarly treat sediment, that will be installed between disturbed areas and the undisturbed vegetated areas in order to increase sediment removal and maximize stormwater infiltration;
- (4) locations of surface waters;
- (5) locations where concentrated stormwater is discharged;
- (6) locations of any construction support activities; and
- (7) when applicable, the location of the on-site rain gauge, or methodology established in consultation with the VESMP authority, used to identify measurable storm events for inspection purposes.

b. Erosion and Sediment Control Plan

Stormwater pollution prevention plans must include an approved erosion and sediment control plan, an “*agreement in lieu of a plan*” as defined in 9VAC25-875-20, or an erosion and sediment control plan prepared in accordance with department-approved standards and specifications for the *Estimated Area to be Disturbed* as reported on the registration statement. An erosion and sediment control plan or an “*agreement in lieu of a plan*” ensures the proper design and implementation of erosion and sediment controls to minimize pollutants in stormwater discharges from the construction activity. In addition, all erosion and sediment control plans must include a statement describing the maintenance responsibilities required for all controls employed, which serves to aid operators in maintenance activities. Unless there is evidence to the contrary, a properly implemented approved erosion and sediment control plan, an “*agreement in lieu of a plan*,” or an erosion and sediment control plan prepared in accordance with department-approved standards and specifications, adequately:

- (1) controls the volume and velocity of stormwater runoff within the construction site to minimize erosion;
- (2) controls stormwater discharges, including peak flow rates and total stormwater volume, to minimize erosion at outfalls and to minimize downstream channel and stream bank erosion;
- (3) minimizes the amount of soil exposed during the construction activity;
- (4) minimizes the disturbance of steep slopes;
- (5) minimizes sediment discharges from the construction site in a manner that (i) addresses the amount, frequency, intensity, and duration of precipitation, (ii) the nature of resulting stormwater runoff, and (iii) soil characteristics, including the range of soil particle sizes expected to be present on the construction site;
- (6) provides and maintains natural buffers around surface waters, directs stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration, unless infiltration would be inadvisable due to the underlying geology (e.g., karst topography) and groundwater contamination concerns, or infeasible due to site conditions;
- (7) minimizes soil compaction (not required where the intended function of a specific area of the construction site dictates that it is to be compacted);
- (8) unless infeasible, preserve topsoil (not required where the intended function of a specific area of the construction site dictates that the topsoil be disturbed or removed);
- (9) ensures the initiation of stabilization activities of disturbed areas occurs immediately whenever any clearing, grading, or excavating, or other land-disturbing activities have permanently ceased on any portion of the construction site, or temporarily ceased on any portion of the construction site and will not resume for a period exceeding 14 days; and
- (10) utilizes outlet structures that withdraw stormwater from the surface (i.e., above the permanent pool or wet storage water surface elevation), unless infeasible, when discharging from sediment basins or sediment traps.

In order to obtain permit coverage under the 2024 general permit, all operators must have obtained approval of an erosion and sediment control plan for the *Estimated Area to be Disturbed* as reported on the registration statement.

c. Stormwater Management Plan

Stormwater management plans ensure the implementation and maintenance of post-development stormwater management controls to minimize pollutants in stormwater discharges from the site after final stabilization and general permit termination has occurred. Stormwater management controls that mitigate changes to pre-development runoff characteristics assist in protecting and maintaining the physical and biological characteristics of receiving streams and wetlands. Therefore, stormwater pollution prevention plans must include an approved stormwater management plan in accordance with the Virginia Erosion and Stormwater Management Regulation (9VAC25-875) for new construction activities, an “*agreement in lieu of a plan*” as defined in 9VAC25-875-20, or a stormwater management plan prepared in accordance with department-approved standards and specifications.

For any operator that obtained an initial permit or commenced land disturbance prior to July 1, 2014, meeting the conditions of 9VAC25-875-480 B of the VESMP Regulation, an approved stormwater management plan is not required. In lieu of an approved stormwater management plan, the SWPPP shall include a description of, and all necessary calculations supporting, all post-construction stormwater management measures that will be installed prior to the completion of the construction process to control pollutants in stormwater discharges after construction operations have been completed. Structural measures should be placed on upland soils to the degree possible. Such measures must be designed and installed in accordance with applicable VESCP authority, VESMP authority, state, and federal requirements, and any necessary permits must be obtained.

d. Pollution Prevention Plan

Pollution prevention plans identify and address pollutant-generating activities from both on-site and off-site activities, including construction support activities, which may be reasonably expected to affect the quality of discharges. The plan must identify and ensure the implementation of applicable pollution prevention practices for each component of the discharge. The pollution prevention plan shall include:

- (1) the identification of pollutant-generating activities and the pollutants that are expected to be exposed to stormwater;
- (2) the location where the pollutant-generating activities will occur (or if identified on the site plan, reference the site plan);
- (3) the identification of all nonstormwater discharges that are or will be commingled with stormwater discharges from the construction activity, including any support activity;
- (4) the identification of the person responsible for implementing the pollution prevention practice(s) for each pollutant-generating activity (if other than the person listed as the qualified personnel);
- (5) a description of the pollution prevention procedures and practices that will be implemented to:
 - (i) prevent and respond to leaks, spills, and other releases,
 - (ii) prevent the discharge of spilled and leaked fuels and chemicals from vehicle fueling and maintenance activities,
 - (iii) prevent the discharge of soaps, solvents, detergents, and wash water from construction materials, including the clean-up of stucco, paint, form release oils, and curing compounds,
 - (iv) minimize the discharge of pollutants from vehicle and equipment washing, wheel wash water and other types of washing,
 - (v) direct concrete wash water into a leak-proof container or leak-proof settling basin designed so that no overflows can occur due to the inadequate sizing or precipitation,
 - (vi) minimize the discharge of pollutants from storage, handling, and disposal of construction products, materials, and wastes,
 - (vii) prevent the discharge of fuels, oils, and other petroleum products, hazardous or toxic wastes, waste concrete, and sanitary wastes;
 - (viii) addresses any other discharge from the potential pollutant-generating activities not addressed above;
 - (ix) minimizes the exposure of water materials to precipitation by closing or covering waste containers during precipitation events and at the end of the business day or implementing other similarly effective practices; and
- (6) a description of the procedures for providing pollution prevention awareness of all applicable wastes to personnel in order to comply with the conditions of this general permit.

e. Measures to address stormwater discharges to impaired waters, surface waters with a TMDL approved prior to the term of this general permit, and exceptional waters

Operators must develop, implement, and maintain a SWPPP that minimizes the pollutants of concern (i.e., sediment or a sediment-related parameter or nutrients) when discharging to surface waters identified as impaired on the 2022 305(b)/303(d) Water Quality Assessment Integrated Report for Benthic Macroinvertebrates Bioassessments or with an applicable TMDL wasteload allocation established and approved prior to the term of this general permit, including all surface waters within the Chesapeake Bay Watershed. Operators must also:

- (1) identify the impaired water(s), approved TMDL(s), and pollutant(s) of concern, in the SWPPP and
- (2) provide documentation in the SWPPP that:
 - (i) permanent or temporary soil stabilization shall be applied to denuded areas within 7 days after final grade is reached on any portion of the construction site,
 - (ii) nutrients shall be applied in accordance with manufacturer's recommendations or an approved nutrient management plan and shall not be applied during rainfall events, and
 - (iii) perform site inspections at a frequency of at least once every 4 business days or, at least once every 5 business days and no later than 24 hours following a measurable storm event. In addition, operators shall inspect all outfalls discharging to impaired waters when employing representative inspections for utility line installations, pipeline construction, or other similar linear construction activities.

When construction activities discharge to surface waters identified as PCB impaired on the 2022 305(b)/303(d) Water Quality Assessment Integrated Report or with an applicable TMDL wasteload allocation established approved prior to the term of this general permit and the activities include the demolition of a building 10,000 square feet or greater of floor space built or renovated prior to January 1, 1980, operators must develop, implement, and maintain a SWPPP that minimizes the exposure of building materials containing PCBs to precipitation and stormwater. Operators must also perform the following:

- (i) identify the impaired water(s), approved TMDL(s), and pollutant(s) of concern; in the SWPPP;
- (ii) implement the approved erosion and sediment control plan;
- (iii) ensure disposal of waste materials in compliance with applicable state, federal, and local requirements; and
- (iv) perform site inspections at a frequency of at least once every four business days or, at least once every five business days and no later than 24 hours following a measurable storm event.

It is anticipated that the implementation and maintenance of traditional erosion and sediment controls in accordance with an approved Erosion and Sediment Control Plan, an "*agreement in lieu of a plan*", or an Erosion and Sediment Control Plan prepared in accordance with department-approved standards and specifications will minimize (i.e., reduce or eliminate) the discharge of (i) sediment or a sediment related parameter or (ii) nutrients from construction activities. The implementation and maintenance of traditional erosion and sediment controls is also expected to minimize the discharge of pollutants typically bound to sediment particles such as heavy metals or polychlorinated biphenyl (PCB). Also, more frequent inspection requirements will enhance an operator's ability to find and correct problems before a discharge of pollutants to impaired waters occurs. In addition, reducing the amount of time that exposed soil is left in an un-stabilized state is important for limiting the sediment or nutrient load to waters already degraded for pollutants associated with construction activities. The faster stabilization requirement for construction activities discharging to sediment or nutrient impaired waters is anticipated to minimize the erosion losses and downstream sedimentation issues that are associated with large, exposed areas. In the absence of information demonstrating otherwise, it is anticipated that compliance with the conditions of this general permit will result in stormwater discharges being controlled as necessary such that an operator's stormwater discharges will not cause or contribute to a water quality impairment and are consistent with the assumptions and requirements of all applicable TMDLs approved prior to the term of this general permit.

The Chesapeake Bay TMDL established and approved by EPA in December 2010 was developed to address water quality impairments associated with excess sediment and nutrient loadings. Since discharges of stormwater from construction activities are an identified source of sediment and nutrients, all construction activities occurring within the Bay watershed must implement the provisions of Part II B 5 of the general permit as discussed above.

For stormwater discharges to exceptional waters identified in the Virginia Water Quality Standards, operators must:

- (1) identify the exceptional water(s) in the SWPPP and
- (2) provide documentation in the SWWP that:
 - (i) permanent or temporary soil stabilization shall be applied to denuded areas within 7 days after final grade is reached on any portion of the site;
 - (ii) nutrients shall be applied in accordance with manufacturer's recommendations or an approved nutrient management plan and not during rainfall events, and
 - (iii) perform site inspections at a frequency of at least once every four days or, at least once every seven days and no later than 24 hours following a measurable storm event.

In addition, operators must inspect all outfalls discharging to exceptional waters when employing representative inspections for utility line installations, pipeline construction, or other similar linear construction activities. These general permit requirements serve to implement the Commonwealth's antidegradation policy for exceptional (i.e., Tier 3) waters.

f. Construction dewatering discharges to sediment impaired waters or exceptional waters

Dewatering discharges from construction site dewatering activities may contain pollutants that exceed applicable water quality standards and contribute to downstream erosion, if not managed by appropriate controls. The turbidity levels in construction dewatering effluent can vary greatly depending upon many site-specific conditions, such as soil condition, type and extent of construction activity, implementation of controls, and location of the activity in relation to receiving waters.

As previously mentioned, the U.S. EPA CGP, effective on February 17, 2022, included new requirements for dewatering discharge. DEQ has proposed three options for monitoring construction dewatering discharge, in order to provide flexibility, but still remain equally as protective of water quality as the EPA CGP. The benchmark threshold for turbidity is not an effluent limit. As such, an exceedance of the benchmark threshold does not itself constitute a permit violation. Rather, the benchmark threshold acts as a warning sign to the operator that changes may be needed in the dewatering controls to improve pollutant removal and protect water quality. The permit language requires the operator to test a minimum of one time or two times if a benchmark is exceeded. An ongoing exceedance of a benchmark would not constitute a permit violation, provided the operator verified their controls were in place, ensured controls were being maintained, and documented corrective actions. Failure to verify controls or perform routine maintenance would constitute a permit violation. In addition, if dewatering activities do not reach surface water (e.g., are allowed to infiltrate through a vegetated area) then no turbidity monitoring is required due to there not being a discharge.

Dewatering discharges of uncontaminated stormwater or groundwater from footers or foundations of a single-family detached residential structure is exempt from the requirements of this section, provided that such discharges are not directly discharged to surface waters.

For construction dewatering discharges to surface waters (i) identified as impaired in the 2022 § 305(b)/303(d) Water Quality Assessment Integrated Report for Benthic Macroinvertebrates Bioassessments; (ii) with an applicable TMDL wasteload allocation established and approved prior to the term of this general permit for sediment or a sediment-related parameter (i.e., total suspended solids or turbidity) including all surface waters within the Chesapeake Bay Water; or (iii) identified in 9VAC25-260-30 A 3 c as an exceptional water, the operator shall undertake one of the following methods for controlling and documenting construction dewatering discharges:

A. Turbidity benchmark – Option 1

- (1) identify the location of all construction dewatering discharges in the SWPPP;
- (2) select, install, implement, and maintain control measures at each dewatering location that minimize pollutants, including suspended solids, in construction dewatering discharges prior to discharging into a stormwater conveyance system or surface water; and
- (3) provide documentation in the SWPPP that:
 - (i) one upstream grab sample collected from the receiving stream and at least one grab sample shall be collected from each construction dewatering discharge when the first discharge at that

- location occurs, daily thereafter, and after any installation of new controls or routine maintenance activity of existing control;
- (ii) upstream grab samples of the receiving stream shall be collected within 15 minutes of the corresponding construction dewatering discharge sample and grab samples of the construction dewatering discharge shall be collected during the first 15 minutes of the construction dewatering discharge and daily thereafter;
 - (iii) grab samples shall be collected after the construction dewatering water has been filtered, settled, or similarly treated and prior to its discharge into a stormwater conveyance system or surface water;
 - (iv) grab samples taken as required by this section shall be measured using a turbidity meter that reports results in nephelometric turbidity units (NTUs) or foramzine turbidity unit (FTUs), and conduct a turbidity meter calibration verification prior to each day's use, consistent with manufacturer recommendations;
 - (v) all dewatering discharges shall be visually monitored for changes in the characterization of effluent discharge;
 - (vi) if any turbidity measurement of the construction dewatering discharge exceeds the upstream grab sample of the receiving stream by more than 50 NTUs/FTUs, or if visual monitoring indicates a change in the characterization of effluent discharge, corrective action shall be taken in accordance with Part II H 2 of the general permit; and
 - (vii) turbidity monitoring information (i.e., location, date, sample collection time, and turbidity measurement) and any necessary corrective actions taken shall be recorded in the SWPPP;
- or
- B. Turbidity benchmark – Option 2
- (1) identify the location of all construction dewatering discharges in the SWPPP;
 - (2) select, install, implement, and maintain control measures at each dewatering location that minimize pollutants, including suspended solids, in construction dewatering discharges prior to discharging into a stormwater conveyance system or surface water; and
 - (3) provide documentation in the SWPPP that:
 - (i) at least one grab sample shall be collected from each construction dewatering discharge when the first discharge at that location occurs, daily thereafter, and after any installation of new controls or routine maintenance activity of existing controls, and tested to confirm a turbidity measurement of equal to or less than 150 NTUs/FTUs from the construction dewatering discharge;
 - (ii) grab samples of the construction dewatering discharge shall be collected during the first 15 minutes of the construction dewatering discharge and daily thereafter;
 - (iii) grab samples shall be collected after the construction dewatering water has been filtered, settled, or similarly treated and prior to its discharge into a stormwater conveyance system or surface water;
 - (iv) grab samples taken as required by this section shall be measured using a turbidity meter that reports results in nephelometric turbidity units (NTUs) or foramzine turbidity unit (FTUs), and conduct a turbidity meter calibration verification prior to each day's use, consistent with manufacturer recommendations;
 - (v) all dewatering discharges shall be visually monitored for changes in the characterization of effluent discharge;
 - (vi) if any turbidity measurement of the construction dewatering discharge exceeds 150 NTUs/FTUs, or if visual monitoring indicates a change in the characterization of effluent discharge, corrective action shall be taken in accordance with Part II H 2 of the general permit; and
 - (vii) turbidity monitoring information (i.e., location, date, sample collection time, and turbidity measurement) and any necessary corrective actions taken shall be recorded in the SWPPP.
- C. Turbidity benchmark – Option 3
- (1) identify the location of all construction dewatering discharges in the SWPPP;
 - (2) select, install, implement, and maintain control measures at each dewatering location that minimize pollutants, including suspended solids, in construction dewatering discharges prior to discharging into a stormwater conveyance system or surface water; and

- (3) provide documentation in the SWPPP that:
- (i) at least one grab sample shall be collected from each construction dewatering discharge when the first discharge at that location occurs, daily thereafter, and after any installation of new controls or routine maintenance activity of existing controls, and tested to confirm a weekly average turbidity measurement of equal to or less than 50 NTUs/FTUs from the construction dewatering discharge;
 - (ii) grab samples of the construction dewatering discharge shall be collected during the first 15 minutes of the construction dewatering discharge and daily thereafter;
 - (iii) grab samples shall be collected after the construction dewatering water has been filtered, settled, or similarly treated and prior to its discharge into a stormwater conveyance system or surface water;
 - (iv) grab samples taken as required by this section shall be measured using a turbidity meter that reports results in nephelometric turbidity units (NTUs) or formazine turbidity unit (FTUs), and conduct a turbidity meter calibration verification prior to each day's use, consistent with manufacturer recommendations;
 - (v) all dewatering discharges shall be visually monitored for changes in the characterization of effluent discharge;
 - (vi) if the weekly average turbidity measurement of the construction dewatering discharge exceeds 50 NTUs/FTUs, or if visual monitoring indicates a change in the characterization of effluent discharge, corrective action shall be taken in accordance with Part II H 2 of the general permit; and
 - (vii) turbidity monitoring information (i.e., location, date, sample collection time, and turbidity measurement) and any necessary corrective actions taken shall be recorded in the SWPPP.

For Option 3, the weekly average is the sum of all turbidity samples taken during a monitoring week divided by the number of samples measures during that week. A monitoring week starts on Monday and ends on Sunday. If dewatering does not occur on one or more days, those days are not included in the calculation of the weekly average. At the beginning of each monitoring week, a new average for that week of turbidity monitoring results is required to be calculated. If the operator elects to perform more than one turbidity sample per day from the dewatering discharge, these additional results must be included in the calculation of the weekly average. In addition, a weekly average turbidity value must be calculated for each discharge point and compared to the turbidity benchmark.

Below are two examples of how to calculate the weekly average:

Day Dewatering Occurs	Monitoring result (NTU or FTU)
Tuesday	45
Wednesday	63
Thursday	40
Weekly Average	49 $((45+63+40) \div 3)$

Day Dewatering Occurs	Monitoring result (NTU or FTU)
Monday	52
Monday	45
Tuesday	48
Wednesday	34
Friday	60
Friday	72
Weekly Average	52 $((52+45+48+34+60+72) \div 6)$

If in week 2, your turbidity samples resulted in values of 45 NTU on Monday, 30 NTU on Tuesday, 25 NTU on Wednesday, and 15 NTU on Thursday, you would calculate a new average for that week, which would yield an average turbidity value of 28.75 NTU $((45+30+25+15) \div 4 = 28.75 \text{ NTU})$.

At any time prior to or during coverage under the permit, the operator may request approval from the department for an alternative benchmark threshold for their construction site. To request approval, the operator shall submit the following to the department:

- (1) The current turbidity water quality standard that applied to the receiving stream and the supporting documentation of this standard, and
- (2) Applicable information on the natural or background turbidity level to determine the specific standard for the receiving water, including available data that can be used to establish the natural turbidity levels of your receiving water. This information may include literature studies or local government data and must be representative of the natural turbidity levels of the receiving water.

3. SWPPP Amendments, Modification, and Updates

The operator shall amend the stormwater pollution prevention plan whenever there is a change in design, construction, operation or maintenance that has a significant effect on the discharge of pollutants to surface waters. The SWPPP must also be amended if, during inspections or investigations by the operator's qualified personnel, or by local, state, or federal officials, it is determined that the existing control measures are ineffective in minimizing pollutants in discharges from the construction activity. Qualified personnel must be a person knowledgeable in the principles and practices of erosion and sediment and stormwater management controls who possesses the skills to assess conditions at the construction site for the operator that could impact stormwater quality and quantity and to assess the effectiveness of any sediment and erosion control measures or stormwater management facilities selected to control the quality and quantity of stormwater discharges from the construction activity. On or after July 1, 2025, qualified personnel shall hold an unexpired certificate of competence for Project Inspector for Erosion and Sediment Control and an unexpired certificate of competence for Project Inspector for Stormwater Management, both issued by the department, a Construction General Permit Qualified Personnel Certificate issued by the department or the Virginia Department of Transportation, or an equivalent certification provided by EPA (currently titled Construction Inspection Training Course).

Amendments to the SWPPP shall include additional or modified control measures designed and implemented to correct problems identified. In addition, the SWPPP shall be amended to identify any new contractor that will implement and maintain a control measure of the stormwater pollution prevention plan. The SWPPP shall be updated as soon as possible but no later than five business days following any modifications to its implementation, unless approval by a Virginia Erosion and Sediment Control Program (VESCP) authority, VESMP authority, or the department is necessary for the implementation of an additional or modified control measure. If VESCP authority, VESMP authority, or department approval is necessary, the SWPPP shall be updated no later than five business days following approval.

Unless otherwise required above, the operator shall update the SWPPP to include the following:

- (1) a record of dates when major grading activities occur, construction activities temporarily or permanently cause on a portion of the construction site, and stabilization measures are initiated;
- (2) documentation of replaced or modified controls where periodic inspections or other information have indicated that the controls have been used inappropriately or incorrectly and were modified;
- (3) areas that have reached final stabilization and where no further SWPPP or inspection requirements apply;
- (4) all properties that are no longer under the legal control of the operator and the dates on which the operator no longer had legal control over each property;
- (5) the date of any prohibited discharge, the discharge volume released, and actions taken to minimize the impact of the release of the release;
- (6) measures taken to prevent the reoccurrence of an prohibited discharge; and
- (7) measures taken to address any inspection deficiencies.

All amendments, modifications, or updates to the SWPPP shall be signed in accordance with Part III K 2 of the general permit and shall include the required certification in accordance with Part III K 4 of the general permit.

4. Public Notification

Upon commencement of construction activities, the operator shall post a copy of the Notice of Coverage letter at a publicly accessible location near the main entrance of the construction site. For linear projects, the operator shall post a copy of the Notice of Coverage letter at a publicly accessible location near an active portion of the construction site (e.g., where a pipeline project crosses a public road). The copy of the Notice of Coverage letter shall be visible such that it can be readily viewed from a public right-of-way. In addition, the operator must maintain the posted information until termination of general permit coverage.

5. SWPPP Availability

The operator with day-to-day operational control over stormwater pollution prevention plan implementation is required to have a copy of the SWPPP available at a central location on-site for use by those identified as having responsibilities under the SWPPP. In addition, the general permit requires the operator to make the SWPPP and all updates available upon request to the department, the VESMP authority, the EPA, the VESCP authority, local government officials, or the operator of a municipal stormwater sewer system (MS4) receiving discharges from the construction activity. If an on-site location is unavailable to store the SWPPP when no personnel are present, notice of the SWPPP's location must be posted near the main entrance of the construction site.

The general permit also requires the operator to make the SWPPP available for public review in an electronic format or in hard copy. Information for public access to the SWPPP is required to be posted and maintained in accordance with the SWPPP public notification requirements, above. If the operator does not provide the SWPPP electronically, then public access to the SWPPP may be arranged upon request at a time (during normal business hours) and at a publicly accessible location convenient to the operator or his designee. Please note that information not required to be contained within the SWPPP by this general permit is not required to be released by the operator.

6. SWPPP Implementation

The operator is required to implement the stormwater pollution prevention plan and subsequent amendments, modifications, and updates from the commencement of land disturbance until termination of general permit coverage.

All control measures must be properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications. If required site inspections identify control measures that are not operating effectively or needs routine maintenance, corrective actions or routine maintenance shall be performed as soon as practicable, but no later than five business days after discovery or a longer period as established by the VESMP authority, to maintain the continued effectiveness of the control measures. If the operator must make the same repairs more than two times to the same control at the same location, even if the fix can be completed by the close of the next business day, the operator shall either (1) complete work to fix any subsequent repeat occurrences of this same problem under the corrective action procedures outlined in Part II H of the general permit, including keeping any records of the condition and how it was corrected, or (2) document in the inspection report under Part II G of the general permit why the specific reoccurrence of this same problems should still be addressed as a routine maintenance fix.

If required site inspections identify existing control measures that need to be modified or if additional or alternative control measures are necessary for any reason, implementation shall be completed prior to the next anticipated measurable storm event. If implementation prior to the next anticipated measurable storm event is impracticable, then alternative control measures shall be implemented as soon as practicable, but no later than five business days after discovery or a longer period as established by the VESMP authority.

7. SWPPP Inspections

Diligent site inspections are necessary to ensure adequate implementation of on-site erosion and sediment controls, particularly in the later stages of construction when the volume of runoff is greatest and the storage capacity of sediment basins or sediment traps have been reduced.

Inspection procedures in the stormwater pollution prevention plan must provide that specified areas on the construction site are inspected by qualified personnel identified by the operator a minimum of once every 10 business days and no later than 24 hours following a measurable storm event, or a minimum of once every five business days. Qualified personnel may be a person on the operator's staff, or a third party hired to conduct such inspections. Construction activities that discharge to impaired waters, surface waters with a TMDL approved prior to the term of this general permit, and exceptional waters shall be inspected a minimum of once every five business days and no later than 24 hours following a measurable storm event, or a minimum of once every four business days. Where areas have been temporarily stabilized or land disturbing activities will be suspended due to continuous frozen ground conditions and stormwater discharges are unlikely, the inspection frequency may be reduced to once per month. If weather conditions (such as above freezing temperatures or rain or snow events) make discharges likely, the operator shall immediately resume the regular inspection frequency.

For this general permit a "*measurable storm event*" is defined as a rainfall event producing 0.25 inches of rain or greater over 24 hours or snow melt from a snow event producing 3.25 inches or more of snow within a 24-hour period. EPA believes that storm events with rainfall totals between 0.25 and 0.5 inches or snow melt from a snow event producing 3.25 inches or more of snow have the potential to produce discharges of stormwater that could lead to discharges of pollutants to surface waters, particularly if stormwater controls are not functioning effectively. Furthermore, EPA also believes that storm events in this size range may compromise stormwater controls on the construction site. Readers are referred to EPA's final 2022 CGP Fact Sheet for additional details.

Representative inspections may be utilized for utility line installation, pipeline construction, or other similar linear construction activities provided that:

- (1) temporary or permanent soil stabilization has been installed and vehicle access may compromise the temporary or permanent soil stabilization and potentially cause additional land disturbance increasing the potential for erosion;
- (2) inspections occur on the same frequency as other construction activities;
- (3) control measures are inspected along the construction site 0.25 miles above and below each access point (i.e., where a roadway, undisturbed right-of-way, or other similar feature intersects the construction activity and access does not compromise temporary or permanent soil stabilization);
- (4) and the inspection locations are identified in the required inspection report.

Areas of the construction site that must be observed during inspections include, but are not limited to: disturbed areas, areas used for the storage of construction materials that are exposed to precipitation, structural control measures, and locations where vehicles enter or exit the construction site. Disturbed areas and areas used for the storage of construction materials that are exposed to precipitation must be inspected for evidence of, or the potential for, pollutants entering stormwater discharges from the construction site. Erosion and sediment controls and pollution prevention measures identified in the SWPPP must be observed to ensure that they are operating correctly and effectively and do not require maintenance; observations can be made during wet or dry weather conditions. Locations where vehicles enter or exit the construction site must be inspected for evidence of off-site sediment tracking.

SWPPP inspection reports must include the following information:

- (1) the date and time of the inspection and when applicable, the date and rainfall or snowfall amount of the last measurable storm event;
- (2) summarized findings of the inspection;
- (3) the locations, visual quality, and characteristics of all stormwater discharges, when occurring;
- (4) the locations, visual quality, and characteristics of all construction dewatering discharges, if applicable;
- (5) the locations of prohibited discharges;
- (6) the locations of control measures that require routine maintenance;
- (7) the locations of control measures that failed to operate as designed or proved inadequate or inappropriate for a particular location;
- (8) the locations where an erosion and sediment control plan or an agreement in lieu of a plan has not been properly implemented;

- (9) the locations where any additional control measures are needed;
- (10) a list of corrective actions required (including any changes to the SWPPP that are necessary) as a result of the inspection or to maintain permit compliance;
- (11) documentation of any corrective action required from a previous inspection that have not been implemented;
- (12) any incidents of noncompliance;
- (13) the required certification in accordance with the general permit; and
- (14) the date and signature of the qualified personnel and operator or the operator's duly authorized representative.

When the report does not identify any incidents of noncompliance, the report shall contain a certification that the construction activity is in compliance with the SWPPP and the general permit. Inspection report must be signed in accordance with Part III K of the general permit and must be retained for at least three years after the date of general permit expiration or termination of general permit coverage.

Based on the results of a site inspection, corrective action(s) must be taken as soon as practicable. The inspection and SWPPP review process must provide for the timely modification of the stormwater pollution prevention plan no later than five business days following the inspection, or a longer period as approved by the VESMP authority, unless regulatory authority approval of a corrective action is necessary.

If adverse weather causes the safety of the inspection personnel to be in jeopardy, the SWPPP inspection may be delayed until the next business day on which it is safe to perform the inspection. Any time inspections are delayed due to adverse weather conditions, evidence of the adverse weather conditions must be included in the SWPPP with the dates of occurrence.

8. Corrective Actions

The general permit requires the operator to implement any corrective action identified as a result of an inspection as soon as practicable but no later than five business days after discovery or a longer period as approved by the VESMP authority. If approval of a corrective action by a regulatory authority (e.g., VESMP authority, VESCP authority, the department) is necessary, the operator is further required to implement additional control measures to minimize pollutants in stormwater discharges until such approvals can be obtained. The operator may be required to remove accumulated sediment deposits located outside of the construction activity covered by this general permit as soon as practicable in order to minimize environmental impacts. The general permit requires that the operator notify the VSMP authority and the department as well as obtain all applicable federal, state, and local authorizations, approvals, and permits prior to the removal of sediments accumulated in surface waters including wetlands.

For construction dewatering discharges, when any construction dewatering discharge turbidity measurement exceeds the turbidity benchmark or where visual monitoring indicates a change in the characterization of effluent discharge, the operator shall:

- (1) immediately cease the construction dewatering discharge at the location that exceeds upstream grab sample or where visual monitoring indicates a change in the characterization of effluent discharge;
- (2) determine whether the construction dewatering controls are operating effectively, need routine maintenance, or if an additional or alternate control measure is necessary; and
- (3) make any necessary adjustments, additions, repairs, or replacements to the construction dewatering controls.

Once these corrective action steps are completed and any necessary adjustments, additions, repairs, or replacements are made, the operator may resume its construction dewatering discharge and shall sample for turbidity within 15 minutes of the construction dewatering discharge commencing. No additional correction action items are required beyond recording the results in the SWPPP.

Numeric Effluent Limitations and Monitoring Requirements

As previously noted, on November 5, 2010, EPA finalized a stay (75 FR 68215), effective January 4, 2011, for 40 CFR Parts 450.22 (a) and (b). EPA published amendments to the C&D Rule (79 CFR 12661) on March 6, 2014, and May 4, 2014 (80 CFR 25235) with an effective date of May 5, 2014, that lifted the

indefinite stay and withdrew the numeric effluent limitation. Therefore, the numeric effluent limitations for turbidity have not been incorporated into the general permit for stormwater discharges from construction activities. Requirements in this general permit include the development of a stormwater pollution prevention plan. Discharge sampling information does not provide a direct link to compliance with this permit condition as it does with numeric effluent limitations. Where permits require the implementation of stormwater pollution prevention measures and do not establish numeric effluent limitations, conducting inspections to identify sources of pollution and to evaluate whether the pollution prevention measures required by the permit are being effectively implemented and are in compliance with the terms of the permit will provide a better indication than discharge sampling of whether a construction activity is complying with the general permit. This will also reduce discharge sampling burdens on the operator. Also, due to the changing nature of the activity at a construction site, monitoring stormwater from this type of site would have limited usefulness. The operator is also required to maintain records summarizing the results of an inspection as well as certify that the construction activity is in compliance with the general permit. The requirement for adequate documentation of an inspection is particularly important given the lack of requirements to collect discharge monitoring data under the general permit and the importance placed on using site inspections to ensure the effective implementation of stormwater pollution prevention plans.

The areas of the construction site that must be observed during operator or qualified personnel inspections include, but are not limited to the following: disturbed areas, areas used for the storage of construction materials that are exposed to precipitation, structural control measures, and locations where vehicles enter or exit the construction site. At a minimum, these inspections shall be conducted at least once every 10 business days and no later than 24 hours following a measurable storm event. Records of these inspections are to be retained as part of the stormwater pollution prevention plan. In establishing the minimum monitoring and reporting requirements for stormwater discharges from construction activities, the Board determined that frequent and thorough inspections would allow for the identification of areas contributing to a stormwater discharge and the evaluation of whether measures to minimize pollutant loadings identified in the stormwater pollution prevention plan are adequate and properly implemented in accordance with the terms of the general permit or whether additional control measures are needed.

Because construction activities can be complex, transient operations, frequent inspections are necessary to ensure that new pollutant sources are identified, control measures are implemented for new activities at the site, and existing control measures are kept operational. Control measures to minimize pollutants in stormwater discharges must be properly maintained in order to be effective. Often, these types of controls may become altered by construction activities or by storm events such that their ability to remove pollutants is limited. Frequent inspections for construction activities are appropriate and necessary for successful program implementation.

Chesapeake Bay Total Maximum Daily Load

This general permit includes the construction and development point source category effluent limitation guidelines and new source performance standards established in 40 CFR Part 450. Readers are referred to 74 FR 62996, 75 FR 68215, 79 FR 12661, and 80 FR 25235 for additional details. In addition, this general permit requires construction activity operators to develop a SWPPP which includes an approved stormwater management plan or a stormwater management plan prepared in accordance with department-approved standards and specifications for new construction activities. As of July 1, 2014, these stormwater management plans must comply with the Commonwealth's new stormwater management technical criteria, including newly revamped water quantity and water quality requirements. These new technical criteria have been developed in order to offset future growth in Virginia resulting from the development of agricultural and forest lands into residential and commercial uses.

APPENDIX J

CONCRETE WASHOUT

Minimum Measure

Construction Site Stormwater Runoff Control

Subcategory

Good Housekeeping/Materials Management

Description of Concrete Washout at Construction Sites

Concrete and its ingredients

Concrete is a mixture of cement, water, and aggregate material. Portland cement is made by heating a mixture of limestone and clay containing oxides of calcium, aluminum, silicon and other metals in a kiln and then pulverizing the resulting clinker. The fine aggregate particles are usually sand. Coarse aggregate is generally gravel or crushed stone. When cement is mixed with water, a chemical reaction called hydration occurs, which produces glue that binds the aggregates together to make concrete.

Concrete washout

After concrete is poured at a construction site, the chutes of ready mixed concrete trucks and hoppers of concrete pump trucks must be washed out to remove the remaining concrete before it hardens. Equipment such as wheelbarrows and hand tools also need to be washed down. At the end of each work day, the drums of concrete trucks must be washed out. This is customarily done at the ready mixed batch plants, which are usually off-site facilities, however large or rural construction projects may have on-site batch plants. Cementitious (having the properties of cement) washwater and solids also come from using such construction materials as mortar, plaster, stucco, and grout.

Environmental and Human Health Impacts

Concrete washout water (or washwater) is a slurry containing toxic metals. It's also caustic and corrosive, having a pH near 12. In comparison, Drano liquid drain cleaner has a pH of 13.5. Caustic washwater can harm fish gills and eyes and interfere with reproduction. The safe pH ranges for aquatic life habitats are 6.5 – 9 for freshwater and 6.5 – 8.5 for saltwater.

Construction workers should handle wet concrete and washout water with care because it may cause skin irritation and eye damage. If the washwater is dumped on the ground (Fig. 1), it can run off the construction site to adjoining roads and enter roadside storm drains, which discharge to surface waters such as rivers, lakes, or estuaries. The red arrow in Figure 2 points to a ready mixed truck chute that's being washed out into a roll-off bin, which isn't watertight. Leaking washwater, shown in the foreground, will likely follow similar



Figure 1. Chute washwater being dumped on the ground



Figure 2. Chute washwater leaking from a roll-off bin being used as a washout container

paths to nearby surface waters. Rainfall may cause concrete washout containers that are uncovered to overflow and also transport the washwater to surface waters. Rainwater polluted with concrete washwater can percolate down through the soil and alter the soil chemistry, inhibit plant growth, and contaminate the groundwater. Its high pH can increase the toxicity of other substances in the surface waters and soils. Figures 1 and 2 illustrate the need for better washout management practices.

Best Management Practice Objectives

The best management practice objectives for concrete washout are to (a) collect and retain all the concrete washout water and solids in leak proof containers, so that this caustic material does not reach the soil surface and then migrate to surface waters or into the ground water, and (b) recycle 100 percent of the collected concrete washout water and solids. Another

objective is to support the diversion of recyclable materials from landfills. Table 1 shows how concrete washout materials can be recycled and reused.

Table 1 – Recycling concrete washout materials

Uses of Recycled Materials	Concrete Washout Materials					
	Washwater	Cement fines ^a	Fine aggregate	Coarse aggregate	Hardened concrete	Unused wet concrete
Reused to washout additional mixer truck chutes or drums	x					
Reused as a ready mixed concrete ingredient	x	x ^b	x	x		
Reused as an ingredient of precast concrete products, e.g., highway barriers, retaining wall blocks, riprap	x	x	x	x		x
Reused as crushed concrete products, e.g., road base or fill		x	x	x	x	
Reused to pave the yards of ready mixed concrete plants						x
Returned back to a surface water, e.g., river, lake, or estuary	x ^c					

a. Fine particles of cementitious material (e.g., Portland cement, slag cement, fly ash, silica fume)

b. Recyclable, if allowed by the concrete quality specifications

c. Treated to reduce the pH and remove metals, so it can be delivered to a municipal wastewater treatment plant, where it is treated further and then returned to a natural surface water

Washwater recycling, treatment, disposal

Washwater from concrete truck chutes, hand mixers, or other equipment can be passed through a system of weirs or filters to remove solids and then be reused to wash down more chutes and equipment at the construction site or as an ingredient for making additional concrete. A three chamber washout filter is shown in Figure 3. The first stage collects the coarse aggregate. The middle stage filters out the small grit and sand. The third stage has an array of tablets that filter out fines and reduces the pH. The filtered washwater is then discharged through a filter sock. An alternative is to pump the washout water out of the washout container (Fig 4) and treat the washwater off site to remove metals and reduce its pH, so it can be delivered to a publicly owned treatment works (POTW), also known as a municipal wastewater treatment plant, which provides additional treatment allowing the washwater to be discharged to a surface water. The POTW should be



Figure 3. Concrete washout filter

contacted to inquire about any pretreatment requirements, i.e., the National Pretreatment Standards for Prohibited Dischargers (40CFR 403.5) before discharging the washwater to the POTW. The washwater can also be retained in the washout container and allowed to evaporate, leaving only the hardened cementitious solids to be recycled.

Solids recycling

The coarse aggregate materials that are washed off concrete truck chutes into a washout container can be either separated by a screen and placed in aggregate bins to be reused at the construction site or returned to the ready mixed plant and washed into a reclaimer (Fig. 5). When washed out into a reclaimer, the fine and coarse aggregates are separated out and placed in different piles or bins to be reused in making fresh concrete. Reclaimers with settling tanks separate cement fines from the washwater, and these fines can also be used in new concrete unless prohibited by the user's concrete quality specifications.



Figure 4. Vacuuming washwater out of a washout container for treatment and reuse



Figure 5. Ready mixed truck washing out into a reclaimer

Hardened concrete recycling

When the washwater in a construction site concrete washout container has been removed or allowed to evaporate, the hardened concrete that remains can be crushed (Fig. 6) and reused as a construction material. It makes an excellent aggregate for road base and can be used as fill at the



Figure 6. Crushed concrete stockpile and crusher

construction site or delivered to a recycler. Concrete recyclers can be found at municipal solid waste disposal facilities, private recycling plants, or large construction sites.

Wet concrete recycling

Builders often order a little more ready mixed concrete than they actually need, so it is common for concrete trucks to have wet concrete remaining in their drum after a delivery. This unused concrete can be returned to the ready mixed plant and either (1) used to pour precast concrete products (e.g., highway barriers, retaining wall blocks, riprap), (2) used to pave the ready mixed plant's yard, (3) washed into a reclaimer, or (4) dumped on an impervious surface and allowed to harden, so it can be crushed and recycled as aggregate. Unused wet concrete should not be dumped on bare ground to harden at construction sites because this can contribute to ground water and surface water contamination.

Washout Containers

Different types of washout containers are available for collecting, retaining, and recycling the washwater and solids from washing down mixed truck chutes and pump truck hoppers at construction sites.

Chute washout box

A chute washout box is mounted on the back of the ready mixed truck. If the truck has three chutes, the following procedure is used to perform the washout from the top down: (1) after the pour is completed, the driver attaches the extension chute to the washout box, (2) the driver then rotates the main chute over the extension chute (Fig. 7) and washes down the hopper first then the main chute, (3) finally the driver washes down the flop down chute and last the extension chute hanging on the box. All washwater and solids are captured in the box.



Figure 7. Chute washout box

Chute washout bucket and pump

After delivering ready mixed concrete and scraping the last of the customer's concrete down the chute, the driver hangs a washout bucket shown in Figure 8 (see red arrow) on the end of the truck's chute and secures the hose to insure no leaks. The

driver then washes down the chute into the bucket to remove any cementitious material before it hardens. After washing out the chute, the driver pumps (yellow arrow points to the pump) the washwater, sand, and other fine solids from the bucket up into the truck's drum to be returned to the ready mixed plant, where it can be washed into a reclaimer. A removable screen at the bottom of the washout bucket prevents course aggregate from entering the pump. This course aggregate can also be returned to the plant and added to the coarse aggregate pile to be reused. All the materials are recycled.



Figure 8. Chute washout bucket and pump

Hay bale and plastic washout pit

A washout pit made with hay bales and a plastic lining is shown in Figure 9. Such pits can be dug into the ground or built above grade. The plastic lining should be free of tears or holes that would allow the washwater to escape (Fig. 10). After the pit is used to wash down the chutes of multiple ready mixed trucks and the washwater has evaporated or has been vacuumed off, the remaining hardened solids can be broken up and removed from the pit. This process may damage the hay bales and plastic lining. If damage occurs, the pit will need to be repaired and relined with new plastic. When the hardened solids are removed, they may be bound up with the plastic lining and have to be sent to a landfill, rather than recycled. Recyclers usually accept only unmixed material. If the pit is going to be emptied and repaired more than a few times, the hay bales and plastic will be generating additional solid waste. Ready mixed concrete



Figure 9. Hay bale and plastic washout pit



Figure 10. Leaking washout pit that has not been well maintained

Stormwater Best Management Practice: Concrete Washout

trucks can use hay bale washout pits, but concrete pump trucks have a low hanging hopper in the back that may prevent their being washed out into bale-lined pits.

Vinyl washout container



Figure 11. Vinyl washout pit with filter bag

The vinyl washout container (Fig. 11) is portable, reusable, and easier to install than a hay bale washout pit. The biodegradable filter bag (Fig. 12) assists in

extracting the concrete solids and prolongs the life of the vinyl container. When the bag is lifted, the water is filtered out and the remaining concrete solids and the bag can be disposed of together in a landfill, or the hardened concrete can be delivered to a recycler. After the solids have been removed several times and the container is full of washwater, the washwater can be allowed to evaporate, so the container can be reused. The washwater can be removed more quickly by placing another filter bag in the container and spreading water gelling granules evenly across the water. In about five minutes, the water in the filter bag will turn into a gel that can be removed with the bag. Then the gel and filter bag can be disposed of together.



Figure 12. Extracting the concrete solids or gelled washwater

Metal washout container

The metal roll-off bin (Fig. 13) is designed to securely contain concrete washwater and solids and is portable and reusable. It also has a ramp that allows concrete pump trucks to wash out their hoppers (Fig. 14). Roll-off providers offer recycling services, such as, picking up the roll-off bins after the washwater has evaporated and the solids have hardened, replacing them with empty washout bins, and delivering the hardened concrete to a recycler (Fig. 15), rather than a landfill. Some providers will vacuum off the washwater, treat it to remove metals and reduce the pH, deliver it to a wastewater treatment plant for additional treatment and



Figure 13. Mixer truck being washed out into a roll-off bin

subsequent discharge to a surface water. Everything is recycled or treated sufficiently to be returned to a natural surface water.



Figure 14. Pump truck using the ramp to wash out into a roll-off bin



Figure 15. Delivering hardened concrete to a recycler

Another metal, portable, washout container, which has a rain cover to prevent overflowing, is shown in Figure 16. It is accompanied by an onsite washwater treatment unit, which reduces the pH and uses a forced weir tank system to remove the coarse aggregate, fine aggregate, and cement fines. The washwater can then be reused at the construction site to wash out other mixer truck chutes and equipment. The solids are allowed to harden together and can be taken to a concrete recycler (Fig. 17) to be crushed and used as road base or aggregate for making precast products, such as retaining wall blocks. All materials are recycled.



Figure 16. Washout container with a rain cover and onsite washwater treatment



Figure 17. Delivering hardened concrete to a recycler

Siting Washout Facilities

Concrete washout facilities, such as washout pits and vinyl or metal washout containers, should be placed in locations that provide convenient access to concrete trucks, preferably near the area where concrete is being poured. However they

should not be placed within 50 feet of storm drains, open ditches, or waterbodies. Appropriate gravel or rock should cover approaches to concrete washout facilities when they are located on undeveloped property. On large sites with extensive concrete work, washouts should be placed at multiple locations for ease of use by ready mixed truck drivers. If the washout facility is not within view from the pour location, signage will be needed to direct the truck drivers.

Operating and Inspecting Washout Facilities

Concrete washout facilities should be inspected daily and after heavy rains to check for leaks, identify any plastic linings and sidewalls have been damaged by construction activities, and determine whether they have been filled to over 75 percent capacity. When the washout container is filled to over 75 percent of its capacity, the washwater should be vacuumed off or allowed to evaporate to avoid overflows. Then when the remaining cementitious solids have hardened, they should be removed and recycled. Damages to the container should be repaired promptly. Before heavy rains, the washout container's liquid level should be lowered or the container should be covered to avoid an overflow during the rain storm.

Educating Concrete Subcontractors

The construction site superintendent should make ready mixed truck drivers aware of washout facility locations and be watchful for improper dumping of cementitious material. In addition, concrete washout requirements should be included in contracts with concrete delivery companies.

Reference

NRMCA 2009. Environmental Management in the Ready Mixed Concrete Industry. 2PEMRM, 1st edition. By Gary M. Mullins. Silver Springs, MD: National Ready Mixed Concrete Association.

Websites and Videos

Construction Materials Recycling Association
www.concreterecycling.org

National Ready Mixed Concrete Association
www.nrmca.org

National Ready Mixed Concrete Research and Education Foundation
www.rmc-foundation.org

Additional information and videos on concrete washout containers and systems can be found by a web search for "concrete washout."

Photograph Credits

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APPENDIX K

SITE & SWM PLAN

(TO BE INSERTED WHEN APPROVED)

APPENDIX L
ESC & SWM NARRATIVE
(TO BE INSERTED WHEN APPROVED)