STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER

PROJECT MANUAL

City Project Number A00124

City of Staunton, Virginia

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COMMONWEALTH OF VIRGINIA
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1/15/24
PROFESSIONAL ENGINEER

January 2024
Engineer's Project Number 49408

STAUNTON CROSSING
UTILITY IMPROVEMENTS – SEWER
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JANUARY 2024

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ADVERTISEMENT FOR BIDS

City of Staunton
Staunton, Virginia
Staunton Crossing Utility Improvements – Sewer

General Notice

The **City of Staunton** (Owner) is requesting Bids for the construction of the following Project:

Staunton Crossing Utility Improvements – Sewer
Engineer's Project Number: 49408

City Project Number: A00124

Bids for the construction of the Project will be received at the **Staunton City Hall, Finance Department** located at **116 West Beverley Street, 3rd Floor, Staunton, VA 24401**, until **February 20**, **2024** at **2:00 pm** local time. At that time the Bids received will be **publicly** opened and read.

The Project includes the following Work:

> **The onsite construction of approximately 1,500 linear feet of 15" sanitary sewer, a triplex suction-lift wastewater pump station in a precast concrete building, and 5,600 linear feet of 12" sewer force main. The downstream construction of approximately 4,900 linear feet of 18" and smaller gravity sewer and approximately 580 linear feet of 12" sewer force main. This project also includes all necessary structures and appurtenances to serve the Staunton Crossing development in City of Staunton, Virginia.**

Bids are requested for the following Contract: **Staunton Crossing Utility Improvements – Sewer**

Obtaining the Bidding Documents

Issuing Office: City of Staunton, Finance Department

Information and Bidding Documents for the Project can be found at the following designated website:

Bid documents are available for viewing on the internet on the City of Staunton Website, https://www.ci.staunton.va.us/departments/finance/procurement, and the eVA website at www.eva.virginia.gov. A plan holders list will not be maintained.

Bidding Documents may be downloaded from the designated websites. A list of plan holders will not be maintained. The designated website will be updated periodically with addenda, reports, and other information relevant to submitting a Bid for the Project. All official notifications, addenda, and other Bidding Documents will be offered only through the designated websites. Neither Owner nor Engineer will be responsible for Bidding Documents, including addenda, if any, obtained from sources other than the designated website.

Pre-bid Conference

A mandatory pre-bid conference for the Project will be held on **February 1, 2024** at **10:00 a.m.** at **Staunton City Hall – Caucus Room,** located at **116 West Beverley Street, Staunton, VA 24401.** Bids will not be accepted from Bidders that do not attend the mandatory pre-bid conference.

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Instructions to Bidders

For all further requirements regarding bid submittal, qualifications, procedures, and contract award, refer to the Instructions to Bidders that are included in the Bidding Documents.

This Advertisement is issued by:

Owner: **City of Staunton**
By: **Chad Horvat**
Title: **Finance Business Manager**
Date: **January 16, 2024**

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INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

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ARTICLE 1—DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Issuing Office*—The office from which the Bidding Documents are to be issued.

ARTICLE 2—BIDDING DOCUMENTS

2.01 Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). See the Agreement for a list of the Contract Documents. It is Bidder's responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.

2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.

2.03 Owner has established a Bidding Documents Website as indicated in the Advertisement or invitation to bid. Bidder shall obtain a complete set of the Bidding Documents from such website. Bidders may rely that sets of Bidding Documents obtained from the Bidding Documents Website are complete, unless an omission is blatant. Plan rooms (including construction information subscription services, and electronic and virtual plan rooms) may distribute the Bidding Documents, or make them available for examination. Owner is not responsible for omissions in Bidding Documents or other documents obtained from plan rooms, or for a Bidder's failure to obtain Addenda from a plan room.

2.04 *Electronic Documents*

A. When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to the Bidders as Electronic Documents in the manner specified.

1. Bidding Documents will be provided in Adobe PDF (Portable Document Format). It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the Owner and Engineer cannot and do not guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.

B. Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.04.A above. However, Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of Bidding Documents

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and reproductions prepared from those versions and, further, assumes all risks, costs, and responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in printed paper versions of the documents, and for Bidder's reliance upon such derived information.

ARTICLE 3—QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, after submitting its Bid and within **10** days of Owner's request, Bidder must submit the following information:

A. Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.

B. A written statement that Bidder is authorized to do business in the state where the Project is located, or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.

C. Bidder's state or other contractor license number, if applicable.

D. Subcontractor and Supplier qualification information.

E. Other required information regarding qualifications.

3.02 Bidder is to submit the following information with its Bid to demonstrate Bidder's qualifications to perform the Work:

A. A completed C-451 Qualifications Statement.

3.03 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

3.04 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

ARTICLE 4—PRE-BID CONFERENCE

4.01 A mandatory pre-bid conference will be held at the time and location indicated in the Advertisement or invitation to bid. Representatives of Owner and Engineer will be present to discuss the Project. Proposals will not be accepted from Bidders who do not attend the conference. It is each Bidder's responsibility to sign in at the pre-bid conference to verify its participation. Bidders must sign in using the name of the organization that will be submitting a Bid. A list of qualified Bidders that attended the pre-bid conference and are eligible to submit a Bid for this Project will be issued in an Addendum.

4.02 Information presented at the pre-Bid conference does not alter the Contract Documents. Owner will issue Addenda to make any changes to the Contract Documents that result from discussions

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at the pre-Bid conference. Information presented, and statements made at the pre-bid conference will not be binding or legally effective unless incorporated in an Addendum.

ARTICLE 5—SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

5.01 *Site and Other Areas*

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

5.02 *Existing Site Conditions*

A. *Subsurface and Physical Conditions; Hazardous Environmental Conditions*

1. The Supplementary Conditions identify the following regarding existing conditions at or adjacent to the Site:

a. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.

b. Those drawings known to Owner of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.

c. Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

d. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05 of the General Conditions, and not in the drawings referred to in Paragraph 5.02.A of these Instructions to Bidders. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

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5.03 *Other Site-related Documents*

A. In addition to the documents regarding existing Site conditions referred to in Paragraph 5.02.A, the following other documents relating to conditions at or adjacent to the Site are known to Owner and made available to Bidders for reference:

1. **Western State Hospital New Site, Dated July 18, 1973.**

Owner will make copies of these other Site-related documents available to any Bidder on request.

B. Owner has not verified the contents of these other Site-related documents, and Bidder may not rely on the accuracy of any data or information in such documents. Bidder is responsible for any interpretation or conclusion Bidder draws from the other Site-related documents.

C. The other Site-related documents are not part of the Contract Documents.

D. Bidders are encouraged to review the other Site-related documents, but Bidders will not be held accountable for any data or information in such documents. The requirement to review and take responsibility for documentary Site information is limited to information in (1) the Contract Documents and (2) the Technical Data.

E. No other Site-related documents are available.

5.04 *Site Visit and Testing by Bidders*

A. Bidder is required to visit the Site and conduct a thorough visual examination of the Site and adjacent areas. During the visit the Bidder must not disturb any ongoing operations at the Site.

B. All access to the Site other than during a regularly scheduled Site visit must be coordinated through the following Owner contact for visiting the Site: **Lyle Hart, City Engineer, (540) 332-3804**. Bidder must conduct the required Site visit during normal working hours.

C. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

D. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder general access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site. Bidder is responsible for establishing access needed to reach specific selected test sites.

E. Bidder must comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

F. Bidder must fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

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5.05 *Owner's Safety Program*

A. Site visits and work at the Site may be governed by an Owner safety program. If an Owner safety program exists, it will be noted in the Supplementary Conditions.

5.06 *Other Work at the Site*

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Express Representations and Certifications in Bid Form, Agreement*

A. The Bid Form that each Bidder will submit contains express representations regarding the Bidder's examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications, and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.

B. If Bidder is awarded the Contract, Bidder (as Contractor) will make similar express representations and certifications when it executes the Agreement.

ARTICLE 7—INTERPRETATIONS AND ADDENDA

7.01 Owner on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.

7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing. Contact information and submittal procedures for such questions are as follows:

A. **Email to Bruce W. Strickland, Jr., P.E., Timmons Group Senior Project Manager at bruce.strickland@timmons.com by February 6, 2024 at 1:00 pm.**

7.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than fourteen days prior to the date for opening of Bids may not be answered.

7.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 8—BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of **5** percent (5%) of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in

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the form of a Bid bond issued by a surety meeting the requirements of Paragraph 6.01 of the General Conditions. Such Bid bond will be issued in the form included in the Bidding Documents.

8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract and furnish the required Contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Owner's damages in the case of a damages-form bond. Such forfeiture will be Owner's exclusive remedy if Bidder defaults.

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

ARTICLE 9—CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be (a) substantially completed and (b) ready for final payment, and (c) Milestones (if any) are to be achieved, are set forth in the Agreement.

9.02 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 10—SUBSTITUTE AND "OR EQUAL" ITEMS

10.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or-equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.

10.02 All prices that Bidder sets forth in its Bid will be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as

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supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 11—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

11.01 The apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors or Suppliers proposed within five days after Bid opening.

11.02 If requested by Owner, such list must be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor or Supplier. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor or Supplier, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder will submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

11.03 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors and Suppliers. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor or Supplier, so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.07 of the General Conditions.

ARTICLE 12—PREPARATION OF BID

12.01 The Bid Form is included with the Bidding Documents.

A. All blanks on the Bid Form must be completed in ink and the Bid Form signed in ink. Erasures or alterations must be initialed in ink by the person signing the Bid Form. A Bid price must be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.

B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words "No Bid" or "Not Applicable."

12.02 If Bidder has obtained the Bidding Documents as Electronic Documents, then Bidder shall prepare its Bid on a paper copy of the Bid Form printed from the Electronic Documents version of the Bidding Documents. The printed copy of the Bid Form must be clearly legible, printed on 8½ inch by 11-inch paper and as closely identical in appearance to the Electronic Document version of the Bid Form as may be practical. The Owner reserves the right to accept Bid Forms which nominally vary in appearance from the original paper version of the Bid Form, providing that all required information and submittals are included with the Bid.

12.03 A Bid by a corporation must be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation must be shown.

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12.04 A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.

12.05 A Bid by a limited liability company must be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.

12.06 A Bid by an individual must show the Bidder's name and official address.

12.07 A Bid by a joint venture must be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.

12.08 All names must be printed in ink below the signatures.

12.09 The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.

12.10 Postal and e-mail addresses and telephone number for communications regarding the Bid must be shown.

12.11 The Bid must contain evidence of Bidder's authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.

12.12 If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder's licensure, or Bidder must certify in writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder's state contractor license number, if any, must also be shown on the Bid Form.

ARTICLE 13—BASIS OF BID

13.01 *Unit Price*

A. Bidders must submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.

B. The "Bid Price" (sometimes referred to as the extended price) for each unit price Bid item will be the product of the "Estimated Quantity", which Owner or its representative has set forth in the Bid Form, for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

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ARTICLE 14—SUBMITTAL OF BID

14.01 A Bid must be received no later than the date and time prescribed and at the place indicated in the Advertisement or invitation to bid and must be enclosed in a plainly marked package with the Project title, and, if applicable, the designated portion of the Project for which the Bid is submitted, the name and address of Bidder, and must be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid must be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid must be addressed to the location designated in the Advertisement.

14.02 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

15.01 Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered to the place where Bids are to be submitted at any time prior to the date and time for the opening of Bids.

15.02 *No bidder shall withdraw, modify, or cancel any part of a bid for the number of days stated on the bid form following this date and time except as provided by Code of Virginia Section 2.2-3440(a) Procedure (1).*

15.03 *Withdrawal of Bids After Date for Submission: In accordance with Section 2.2-4330(a) Procedure (1) the bidder shall give notice in writing of their claim of right to withdraw their bid within 2 business days after the conclusion of the bid opening procedure and shall submit original work*

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papers with such notice. Failure to submit contractor's work papers will be considered as a waiver of any right of withdrawal of bids after the date for submission.

ARTICLE 16—OPENING OF BIDS

16.01 Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 17—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

17.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 18—EVALUATION OF BIDS AND AWARD OF CONTRACT

18.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.

18.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.

18.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.

18.04 If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest responsive Bid.

18.05 *Evaluation of Bids*

A. In evaluating Bids, Owner will consider whether the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

18.06 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

18.07 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 19—BONDS AND INSURANCE

19.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds, other required bonds (if any),

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and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by required bonds and insurance documentation.

19.02 Article 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

ARTICLE 20—SIGNING OF AGREEMENT

20.01 When Owner issues a Notice of Award to the Successful Bidder, it will be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder must execute and deliver the required number of counterparts of the Agreement and any bonds and insurance documentation required to be delivered by the Contract Documents to Owner. Within 10 days thereafter, Owner will deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

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BID FORM FOR CONSTRUCTION CONTRACT

The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 1—OWNER AND BIDDER

1.01 This Bid is submitted to: **City of Staunton, 116 W. Beverley St., Staunton, VA 24401**

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2—ATTACHMENTS TO THIS BID

2.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid security;

B. List of Proposed Subcontractors;

C. List of Proposed Suppliers;

D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;

E. Contractor's license number as evidence of Bidder's State Contractor's License or a covenant by Bidder to obtain said license within the time for acceptance of Bids;

F. Required Bidder Qualification Statement with supporting data;

G. Non-Collusion Affidavit; and

H. State Corporation Commission Form.

ARTICLE 3—BASIS OF BID—UNIT PRICES

3.01 *Unit Price Bids*

A. Bidder will perform the following Onsite Work at the indicated unit prices, as shown on the plans bearing the general title, **Staunton Crossing Utility Improvements - Sewer**:

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
A1	Mobilization	LS	1		
A2	Clearing and Grubbing	LS	1		
A3	Street Repair/Patch	SY	1,050		
A4	Restore Gravel Access Road	SY	1,100		
A5	New 15" PVC SDR-35 Gravity Sewer	LF	1,480		
A6	New 48" Precast Concrete Manhole	VF	67		

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A7	Standard Manhole Frame and Cover	EA	8		
A8	Wastewater Pump Station	LS	1		
A9	New 12" Ductile Iron Class 350 Force Main	LF	4,609		
A10	New 12" Ductile Iron Class 350 Force Main (with Zinc Coating and Polywrap)	LF	958		
A11	New 12" Plug Valve	EA	4		
A12	2" Combination Air/Vacuum Release Valve Assembly	EA	3		
A13	Existing Line Abandonment	LS	1		
A14	Erosion and Sediment Control	LS	1		
A15	Replacement of Concrete Curb and Gutter	LF	110		
A16	Post CCTV of New Gravity Sewer	LF	1,480		
Subtotal of All Onsite Unit Price Bid Items					

B. Bidder will perform the following Downstream Work at the indicated unit prices as shown on the plans bearing the general title, **Staunton Crossing Downstream Sewer Upgrades**:

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
B1	Mobilization	LS	1		
B2	Clearing and Grubbing	LS	1		
B3	Bypass Pumping	LS	1		
B4	Replace Existing Gravity Sewer with 18" Ductile Iron (with Polywrap)	LF	280		
B5	Replace Existing Gravity Sewer with 16" Ductile Iron (with Polywrap)	LF	503		
B6	New 12" Ductile Iron Class 350 Force Main	LF	379		
B7	New 12" Ductile Iron Class 350 Force Main (with Zinc Coating and Polywrap)	LF	200		
B8	Replace Existing Gravity Sewer with 15" PVC	LF	3,257		
B9	Furnish and Install New 15" PVC Gravity Sewer	LF	825		
B10	Replace Existing Gravity Sewer with 8" PVC	LF	20		
B11	Replace Existing Gravity Sewer with 4" PVC	LF	35		
B12	Service Reconnections	EA	7		

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B13	Concrete Encasement	LF	95		
B14	Plug and Abandon Existing Gravity Sewer with Flowable Fill	LF	1,200		
B15	Replace Concrete Manhole, 60" I.D.	VF	30		
B16	Replace Concrete Manhole, 48" I.D.	VF	97		
B17	Furnish and Install New 48" Precast Concrete Manhole	VF	25		
B18	Standard Manhole Frame and Cover	EA	12		
B19	Watertight Manhole Frame and Cover	EA	8		
B20	Manhole Liners, 60" I.D.	VF	24		
B21	Manhole Liners, 48" I.D.	VF	47		
B22	Manhole Removal and Disposal	EA	1		
B23	Connect to Existing Manhole	EA	1		
B24	Precast Junction Box, 60'' Square (includes fittings for reconnection to existing 4" Forcemain)	EA	1		
B25	Combination Air/Vacuum Release Valve Assembly	EA	2		
B26	Manhole Vents	EA	3		
B27	Connect new force main to existing force main	EA	1		
B28	Replacement of Concrete Curb & Gutter	LF	42		
B29	Street Repair/Patch	SY	34		
B30	Seeding	LS	1		
B31	Erosion and Sediment Control	LS	1		
B32	Traffic Control	LS	1		
B33	Post CCTV of New Sewer Main	LF	4,865		
Subtotal of All Downstream Unit Price Bid Items					

C. Bidder acknowledges that:

1. each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and

2. estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.

3.02 *Total Bid Price*

Total Bid Price (Total of all Lump Sum and Unit Price Bids)	$

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ARTICLE 4—TIME OF COMPLETION

4.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

4.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 5—BIDDER'S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

5.01 *Bid Acceptance Period*

A. This Bid will remain subject to acceptance for **60** days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

5.02 *Instructions to Bidders*

A. Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

5.03 *Receipt of Addenda*

A. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Bidder's Representations*

A. In submitting this Bid, Bidder represents the following:

1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.
2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work**.**
4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.

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5. Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder's (Contractor's) safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

9. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

6.02 *Bidder's Certifications*

A. The Bidder certifies the following:

1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.

2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.

3. Bidder has not solicited or induced any individual or entity to refrain from bidding.

4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 8.02.A:

a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.

b. Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at

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artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.

c. Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.

d. Coercive practice means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

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BIDDER hereby submits this Bid as set forth above:

Bidder:

_____

(typed or printed name of organization)

By: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

Address for giving notices:

_____

_____

Bidder's Contact:

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Phone: _____

Email: _____

Address:

_____

_____

_____

Bidder's Contractor License No.: (if applicable) _____

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NON-COLLUSION AFFIDAVIT

Under oath, I hereby affirm under penalty of perjury:

(1) That I am the bidder or a partner of the bidder, or an officer or employee of the bidding corporation with authority to sign on its behalf;
(2) That the attached bid or bids have been arrived at by the bidder and have been arrived at and submitted without collusion or any design to limit bidding or competition;
(3) That the contents of the bid or bids have not been communicated to any person not an employee or agent of the bidder on any bid furnished with the bid or bids, and will not be communicated to any such person prior to the official opening of the bid or bids; and
(4) That I have fully informed myself regarding the accuracy of the statements made in this affidavit.

Signed_____

Title_____

Firm Name _____

CITY / COUNTY OF _____

STATE OF _____, to wit:

I, _____, a Notary Public, do certify that

_____whose name is signed to the foregoing has this date acknowledged the same before me in my City foresaid.

Given under my hand this _____ day of _____, 20___.

My Commission expired _____.

_____
Notary Public

This document must be completed & returned with bid submission.

END OF NON-COLLUSION AFFIDAVIT

STATE CORPORATION COMMISSION FORM

Virginia State Corporation Commission ("SCC") registration information:

The undersigned Offeror:

- ☐ is a corporation or other business entity with the following SCC identification number: _____ **-OR-**
- ☐ is not a corporation, limited liability company, limited partnership, registered limited liability partnership, or business trust **-OR-**
- ☐ is an out-of-state business entity that does not regularly and continuously maintain as part of its ordinary and customary business any employees, agents, offices, facilities, or inventories in Virginia (not counting any employees or agents in Virginia who merely solicit orders that require acceptance outside Virginia before they become contracts, and not counting any incidental presence of the Offeror in Virginia that is needed in order to assemble, maintain, and repair goods in accordance with the contracts by which such goods were sold and shipped into Virginia from bidder's out-of-state location) **-OR-**
- ☐ is an out-of-state business entity that is including with this bid an opinion of legal counsel which accurately and completely discloses the undersigned Offeror's current contacts with Virginia and describes why those contacts do not constitute the transaction of business in Virginia within the meaning of § 13.1-757 or other similar provisions in Titles 13.1 or 50 of the Code of Virginia. **Attach opinion of legal counsel to this form.**

****NOTE**** >> Check the following box if you have not completed any of the foregoing options but currently have pending before the SCC an application for authority to transact business in the Commonwealth of Virginia and wish to be considered for a waiver to allow you to submit the SCC identification number after the due date for proposals (the Commonwealth reserves the right to determine in its sole discretion whether to allow such waiver): ☐

Signature: _____ Date: _____

Name: _____
Print

Title: _____

Name of Firm: _____

This document must be completed & returned with bid submission.

END OF STATE CORPORATION COMMISSION FORM

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 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, this _____day of _____, 20___

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

_____

_____

NOW THEREFORE,

(a) If said Bid shall be rejected, or in the alternate

(b) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a bond for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said 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 said Surety and its bond shall be in no way impaired or affected by an extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto 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.

_____ (L.S.)
Principal

_____
Surety

By: _____

Seal

This document must be completed & returned with bid submission.

END OF BID BOND

ARTICLE 1—GENERAL INFORMATION

1.01 Provide contact information for the Business:

Legal Name of Business:			
Corporate Office			
Name:		Phone number:	
Title:		Email address:	
Business address of corporate office:			
Local Office			
Name:		Phone number:	
Title:		Email address:	
Business address of local office:			

1.02 Provide information on the Business's organizational structure:

Form of Business:	☐ Sole Proprietorship ☐ Partnership ☐ Corporation		
☐ Limited Liability Company ☐ Joint Venture comprised of the following companies:			
	1.		
	2.		
	3.		
Provide a separate Qualification Statement for each Joint Venturer.			
Date Business was formed:		State in which Business was formed:	
Is this Business authorized to operate in the Project location?		☐ Yes ☐ No ☐ Pending	

1.03 Identify all businesses that own Business in whole or in part (25% or greater), or that are wholly or partly (25% or greater) owned by Business:

Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			

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1.04 Provide information regarding the Business's officers, partners, and limits of authority.

Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	

ARTICLE 2—LICENSING

2.01 Provide information regarding licensure for Business:

Name of License:			
Licensing Agency:			
License No:		Expiration Date:	
Name of License:			
Licensing Agency:			
License No:		Expiration Date:	

ARTICLE 3—DIVERSE BUSINESS CERTIFICATIONS

3.01 Provide information regarding Business's Diverse Business Certification, if any. Provide evidence of current certification.

Certification	Certifying Agency	Certification Date
☐ Disadvantaged Business Enterprise		
☐ Minority Business Enterprise		
☐ Woman-Owned Business Enterprise		
☐ Small Business Enterprise		
☐ Disabled Business Enterprise		
☐ Veteran-Owned Business Enterprise		
☐ Service-Disabled Veteran-Owned Business		
☐ HUBZone Business (Historically Underutilized) Business		
☐ Other		
☐ None		

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ARTICLE 4—SAFETY

4.01 Provide information regarding Business's safety organization and safety performance.

Name of Business's Safety Officer:		
Safety Certifications		
Certification Name	Issuing Agency	Expiration

4.02 Provide Worker's Compensation Insurance Experience Modification Rate (EMR), Total Recordable Frequency Rate (TRFR) for incidents, and Total Number of Recorded Manhours (MH) for the last 3 years and the EMR, TRFR, and MH history for the last 3 years of any proposed Subcontractor(s) that will provide Work valued at 10% or more of the Contract Price. Provide documentation of the EMR history for Business and Subcontractor(s).

Year									
Company	EMR	TRFR	MH	EMR	TRFR	MH	EMR	TRFR	MH

ARTICLE 5—FINANCIAL

5.01 Provide information regarding the Business's financial stability. Provide the most recent audited financial statement, and if such audited financial statement is not current, also provide the most current financial statement.

Financial Institution:		
Business address:		
Date of Business's most recent financial statement:		☐ Attached
Date of Business's most recent audited financial statement:		☐ Attached
Financial indicators from the most recent financial statement		
Contractor's Current Ratio (Current Assets ÷ Current Liabilities)		
Contractor's Quick Ratio ((Cash and Cash Equivalents + Accounts Receivable + Short Term Investments) ÷ Current Liabilities)		

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ARTICLE 6—SURETY INFORMATION

6.01 Provide information regarding the surety company that will issue required bonds on behalf of the Business, including but not limited to performance and payment bonds.

Surety Name:			
Surety is a corporation organized and existing under the laws of the state of:			
Is surety authorized to provide surety bonds in the Project location?	☐ Yes ☐ No		
Is surety listed in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" published in Department Circular 570 (as amended) by the Bureau of the Fiscal Service, U.S. Department of the Treasury? ☐ Yes ☐ No			
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

ARTICLE 7—INSURANCE

7.01 Provide information regarding Business's insurance company(s), including but not limited to its Commercial General Liability carrier. Provide information for each provider.

Name of insurance provider, and type of policy (CLE, auto, etc.):			
Insurance Provider		Type of Policy (Coverage Provided)	
Are providers licensed or authorized to issue policies in the Project location?		☐ Yes ☐ No	
Does provider have an A.M. Best Rating of A-VII or better?		☐ Yes ☐ No	
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

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ARTICLE 8—CONSTRUCTION EXPERIENCE

8.01 Provide information that will identify the overall size and capacity of the Business.

Average number of current full-time employees:	
Estimate of revenue for the current year:	
Estimate of revenue for the previous year:	

8.02 Provide information regarding the Business's previous contracting experience.

Years of experience with projects like the proposed project:				
As a general contractor:		As a joint venturer:		
Has Business, or a predecessor in interest, or an affiliate identified in Paragraph 1.03:				
Been disqualified as a bidder by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been barred from contracting by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been released from a bid in the past 5 years? ☐ Yes ☐ No				
Defaulted on a project or failed to complete any contract awarded to it? ☐ Yes ☐ No				
Refused to construct or refused to provide materials defined in the contract documents or in a change order? ☐ Yes ☐ No				
Been a party to any currently pending litigation or arbitration? ☐ Yes ☐ No				
Provide full details in a separate attachment if the response to any of these questions is Yes.				

8.03 List all projects currently under contract in Schedule A and provide indicated information.

8.04 List a minimum of three and a maximum of six projects completed in the last 5 years in Schedule B and provide indicated information to demonstrate the Business's experience with projects similar in type and cost of construction.

8.05 In Schedule C, provide information on key individuals whom Business intends to assign to the Project. Provide resumes for those individuals included in Schedule C. Key individuals include the Project Manager, Project Superintendent, Quality Manager, and Safety Manager. Resumes may be provided for Business's key leaders as well.

ARTICLE 9—REQUIRED ATTACHMENTS

9.01 Provide the following information with the Statement of Qualifications:

A. If Business is a Joint Venture, separate Qualifications Statements for each Joint Venturer, as required in Paragraph 1.02.

B. Diverse Business Certifications if required by Paragraph 3.01.

C. Certification of Business's safety performance if required by Paragraph 4.02.

D. Financial statements as required by Paragraph 5.01.

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E. Attachments providing additional information as required by Paragraph 8.02.

F. Schedule A (Current Projects) as required by Paragraph 8.03.

G. Schedule B (Previous Experience with Similar Projects) as required by Paragraph 8.04.

H. Schedule C (Key Individuals) and resumes for the key individuals listed, as required by Paragraph 8.05.

I. Additional items as pertinent.

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This Statement of Qualifications is offered by:

Business: _____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(date signed)

(If Business is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

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Schedule A—Current Projects

Name of Organization				
Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

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Schedule B—Previous Experience with Similar Projects

Name of Organization				
Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

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Schedule B—Previous Experience with Similar Projects

Name of Organization				
Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

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Schedule C—Key Individuals

Project Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

Project Superintendent			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

EJCDC® C-451, Qualifications Statement—Schedule C—Key Individuals.
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Safety Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

Quality Control Manager			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

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NOTICE OF AWARD

Date of Issuance:		
Owner:	City of Staunton	Owner's Project No.:
Engineer:	Timmons Group	Engineer's Project No.:
Project:	Staunton Crossing Utility Improvements – Sewer	
Contract Name:		
Bidder:		
Bidder's Address:		

You are notified that Owner has accepted your Bid dated **[date]** for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

[Describe Work, alternates, or sections of Work awarded]

The Contract Price of the awarded Contract is $**[Contract Price]**. Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

[Number of copies sent] unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

☐ Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner **[number of copies sent]** counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: **[Full formal name of Owner]**

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

Copy: Engineer

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AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

This Agreement is by and between **City of Staunton** ("Owner") and **[name of contracting entity]** ("Contractor").

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions.

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: **The onsite construction of approximately 1,500 linear feet of 15" sanitary sewer, a triplex suction-lift wastewater pump station in a precast concrete building, and 5,600 linear feet of 12" sewer force main. The downstream construction of approximately 4,900 linear feet of 18" and smaller gravity sewer and approximately 580 linear feet of 12" sewer force main. This project also includes all necessary structures and appurtenances to serve the Staunton Crossing development in City of Staunton, Virginia.**

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: **Staunton Crossing Utility Improvements – Sewer.**

ARTICLE 3—ENGINEER

3.01 The Owner has retained **Timmons Group** ("Engineer") to act as Owner's representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

3.02 The part of the Project that pertains to the Work has been designed by **Engineer.**

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Contract Times: Days*

A. The Work will be substantially complete within **450** days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within **480** days after the date when the Contract Times commence to run.

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4.05 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. *Substantial Completion:* Contractor shall pay Owner **$1,000** for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.

2. *Completion of Remaining Work:* After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner **$500** for each day that expires after such time until the Work is completed and ready for final payment.

3. Liquidated damages for failing to timely attain Milestones, Substantial Completion, and final completion are not additive, and will not be imposed concurrently.

B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

ARTICLE 5—CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:

A. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment submitted by the **1st** day of each month on or about the **15th** day of each month (approximately 45 days), provided that Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as

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provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.

    a. **95** percent of the value of the Work completed (with the balance being retainage).

    b. **95** percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion **of the entire construction to be provided under the construction Contract Documents**, Owner shall pay an amount sufficient to increase total payments to Contractor to **95** percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less **100** percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

6.04 *Consent of Surety*

A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

6.05 *Interest*

A. All amounts not paid when due will bear interest at the rate **as set forth by the Secretary of the Treasury pursuant to 31 U.S. Code § 3902(a).**

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

A. The Contract Documents consist of all of the following:

1. This Agreement.
2. Bonds:
    a. Performance bond (together with power of attorney).
    b. Payment bond (together with power of attorney).
3. General Conditions.
4. Supplementary Conditions.
5. Specifications (not attached but incorporated by reference) as listed in the table of contents of the project manual.

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6. Drawings (not attached but incorporated by reference) consisting of:

   a. **30** sheets with each sheet bearing the following general title: **Staunton Crossing Utility Improvements - Sewer**.

   b. **17** sheets with each sheet bearing the following general title: **Staunton Crossing Downstream Sewer Upgrades**.

7. Addenda (numbers **[number]** to **[number]**, inclusive).

8. Exhibits to this Agreement (enumerated as follows):

   a. Contractor's Bid

   b. Documentation submitted by the Contractor prior to Notice of Award.

9. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:

   a. Notice to Proceed.

   b. Work Change Directives.

   c. Change Orders.

   d. Field Orders.

   e. Warranty Bond, if any.

B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.

2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.

4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the

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Supplementary Conditions, with respect to the Technical Data in such reports and drawings.

5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

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3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.03 *Standard General Conditions*

A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

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IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on **[indicate date on which Contract becomes effective]** (which is the Effective Date of the Contract).

Owner:	Contractor:
_____	_____
(typed or printed name of organization)	*(typed or printed name of organization)*
By: _____	By: _____
(individual's signature)	*(individual's signature)*
Date: _____	Date: _____
(date signed)	*(date signed)*
Name: _____	Name: _____
(typed or printed)	*(typed or printed)*
Title: _____	Title: _____
(typed or printed)	*(typed or printed)*
	*(If **[Type of Entity]** is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)*
Attest: _____	Attest: _____
(individual's signature)	*(individual's signature)*
Title: _____	Title: _____
(typed or printed)	*(typed or printed)*
Address for giving notices:	Address for giving notices:
_____	_____
_____	_____
_____	_____
Designated Representative:	Designated Representative:
Name: _____	Name: _____
(typed or printed)	*(typed or printed)*
Title: _____	Title: _____
(typed or printed)	*(typed or printed)*
Address:	Address:
_____	_____
_____	_____
_____	_____
Phone: _____	Phone: _____
Email: _____	Email: _____
*(If **[Type of Entity]** is a corporation, attach evidence of authority to sign. If **[Type of Entity]** is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)*	License No.: _____
	(where applicable)
	State: _____

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NOTICE TO PROCEED

Owner:	_____	Owner's Project No.:	_____
Engineer:	_____	Engineer's Project No.:	_____
Contractor:	_____	Contractor's Project No.:	_____
Project:	_____		
Contract Name:	_____		
Effective Date of Contract:	_____		

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on **[date Contract Times are to start]** pursuant to Paragraph 4.01 of the General Conditions.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement:

> The number of days to achieve Substantial Completion is **[number of days, from Agreement]** from the date stated above for the commencement of the Contract Times, resulting in a date for Substantial Completion of **[date, calculated from commencement date above]**; and the number of days to achieve readiness for final payment is **[number of days, from Agreement]** from the commencement date of the Contract Times, resulting in a date for readiness for final payment of **[date, calculated from commencement date above]**.

Before starting any Work at the Site, Contractor must comply with the following:

> **[Note any access limitations, security procedures, or other restrictions]**

Owner:	**[Full formal name of Owner]**
By *(signature)*:	_____
Name *(printed)*:	_____
Title:	_____
Date Issued:	_____

Copy: Engineer

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PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: That

_____

_____

_____

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

as Principal, hereinafter called Contractor, and

_____

_____

_____

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

as Surety, hereinafter called Surety, are held and firmly bound unto

_____

_____

_____

(Insert name and address of Owner)

As Obligee in the amount of _____ dollars ($_____)

(Insert sum equal to contract price in both words and figures)

For the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,

Contractor has by written agreement dated _____, 20___entered into a Contract with the Owner for:

In accordance with Drawings and Specifications prepared for:

City of Staunton Engineering Division
116 W. Beverley Street
Staunton, Virginia 24401

Which Contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Contractor shall promptly and faithfully perform said Contract, in strict conformity with the Drawings, Specifications and Contract Documents, then this obligation shall be null and void. Otherwise, it shall remain in full force and effect for one (1) year after completion of all work:

a) The Surety hereby waives notice of any alternation or extension of time made by the Owner.

b) Any suit under this bond must be instituted, (1) before the expiration of one (1) year after completion of the Contract including the expiration of all warranties and guarantees, or (2) before the expiration of one (1) year after a defect or breach of warranty is discovered, if the action be for such.

c) No right of action shall accrue on this bond to or for the use of any Person or corporation other than the Owner named herein or the successors or assigns of Owner and every action brought hereon shall be filed and maintained solely in the General District Court or the Circuit Court of the City of Staunton, Virginia.

SIGNED AND SEALED THIS _____ day of _____, 20____

In the presence of :

_____(SEAL)
PRINCIPAL

_____
BY TITLE

_____
WITNESS

_____
SURETY

_____
BY TITLE

_____
WITNESS

Surety:

(Attach power of attorney)

CONTRACTOR'S PERFORMANCE BOND

Project:

_____

_____

END OF PERFORMANCE BOND

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: That

_____

_____

_____

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

as Principal, hereinafter called Contractor, and

_____

_____

_____

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

as Surety, hereinafter called Surety, are held and firmly bound unto

_____

_____

_____

(Insert name and address of Owner)

As Obligee for the use and benefit of claimants as herein below defined in the amount of _____ dollars ($_____)

(Insert sum equal to contract price in both words and figures)

For the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,

Contractor has by written agreement dated _____, 20___entered into a Contract with the Owner for:

In accordance with Drawings and Specifications prepared for:

City of Staunton Engineering Division
116 W. Beverley Street
Staunton, Virginia 24401

Which Contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Contractor shall promptly make payment to all claimants as herein defined, for all labor and materials used or reasonably required for use in the performance of the Contract, then this obligation shall be void. Otherwise it shall remain in full force and effect, subject, however, to the following conditions:

a) A claimant is defined as one having a direct contract with the Contractor for labor, material, or both, used or reasonably required for use in performance of the Contract, labor and material be construed to include the part of water, gas, power,

light, heat, oil. Gasoline, telephone service, or rental of equipment directly applicable to the Contract.

b) The above named Contractor and Surety hereby jointly and severally agree with the Owner that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work of labor was done or performed, or materials were furnished by such claimant, may sue on this bond, prosecute the suit to final judgment for such sum or sums as many be justly due claimant and have execution thereon. The Owner shall not be liable for the payment of any costs or expenses of any such suit.

c) Any suit or action hereunder by any claimant:
    1. Shall not be commenced after the expiration of one (1) year following the date on which the claimant last performed labor or last supplied materials.
    2. Shall be filed and maintained solely in the General District Court or the Circuit Court of the City of Staunton, Virginia.

SIGNED AND SEALED THIS _____ day of _____, 20____

In the presence of:

_____
WITNESS

_____
BY TITLE

_____
SURETY

_____
WITNESS

_____
BY TITLE

Surety:

(Attach power of attorney)

CONTRACTOR'S LABOR AND MATERIAL PAYMENT BOND

Project:

_____

_____

_____(SEAL)
PRINCIPAL

END OF PAYMENT BOND

Contractor's Application for Payment

Owner:		**Owner's Project No.:**	
Engineer:		**Engineer's Project No.:**	
Contractor:		**Contractor's Project No.:**	
Project:			
Contract:			
Application No.:		**Application Date:**	
Application Period:	**From**	**to**	

1. Original Contract Price		$ -
2. Net change by Change Orders		$ -
3. Current Contract Price (Line 1 + Line 2)		$ -
4. Total Work completed and materials stored to date (Sum of Column G Lump Sum Total and Column J Unit Price Total)		$ -
5. Retainage		
a. _____ X $ -	Work Completed = $ -	
b. _____ X $ -	Stored Materials = $ -	
c. Total Retainage (Line 5.a + Line 5.b)		$ -
6. Amount eligible to date (Line 4 - Line 5.c)		$ -
7. Less previous payments (Line 6 from prior application)		
8. Amount due this application		$ -
9. Balance to finish, including retainage (Line 3 - Line 4 + Line 5.c)		$ -

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:
(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;
(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such liens, security interest, or encumbrances); and
(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor: _____

Signature: _____ **Date:** _____

Recommended by Engineer	**Approved by Owner**
By:	**By:**
Title:	**Title:**
Date:	**Date:**
Approved by Funding Agency	
By:	**By:**
Title:	**Title:**
Date:	**Date:**

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Progress Estimate - Lump Sum Work **Contractor's Application for Payment**

Owner:		**Owner's Project No.:**	
Engineer:		**Engineer's Project No.:**	
Contractor:		**Contractor's Project No.:**	
Project:			
Contract:			

Application No.: **Application Period:** **From** **to** **Application Date:**

A	B	C	D	E	F	G	H	I
			Work Completed					
Item No.	Description	Scheduled Value ($)	(D + E) From Previous Application ($)	This Period ($)	Materials Currently Stored (not in D or E) ($)	Work Completed and Materials Stored to Date (D + E + F) ($)	% of Scheduled Value (G / C) (%)	Balance to Finish (C - G) ($)
			Original Contract					
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
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						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
	Original Contract Totals	$ -	$ -	$ -	$ -	$ -		$ -

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Progress Estimate - Lump Sum Work

Contractor's Application for Payment

Owner:		**Owner's Project No.:**	
Engineer:		**Engineer's Project No.:**	
Contractor:		**Contractor's Project No.:**	
Project:			
Contract:			

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I
			Work Completed					
Item No.	Description	Scheduled Value ($)	(D + E) From Previous Application ($)	This Period ($)	Materials Currently Stored (not in D or E) ($)	Work Completed and Materials Stored to Date (D + E + F) ($)	% of Scheduled Value (G / C) (%)	Balance to Finish (C - G) ($)
Change Orders								
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
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						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
	Change Order Totals	$ -	$ -	$ -	$ -	$ -		$ -
Original Contract and Change Orders								
	Project Totals	$ -	$ -	$ -	$ -	$ -		$ -

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Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: _____ **Owner's Project No.:** _____
Engineer: _____ **Engineer's Project No.:** _____
Contractor: _____ **Contractor's Project No.:** _____
Project: _____
Contract: _____

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	Item Quantity	Units	Unit Price ($)	Value of Bid Item (C X E) ($)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
Original Contract											
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
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					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
				Original Contract Totals	$ -		$ -	$ -	$ -		$ -

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Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: _____ **Owner's Project No.:** _____
Engineer: _____ **Engineer's Project No.:** _____
Contractor: _____ **Contractor's Project No.:** _____
Project: _____
Contract: _____

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	Item Quantity	Units	Unit Price ($)	Value of Bid Item (C X E) ($)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
Change Orders											
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
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					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
				Change Order Totals	$ -		$ -	$ -	$ -		$ -
Original Contract and Change Orders											
				Project Totals	$ -		$ -	$ -	$ -		$ -

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Stored Materials Summary

Contractor's Application for Payment

Owner: _____
Engineer: _____
Contractor: _____
Project: _____
Contract: _____

Owner's Project No.: _____
Engineer's Project No.: _____
Contractor's Project No.: _____

Application No.: _____ **Application Period:** From _____ to _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I	J	K	L	M
						Materials Stored			Incorporated in Work			
Item No. (Lump Sum Tab) or Bid Item No. (Unit Price Tab)	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Description of Materials or Equipment Stored	Storage Location	Application No. When Materials Placed in Storage	Previous Amount Stored ($)	Amount Stored this Period ($)	Amount Stored to Date (G+H) ($)	Amount Previously Incorporated in the Work ($)	Amount Incorporated in the Work this Period ($)	Total Amount Incorporated in the Work (J+K) ($)	Materials Remaining in Storage (I-L) ($)
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
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								-			-	-
								-			-	-
								-			-	-
								-			-	-
					Totals	$ -	$ -	$ -	$ -	$ -	$ -	$ -

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CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:
Engineer:
Contractor:
Project:
Contract Name:

Owner's Project No.:
Engineer's Project No.:
Contractor's Project No.:

This ☐ Preliminary ☐ Final Certificate of Substantial Completion applies to:

☐ All Work ☐ The following specified portions of the Work:

[Describe the portion of the work for which Certificate of Substantial Completion is issued]

Date of Substantial Completion: **[Enter date, as determined by Engineer]**

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and 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.

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work must be as provided in the Contract, except as amended as follows:

Amendments to Owner's Responsibilities: ☐ None ☐ As follows:

[List amendments to Owner's Responsibilities]

Amendments to Contractor's Responsibilities: ☐ None ☐ As follows:

[List amendments to Contractor's Responsibilities]

The following documents are attached to and made a part of this Certificate:

[List attachments such as punch list; other documents]

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

Engineer

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

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NOTICE OF ACCEPTABILITY OF WORK

Owner:	Owner's Project No.:
Engineer:	Engineer's Project No.:
Contractor:	Contractor's Project No.:
Project:	
Contract Name:	
Notice Date:	Effective Date of the Construction Contract:

The Engineer hereby gives notice to the Owner and Contractor that Engineer recommends final payment to Contractor, and that the Work furnished and performed by Contractor under the Construction Contract is acceptable, expressly subject to the provisions of the Construction Contract's Contract Documents ("Contract Documents") and of the Agreement between Owner and Engineer for Professional Services dated **[date of professional services agreement]** ("Owner-Engineer Agreement"). This Notice of Acceptability of Work (Notice) is made expressly subject to the following terms and conditions to which all who receive and rely on said Notice agree:

1. This Notice has been prepared with the skill and care ordinarily used by members of the engineering profession practicing under similar conditions at the same time and in the same locality.
2. This Notice reflects and is an expression of the Engineer's professional opinion.
3. This Notice has been prepared to the best of Engineer's knowledge, information, and belief as of the Notice Date.
4. This Notice is based entirely on and expressly limited by the scope of services Engineer has been employed by Owner to perform or furnish during construction of the Project (including observation of the Contractor's Work) under the Owner-Engineer Agreement, and applies only to facts that are within Engineer's knowledge or could reasonably have been ascertained by Engineer as a result of carrying out the responsibilities specifically assigned to Engineer under such Owner-Engineer Agreement.
5. This Notice is not a guarantee or warranty of Contractor's performance under the Construction Contract, an acceptance of Work that is not in accordance with the Contract Documents, including but not limited to defective Work discovered after final inspection, nor an assumption of responsibility for any failure of Contractor to furnish and perform the Work thereunder in accordance with the Contract Documents, or to otherwise comply with the Contract Documents or the terms of any special guarantees specified therein.
6. This Notice does not relieve Contractor of any surviving obligations under the Construction Contract, and is subject to Owner's reservations of rights with respect to completion and final payment.

Engineer

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

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requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

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recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

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33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

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43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

48. *Unit Price Work*—Work to be paid for on the basis of unit prices.

49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

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1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

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F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work

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into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

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ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility

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inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

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B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the

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established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.

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D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;

2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

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B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment

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and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

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5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;

2. is of such a nature as to require a change in the Drawings or Specifications;

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in

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Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

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3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

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or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures

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of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

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conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

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Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

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Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

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L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

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4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against

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Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.
2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

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6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, 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 Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

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B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that the proposed item:

1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

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2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) has a proven record of performance and availability of responsive service; and

4) is not objectionable to Owner.

b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

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3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

    a. will certify that the proposed substitute item will:

        1) perform adequately the functions and achieve the results called for by the general design;

        2) be similar in substance to the item specified; and

        3) be suited to the same use as the item specified.

    b. will state:

        1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

        2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

        3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

    c. will identify:

        1) all variations of the proposed substitute item from the item specified; and

        2) available engineering, sales, maintenance, repair, and replacement services.

    d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

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E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

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H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

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7.09 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

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7.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

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I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

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3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will

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document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

   a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

   b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

   c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

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d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

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9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

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D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

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E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

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B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

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9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

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ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

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E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

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ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

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B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

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1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;

b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;

c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

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11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

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Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge

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and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

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2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are

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consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

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g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

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Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision

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thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

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D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

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losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work,

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or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

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establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

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4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

    a. to supervise, direct, or control the Work;

    b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

    c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

    d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

    e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

    a. the Work is defective, requiring correction or replacement;

    b. the Contract Price has been reduced by Change Orders;

    c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

    e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

    a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

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b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time

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submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without

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significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

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d. a list of all duly pending Change Proposals and Claims; and

e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

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appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;
2. correct such defective Work;
3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

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F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

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attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The

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provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

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18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added—for example, “Paragraph SC-4.05.”

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

No suggested Supplementary Conditions in this Article.

ARTICLE 2—PRELIMINARY MATTERS

2.02 *Copies of Documents*

SC-2.02 Amend the first sentence of Paragraph 2.02.A. to read as follows:

Owner shall furnish to Contractor one fully signed counterpart of the Agreement, and one copy of the Agreement and Contract Documents in electronic portable document format (PDF).

2.05 *Acceptance of Schedules*

SC-2.05 Add the following language at the end of Paragraph 2.05.A.1:

Owner’s or Engineer’s silence as to a submitted schedule that exceeds time limits under the Contract Documents shall not relieve Contractor of its obligation to meet those time limits, nor shall it make Owner or Engineer liable for any Contractor damages incurred as a result of increased construction time or not meeting those time limits. Similarly, Owner’s or Engineer’s silence as to a Contractor’s schedule showing performance in advance of such time limits shall not create or infer any rights in favor of Contractor for performance in advance of such time limits.

2.06 *Electronic Transmittals*

SC-2.06 Delete Paragraph 2.06.A in its entirety and insert the following in its place:

B. At Owner’s sole discretion, the Owner, Engineer, and Contractor may transmit and accept Electronic Documents transmitted by electronic means.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

No suggested Supplementary Conditions in this Article.

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ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

SC-4.01.A – Delete the last sentence of paragraph.

4.05 *Delays in Contractor's Progress*

SC-4.05 Amend Paragraph 4.05.C by adding the following subparagraphs:

5. *Weather-Related Delays*

a. If "abnormal weather conditions" as set forth in Paragraph 4.05.C.2 of the General Conditions are the basis for a request for an equitable adjustment in the Contract Times, such request must be documented by data substantiating each of the following: 1) that weather conditions were abnormal for the period of time in which the delay occurred, 2) that such weather conditions could not have been reasonably anticipated, and 3) that such weather conditions had an adverse effect on the Work as scheduled. **Extreme or unusual weather that is typical for a given region, elevation, or season should not be considered abnormal weather conditions. Requests for time extensions due to abnormal weather conditions will be submitted to the Engineer within five days of the end of the abnormal weather condition event. It is the responsibility of the Contractor to provide the information listed in SC 4.05.C.5.b.**

b. The existence of abnormal weather conditions will be determined on a month-by-month basis in accordance with the following:

1) Every workday on which one or more of the following conditions exist will be considered a "bad weather day":

i) Total precipitation (as rain equivalent) occurring between 7:00 p.m. on the preceding day (regardless of whether such preceding day is a workday) through 7:00 p.m. on the workday in question equals or exceeds **0.1"** of precipitation (as rain equivalent).

2) Determination of actual bad weather days during performance of the Work will be based on the weather records measured and recorded by **NOAA** weather monitoring station at **Staunton, Virginia**.

3) Contractor shall anticipate the number of foreseeable bad weather days per month indicated in the table in Specification 01 3300 – Submittals.

4) In each month, every bad weather day exceeding the number of foreseeable bad weather days established in the table will be considered as "abnormal weather conditions." The existence of abnormal weather conditions will not relieve Contractor of the obligation to demonstrate and document that delays caused by abnormal weather are specific to the planned work activities or that such activities thus delayed were on Contractor's then-current Progress Schedule's critical path for the Project.

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ARTICLE 5—SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraph immediately after Paragraph 5.03.B:

C. Site Conditions Risk: In order to assume sole risk of site conditions (including subsurface conditions below indicated excavation elevations), Contractor covenants and agrees:

1. Reports and drawings of subsurface and physical conditions are provided to Bidders for convenience and general information only and are not considered Contract Documents;

2. Owner makes no representations as to the actual site conditions and is not responsible if actual conditions vary from that described in the provided reports and drawings of subsurface conditions;

3. Owner encourages Bidders to perform their own subsurface investigations prior to submitting Bids; and

4. Owner defines all excavation as "unclassified".

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical Data
Geotechnical Engineering Report – Staunton Crossing Elevated Water Tank and Wastewater Pump Station	July 21, 2023	Boring logs, recorded measurements of subsurface water levels, laboratory test results.

F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
No such drawings are known to the Owner.		

G. Contractor may examine copies of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents by requesting copies from Engineer.

5.06 *Hazardous Environmental Conditions*

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Modified to include RD edits from RUS Bulletin 1780-26 (6/16/2020).

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

4. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely:

Report Title	Date of Report	Technical Data
No such reports are known to the Owner.		

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
No such drawings are known to the Owner.		

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

SC-6.01 Add the following paragraphs immediately after Paragraph 6.01.A:

1. *Required Performance Bond Form:* The performance bond that Contractor furnishes will be in the form of the City of Staunton's standard performance bond.

2. *Required Payment Bond Form:* The payment bond that Contractor furnishes will be in the form of the City of Staunton's standard payment bond.

6.02 *Insurance—General Provisions*

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.B:

1. Contractor may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the Project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.

6.03 *Contractor's Insurance*

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

D. *Other Additional Insureds:* As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to Owner and Engineer) the following: **Valley Automation, Inc.**

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E. *Workers' Compensation and Employer's Liability:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

Workers' Compensation and Related Policies	**Policy limits of not less than:**
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Jones Act (if applicable)	
Bodily injury by accident—each accident	N/A
Bodily injury by disease—aggregate	N/A
Employer's Liability	
Each accident	$1,000,000
Each employee	$1,000,000
Policy limit	$1,000,000
Stop-gap Liability Coverage	
For work performed in monopolistic states, stop-gap liability coverage must be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of:	N/A

F. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
2. damages insured by reasonably available personal injury liability coverage, and
3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.
    a. Such insurance must be maintained for three years after final payment.
    b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

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2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.

3. Severability of interests and no insured-versus-insured or cross-liability exclusions.

4. Underground, explosion, and collapse coverage.

5. Personal injury coverage.

6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.

7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).

2. Any exclusion for water intrusion or water damage.

3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.

4. Any exclusion of coverage relating to earth subsidence or movement.

5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).

6. Any limitation or exclusion based on the nature of Contractor's work.

7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	**Policy limits of not less than:**
General Aggregate	$2,000,000
Products—Completed Operations Aggregate	$2,000,000
Personal and Advertising Injury	$1,000,000
Bodily Injury and Property Damage—Each Occurrence	$1,000,000

J. *Automobile Liability:* Contractor shall purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis.

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Automobile Liability	Policy limits of not less than:
Bodily Injury	
Each Person	$1,000,000
Each Accident	$1,000,000
Property Damage	
Each Accident	$1,000,000
[or]	
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	$1,000,000

K. *Umbrella or Excess Liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	$2,000,000
General Aggregate	$4,000,000

L. *Not Used.*

M. *Contractor's Pollution Liability Insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance must be maintained for no less than three years after final completion.

Contractor's Pollution Liability	Policy limits of not less than:
Each Occurrence/Claim	$2,000,000
General Aggregate	$2,000,000

N. *Contractor's Professional Liability Insurance:* If Contractor will provide or furnish professional services under this *Contract*, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance must cover negligent acts, errors, or omissions in the performance of professional design or related services by the insured or others for whom the insured is legally liable. The insurance must be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. The retroactive date on the policy must pre-date the commencement of furnishing services on the Project.

Contractor's Professional Liability	Policy limits of not less than:
Each Claim	$1,000,000
Annual Aggregate	$2,000,000

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O. *Railroad Protective Liability Insurance:* Prior to commencing any Work within 50 feet of railroad-owned and controlled property, Contractor shall (1) endorse its commercial general liability policy with ISO CG 24 17, removing the contractual liability exclusion for work within 50 feet of a railroad, (2) purchase and maintain railroad protective liability insurance meeting the following requirements, (3) furnish a copy of the endorsement to Owner, and (4) submit a copy of the railroad protective policy and other railroad-required documentation to the railroad, and notify Owner of such submittal.

[Insert additional specific requirements, commonly set by the railroad, here.]

Railroad Protective Liability Insurance	Policy limits of not less than:
Each Claim	N/A
Aggregate	N/A

P. *Unmanned Aerial Vehicle Liability Insurance:* If Contractor uses unmanned aerial vehicles (UAV—commonly *referred* to as drones) at the Site or in support of any aspect of the Work, Contractor shall obtain UAV liability insurance in the amounts stated; name Owner, Engineer, and all individuals and entities identified in the Supplementary Conditions as additional insureds; and provide a certificate to Owner confirming Contractor's compliance with this requirement. Such insurance will provide coverage for property damage, bodily injury or death, and invasion of privacy.

Unmanned Aerial Vehicle Liability Insurance	Policy limits of not less than:
Each Claim	$1,000,000
General Aggregate	$2,000,000

Q. *Other Required Insurance:* **[Here list additional types and amounts of insurance that Contractor is required to carry.]**

6.04 *Builder's Risk and Other Property Insurance*

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

F. *Builder's Risk Requirements:* The builder's risk insurance must:

1. be written on a builder's risk "all risk" policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).

    a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.

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b. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake, volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance will be provided through other insurance policies acceptable to Owner and Contractor.

2. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).

4. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier). If this coverage is subject to a sublimit, such sublimit will be a minimum of $**[amount]**.

5. extend to cover damage or loss to insured property while in transit. If this coverage is subject to a sublimit, such sublimit will be a minimum of $**[amount]**.

6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.

7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.

8. include performance/hot testing and start-up, if applicable.

9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of Owner's procurement of property insurance following Substantial Completion, whichever occurs first.

10 include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder's risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as "insureds." In addition to Owner, Contractor, and Subcontractors of every tier, include as insureds the following:

   a. **Valley Automation, Inc.**
   3221 Peoples Drive, Suite 160
   Harrisonburg, VA 22801

11. include, in addition to the Contract Price amount, the value of the following equipment and materials to be installed by the Contractor but furnished by the Owner or third parties:

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a. **Refer to Valley Automation, Inc. Proposal attached to the Project Manual.**

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provision:

G. *Coverage for Completion Delays:* The builder's risk policy will include, for the benefit of Owner, loss of revenue and soft cost coverage for losses arising from delays in completion that result from covered physical losses or damage. Such coverage will include, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, compensation for loss of net revenues, rental costs, and attorneys' fees and engineering or other consultants' fees, if not otherwise covered.

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

H. *Builder's Risk and Other Property Insurance Deductibles:* The purchaser of any required builder's risk, installation floater, or other property insurance will be responsible for costs not covered because of the application of a policy deductible.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.03 *Labor; Working Hours*

SC-7.03 Add the following new subparagraphs immediately after Paragraph 7.03.C:

1. Regular working hours will be **7:00 a.m. to 5:00 p.m.**
2. Owner's legal holidays.

SC-7.03 Add the following new paragraph immediately after Paragraph 7.03.C:

D. **Contractor** shall be responsible for the cost of any overtime pay or other expense incurred by the Owner for Engineer's services (including those of the Resident Project Representative, if any), Owner's representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as overtime on any regular work day. If Contractor is responsible but does not pay, or if the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

SC-7.03 Add the following new paragraph immediately after Paragraph SC-7.03.D:

E. Any person in the employ of Contractor or any Subcontractor or Supplier or other person or entity performing any of the Work whom Owner or Engineer may reasonably deem incompetent, unfit, troublesome, or otherwise undesirable shall be excluded from the Site and shall not again be employed on it except with the written consent of the Owner. Contractor acknowledges this provision does not create a duty for the Owner or Engineer to evaluate the fitness of those in the employ of the Contractor or any Subcontractor or Supplier.

7.07 *Concerning Subcontractors, Suppliers, and Others*

SC-7.07.M Add the following new paragraph immediately after Paragraph 7.07.N

P. Suppliers Identified on Bid Form: Where multiple Suppliers are identified on the Bid form, Contractor's Bid form shall indicate which Supplier Contractor's Bid is based upon. Contractor

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shall only provide Submittals from the Suppliers indicated on Contractor's Bid form for each category, or first listed Supplier if none was indicated.

7.08 *Patent Fees and Royalties*

SC-7.08 Delete Paragraph 7.08.B and replace with the following:

B. To the fullest extent permitted by Laws and Regulations and without the waiver of sovereign immunity or any other applicable immunity, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

7.16 *Submittals*

SC-7.16 Add a new subparagraph immediately after Paragraph 7.16.D.3:

4. Previously Approved Product: After a product has been approved, no change in brand or make will be permitted unless:

   a. Satisfactory written evidence is presented to demonstrate that the Supplier cannot make scheduled delivery of approved product and that such delivery failure will adversely affect the Project's critical path; or

   b. The product delivered has been rejected and the substitution of suitable product is required to maintain the Project's critical path; or

   c. Other conditions have become apparent which indicate that approval of such other material is, in the opinion of Owner or Engineer, or both, in the best interest of Owner.

7.18 *Indemnification*

SC-7.18 Add the following language at the end of the last sentence of Paragraph 7.18.A:

Regardless of whether or not such claim, cost , loss or damage is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Paragraph 7.18.A.

ARTICLE 8—OTHER WORK AT THE SITE

8.02 *Coordination*

SC-8.02 Add the following new Paragraph 8.02.C immediately after Paragraph 8.02.B:

C. Owner intends to contract with others for the performance of other work at or adjacent to the Site.

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1. **City of Staunton** shall have authority and responsibility for coordination of the various contractors and work forces at the Site;

2. The following specific matters are to be covered by such authority and responsibility: **SCADA and Controls Integration**;

3. The extent of such authority and responsibilities is: **Refer to Valley Automation Proposal attached to the Project Manual**.

ARTICLE 9—OWNER'S RESPONSIBILITIES

SC-9.13 Add the following new paragraph immediately after Paragraph 9.12 of the General Conditions:

9.13 *Owner's Site Representative*

A. Owner will furnish an "Owner's Site Representative" to represent Owner at the Site and assist Owner in observing the progress and quality of the Work. The Owner's Site Representative is not Engineer's consultant, agent, or employee. Owner's Site Representative will be identified at the Preconstruction Meeting. The authority and responsibilities of Owner's Site Representative follows:

1. General: OSR's dealings in matters pertaining to the Work in general shall be with Owner and Contractor. OSR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. OSR shall generally communicate with Engineer only with the knowledge of and under the direction of Owner.

2. Schedules: Review the progress schedule, schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by Contractor and consult with Owner concerning acceptability.

3. Conferences and Meetings: Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings.

4. Liaison:

   a. Serve as Owner's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

   b. Assist Owner in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

   c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.

5. Interpretation of Contract Documents: Report to Engineer when clarifications and interpretations of the Contract Documents are needed.

6. Shop Drawings and Samples:

   a. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.

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b. Advise Owner and Contractor of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal for which RPR believes that the submittal has not been approved by Engineer.

7. Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with OSR's recommendations, if any, to Owner and Engineer.

8. Review of Work and Rejection of Defective Work:

a. Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.

b. Report to Owner whenever OSR believes that any part of Contractor's work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Owner of that part of work in progress that OSR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

9. Inspections, Tests, and System Start-ups:

a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.

b. Observe, record, and report to Owner appropriate details relative to the test procedures and systems start-ups.

10. Records:

a. Prepare a daily report or keep a diary or log book, recording Contractor's hours on the Site, Subcontractors present at the Site, weather conditions, data relative to questions of Change Orders, Field Orders, Work Change Directives, or changed conditions, Site visitors, deliveries of equipment or materials, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Owner.

b. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.

c. Maintain records for use in preparing Project documentation.

11. Reports:

a. Furnish to Owner and Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule and schedule of Shop Drawing and Sample submittals.

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b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.

c. Immediately notify Owner of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, force majeure or delay events, damage to property by fire or other causes, or the discovery of any Constituent of Concern or Hazardous Environmental Condition.

12. Payment Requests: Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

13. Certificates, Operation and Maintenance Manuals: During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

14. Completion:

a. Participate in Engineer's visits to the Site to determine Substantial Completion, assist in the determination of Substantial Completion and the preparation of a punch list of items to be completed or corrected.

b. Participate in Engineer's final visit to the Site to determine completion of the Work, in the company of Owner and Contractor, and prepare a final punch list of items to be completed and deficiencies to be remedied.

c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the notice of acceptability of the work.

C. The OSR shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work.

5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Owner.

7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.

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8. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.03 *Resident Project Representative*

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.B:

C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:

1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.

3. *Liaison*

   a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

   b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

   c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.

4. *Review of Work; Defective Work*

   a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.

   b. Observe whether any Work in place appears to be defective.

   c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.

5. *Inspections and Tests*

   a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.

   b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.

6. *Payment Requests:* Review Applications for Payment with Contractor.

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7. *Completion*

   a. Participate in Engineer's visits regarding Substantial Completion.

   b. Assist in the preparation of a punch list of items to be completed or corrected.

   c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.

   d. Observe whether items on the final punch list have been completed or corrected.

D. The RPR will not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.

5 Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 11—CHANGES TO THE CONTRACT

No suggested Supplementary Conditions in this Article.

ARTICLE 12—CLAIMS

12.01 *Claims*

SC-12.01 Delete Paragraph 12.01.A and replace with the following:

A. Claims Process: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article, however, in no event shall any dispute over a change in price exceeding the limits established in Virginia Code Section 2.2-4309 be subject to this claim procedure:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

2. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

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4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

SC-12.01 Add the following language immediately after Paragraph 12.01.B:

A claim shall only be effective when written notice is provided to the other party within the time specified and the claim is clearly identified as follows: (i) using the phase "NOTICE OF CLAIM" in all capital letters (ii) using the phares in (I) above in underlined bold font of at least 16 points. Written notice of intent to make a claim shall not be considered as submission of a claim. Claimant shall be barred from any remedy by failing to clearly identify the written notice as indicated herein.

The written notice required above is a condition precedent to the assertion of any claim. The right of Owner to receive written notice of claims may not be waived or modified by Owner except in writing signed by Owner, and Contractor will not rely on any purported waiver of this written notice by verbal instructions or other conduct of Owner or Engineer

ARTICLE 13—COST OF WORK; ALLOWANCES, UNIT PRICE WORK

13.01 *Cost of the Work*

SC-13.01 Supplement Paragraph 13.01.B.5.c.(2) by adding the following sentence:

The equipment rental rate book that governs the included costs for the rental of machinery and equipment owned by Contractor (or a related entity) under the Cost of the Work provisions of this Contract is the most current edition of the Rental Rate Blue Book for Construction Equipment per the methodology specified in the VDOT Road and Bridge Specifications.

SC-13.01 Supplement Paragraph 13.01.C.2 by adding the following definition of small tools and hand tools:

a. For purposes of this paragraph, "small tools and hand tools" means any tool or equipment whose current price if it were purchased new at retail would be less than $1,000.

13.03 *Unit Price Work*

SC-13.03 Delete Paragraph 13.03.E in its entirety and insert the following in its place:

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the extended price of a particular item of Unit Price Work amounts to 5 percent (5%) or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 25 percent (25%) from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

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2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCCEPTANCE OF DEFECTIVE WORK

SC-14.02 Add the following new paragraph to Paragraph 14.02.A:

If some or all of the Work is not ready for inspections and tests and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, shall be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

SC-14.02 Add the following new paragraph to Paragraph 14.02.B:

The services of an independent inspector, testing laboratory or other qualified individual or entity will be provided by the Engineer. The services shall be subject to the provisions of Paragraph 14.02.A.

ARTICLE 15—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15 *Payments to Contractor; Set-Offs; Completion; Correction Period*

SC-15 – Add the following language at the beginning of Article 15:

In the event of a conflict between the provisions of this Article 15 in regards to progress payments and the Agreement between Owner and Contractor, the Agreement shall govern.

15.01 *Progress Payments*

SC-15.01.B.5 – Add new paragraph immediately after Paragraph 15.01.B.4:

5. Each Application for Payment shall be accompanied by the following all in form and substance satisfactory to Owner:

    a. A current schedule of outstanding and unresolved Contractor Change Proposals and Claims;

    b. A current Contractor's lien waiver and duly executed and acknowledged sworn statement showing all Subcontractors and Suppliers with whom Contractor has entered into subcontracts, the amount of each subcontract, the amount requested for any Subcontractor and Suppler in the requested payment, and the amount to be paid to Contractor from such progress payment together with similar sworn statements from all such Subcontractors and Supplier;

    c. Duly executed waivers of all liens from all Subcontractors and, when appropriate, from Suppliers and lower tier subcontractors establishing payment or satisfaction

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of payment of all amounts requested by Contractor on behalf of such entities or persons in any previous Application for Payment; and

d. A written list and pictures identifying materials that are stored off the Site and the value of materials at each location. Contractor shall provide proof of insurance satisfactory to Owner for materials stored off the Site in an amount not less than the total value thereof.

e. The consent of any surety shall be obtained to the extent required prior to payment for any materials stored off the Site.

f. Owner, representatives of Owner, and Owner's lender, if any, shall have the right to make inspections of the storage areas for materials stored off the Site at any time.

g. Materials stored off the Site shall be: (1) protected from diversion, destruction, theft, and damage to the satisfaction of Owner and Owner's lender, if any, (2) specifically marked for use on the Project; and (3) segregated from other materials at the storage facility.

SC-15.01 Add the following language at the beginning of Paragraph 15.01.D:

D. Unless time period is otherwise specified in Agreement,

15.03 *Substantial Completion*

SC-15.03 Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

15.05 *Final Inspection*

SC-15.05 Add the following new subparagraph to Paragraph 15.05.A:

1. If some or all of the Work has been determined not to be at a point of Final Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

15.06 *Final Payment*

SC-15.01 Add the following language at the beginning of the last sentence of Paragraph 15.06.E:

D. Unless time period is otherwise specified in Agreement,

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

No suggested Supplementary Conditions in this Article.

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ARTICLE 17—FINAL RESOLUTIONS OF DISPUTES

17.01 *Methods and Procedures*

SC-17.01 Add the following language at the end of Paragraph 17.01.B.3:

3. This contract shall be governed in all respects by the laws of the Commonwealth of Virginia and any litigation with respect thereto shall be brought in the Circuit Court for the City of Staunton, Virginia. Contractor hereby waives any right, which may exist under Federal Law, to remove any case to Federal Court.

ARTICLE 18—MISCELLANEOUS

18.07 *Controlling Law*

SC-18.07 Add the following new paragraph immediately after Paragraph 18.07.A:

B. This solicitation and any resulting contract shall be governed in all respects by the laws of the Commonwealth of Virginia, without reference to conflict of laws, principles or rules of construction. Any action, proceeding, or claim in any way related to this agreement or the relationship between the parties shall be filed and maintained solely in the General District Court or the Circuit Court of the City of Staunton, Virginia.

18.11 *Right to Audit*

SC-18.11 – Add new paragraph immediately after Paragraph 18.10:

18.11 *Right to Audit*

A. Contractor shall keep full and accurate records of all costs incurred and items billed in connection with the performance of the Work, which records shall be open to audit by the Owner or Engineer or its authorized representatives during performance of the Work and until three years after Final Payment. In addition, Contractor shall make it a condition of all subcontracts relating to the Work that any and all Subcontractors will keep accurate records of costs incurred and items billed in connection with their work and that such records shall be open to audit by the Owner or its authorized representatives during performance of the Work and until three years after Final Payment.

18.12 *City/State Required Clauses*

SC-18.12 – Add new paragraph immediately after Paragraph 18.11:

18.12 *City/State Required Clauses*

A. PROMPT PAYMENT ACT: Any contract awarded as a result of this Request for Proposal shall incorporate the terms and conditions of Article 4 of the Virginia Public Procurement Act with respect to Prompt Payment.

B. AVAILABILITY OF FUNDS: Agreements are made subject to the appropriation of funds by the City and are null and void in the event of non-appropriation by the City. Non-appropriation of funds shall not be deemed a cancellation and shall terminate this agreement without recourse and with no liability on the part of the City.

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C. STATE CORPORATION COMMISSION IDENTIFICATION NUMBER: Pursuant to Code of Virginia, §2.2-4311.2 subsection B, a bidder or offeror organized or authorized to transact business in the Commonwealth pursuant to Title 13.1 or Title 50 is required to include in its bid or proposal the identification number issued to it by the State Corporation Commission (SCC). Any bidder or offeror that is not required to be authorized to transact business in the Commonwealth as a foreign business entity under Title 13.1 or Title 50 or as otherwise required by law is required to include in its bid or proposal a statement describing why the bidder or offeror is not required to be so authorized. Link to the Virginia State Corporation Commission site: http://www.scc.virginia.gov/.

D. NEGOTIATION WITH SUCCESSFUL BIDDER: The City reserves the right to negotiate contract terms with the successful offeror for items/services other than those specifically stated in this IFB in the best interest of the City and agreed to by the contractor, in accordance with § 2.2-4318 of the Code of Virginia. Additional work of reasonable scale shall be priced consistent with bid to allow for additions and future expansions.

E. DEBARMENT STATUS: By submitting their proposals, all offerors certify that they are not currently debarred from submitting proposals on contracts by any public body of the Commonwealth of Virginia, nor are they an agent of any person or entity that is currently debarred from submitting proposals on contracts by any public body of the Commonwealth of Virginia.

F. DRUG FREE WORKPLACE: During the performance of this contract, the contractor agrees to:

1. Provide a drug-free workplace for the contractor's employees;
2. Post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, 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;
3. 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
4. Include the provisions of the foregoing clauses in every subcontract or purchase order of over $10,000.00, so that the provisions will be binding upon each subcontractor or vendor.

G. NON-DISCRIMINATION: 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 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 the applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

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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, 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.

4. The contractor will include the provisions of the foregoing paragraphs a, b, c in every subcontract or purchase order of over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

H. IMMIGRATION REFORM AND CONTROL ACT OF 1986: During the performance of this contract, contractor agrees that they will not, and shall not knowingly employ an unauthorized alien as defined in the federal Immigration Reform and Control Act of 1986. (per 2.2-4311.1

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WORK CHANGE DIRECTIVE NO.: [Number of Work Change Directive]

Owner:	Owner's Project No.:
Engineer:	Engineer's Project No.:
Contractor:	Contractor's Project No.:
Project:	
Contract Name:	
Date Issued:	Effective Date of Work Change Directive:

Contractor is directed to proceed promptly with the following change(s):

Description:

[Description of the change to the Work]

Attachments:

[List documents related to the change to the Work]

Purpose for the Work Change Directive:

[Describe the purpose for the change to the Work]

Directive to proceed promptly with the Work described herein, prior to agreeing to change in Contract Price and Contract Time, is issued due to:

Notes to User—Check one or both of the following

☐ Non-agreement on pricing of proposed change. ☐ Necessity to proceed for schedule or other reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price: $ _____ **[increase] [decrease] [not yet estimated]**.

Contract Time: _____ days **[increase] [decrease] [not yet estimated]**.

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price ☐ Cost of the Work ☐ Other

	Recommended by Engineer	Authorized by Owner
By:		
Title:		
Date:		

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CHANGE ORDER NO.: [Number of Change Order]

Owner: Owner's Project No.:
Engineer: Engineer's Project No.:
Contractor: Contractor's Project No.:
Project:
Contract Name:
Date Issued: Effective Date of Change Order:

The Contract is modified as follows upon execution of this Change Order:

Description:

[Description of the change]

Attachments:

[List documents related to the change]

Change in Contract Price	**Change in Contract Times [State Contract Times as either a specific date or a number of days]**
Original Contract Price: $ _____	Original Contract Times: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] from previously approved Change Orders No. 1 to No. **[Number of previous Change Order]**: $ _____	**[Increase] [Decrease]** from previously approved Change Orders No.1 to No. **[Number of previous Change Order]**: Substantial Completion: _____ Ready for final payment: _____
Contract Price prior to this Change Order: $ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] this Change Order: $ _____	**[Increase] [Decrease]** this Change Order: Substantial Completion: _____ Ready for final payment: _____
Contract Price incorporating this Change Order: $ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for final payment: _____

	Recommended by Engineer (if required)	Accepted by Contractor
By:	_____	_____
Title:	_____	_____
Date:	_____	_____
	Authorized by Owner	Approved by Funding Agency (if applicable)
By:	_____	_____
Title:	_____	_____
Date:	_____	_____

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FIELD ORDER NO.: [Number of Field Order]

Owner:	Owner's Project No.:
Engineer:	Engineer's Project No.:
Contractor:	Contractor's Project No.:
Project:	
Contract Name:	
Date Issued:	Effective Date of Field Order:

Contractor is hereby directed to promptly perform the Work described in this Field Order, issued in accordance with Paragraph 11.04 of the General Conditions, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference:

Specification Section(s):

Drawing(s) / Details (s):

Description:

[Description of the change to the Work]

Attachments:

[List documents supporting change]

Issued by Engineer

By: _____

Title: _____

Date: _____

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SECTION 101
MOBILIZATION

101.1 GENERAL

Work shall consist of performing preparatory operations, moving personnel and equipment to the job site, paying bonds and insurance premiums and establishing a Contractors field office.

101.2 MEASUREMENT & PAYMENT

When listed as a separate pay item, mobilization will be paid for at the rate of 50% with the first month's request for payment and 50% with the second month's request for payment. The mobilization bid shall not exceed 10% on projects with a value less than $200,000 and 7.5% on projects over $200,000. If mobilization is not listed as a separate pay item, it will be considered incidental to all other work and the cost distributed accordingly.

END OF MOBILIZATION

SECTION 102
TRAFFIC CONTROL

102.1 GENERAL

All traffic control devices and traffic patterns shall conform to the standards in the Manual of Uniform Traffic Control Devices (MUTCD) and the Virginia Work Area Protection Manual unless shown otherwise on the plans.

102.1.1 Referenced Specifications are referred to by abbreviation as follows:

A. Manual of Uniform Traffic Control Devices (MUTCD)

B. Virginia Department of Transportation (VDOT)

C. Virginia Work Area Protection Manual (VWAPM)

102.1.2 The contractor is responsible for providing the required signage and cones.

102.1.3 All signage and traffic control shall be subject to the City's approval. No rerouting of traffic or street closings will be done without prior approval from the City.

102.1.4 All traffic cones are to be 36" tall and clean.

102.1.5 When left unattended, any work zone adjacent to a City street shall have lighted barricades every 30'. No open excavations will be permitted overnight in a City right-of-way.

102.1.6 Rerouting of traffic shall be delineated with traffic cones.

102.1.7 Flagmen must be used when stopping traffic and for equipment entering and exiting a work zone.

102.1.8 All flagmen shall be certified by VDOT and be in possession of a valid flagging card.

102.2 MEASUREMENT AND PAYMENT

When listed as a separate bid item, Traffic Control will be paid for as a lump sum item. Payment will be made as a percentage of the associated items that are completed. When there is not a separate bid item for Traffic Control, it will be considered incidental to all other work and the cost distributed accordingly.

END OF TRAFFIC CONTROL

SECTION 103

SITE CLEARING

103.1 General

This section provides for general site clearing operations, including trees and vegetation removal, protection of existing trees to be left standing, and clearing and grubbing.

103.1.1 Related requirements specified in other Sections of the Specifications.

A. Section 104 - Trenching & Backfilling

B. Section 106 - Seeding

103.1.2 Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements not indicated to be removed, and improvements on adjoining properties.

103.1.3 Protect existing trees and other vegetation indicated to remain in place against cutting, breaking, or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary fences, barricades or guards as required to protect trees and vegetation to be left standing.

103.1.4 Burning where allowed by local ordinances will be allowed by permit only.

103.2 Execution

103.2.1 Clearing

A. Remove from the site trees, brush, shrubs, down timber, rotten wood, rubbish, other vegetation, including stumps, as well as fences, and incidental structures necessary to allow for new construction.

B. Clearing work shall be restricted to area within rights-of-way or easements or within "Construction Limits" indicated on Drawings.

103.2.2 Existing Trees and Shrubs

A. Trees and shrubs that are to remain within "Construction Limits" shall be marked by the owner prior to clearing operations.

B. Ownership of Trees: Unless otherwise noted, felled trees within the "Construction Limits" shall become the property of the Contractor and shall be removed from the site.

C. Use only hand methods for grubbing inside the drip lines of trees which are to remain.

103.2.3 Clean up debris resulting from site clearing operations continuously with the progress of the work.

103.2.4 Remove all waste material from site.

103.2.5 Remove debris from site in such a manner as to prevent spillage. Keep pavement and area adjacent to site clean and free from mud, dirt and debris at all times.

103.3 Measurement and Payment

When listed as a separate bid item, Site Clearing shall be paid for as a lump sum. When not listed as a separate bid item, Site Clearing shall be considered incidental to associated work items.

END OF SITE CLEARING

SECTION 104
TRENCHING & BACKFILLING FOR UITILITY LINES

104.1 GENERAL

Work included in this Section includes trenching and backfilling for underground pipelines and related structures only.

104.1.1 Related requirements specified in other Sections of the Specifications.

A. Section 102 - Traffic Control

B. Section 103 - Site Clearing

C. Section 105 - Rock Excavation

D. Section 106 - Seeding

E. Section 107 - Sanitary Sewer System

F. Section 108 – Storm Drainage System

G. Section 109 - Water Distribution System

104.1.2 Reference Specifications are referred to by abbreviation as follows:

A. American Society for Testing and Materials – ASTM

B. American Association. of State Highway and Transportation Officials – AASHTO

C. Virginia Department of Transportation – VDOT

104.1.3 The contractor shall provide compaction testing as deemed necessary by the City.

104.1.4 Locate existing utilities, culverts and structures, above and/or below ground, before any excavation starts. Coordinate work with utility companies. Protect, maintain in service, and prevent damage to utilities not designated to be removed. When utilities are encountered and are not shown on Drawings or when locations differ from those shown on Drawings, notify Engineer for instructions before proceeding.

104.2 PRODUCTS

104.2.1 Pipe Bedding Fill

A. Granular fill shall meet requirements for VDOT #68 or #57 aggregate.

104.2.2 Select Backfill

A. Aggregate fill shall be VDOT #21A.

B. Clean earth fill shall be approved material free of debris, roots, frozen materials, organic matter, rock or gravel larger than 2 inches in any dimension or other harmful matter.

C. Flowable Fill shall conform to VDOT Road and Bridge Standards and VDOT Special Provision for Flowable Fill.

104.2.3 Concrete for bedding, backfill or encasement shall have at least 2,000 psi compressive strength.

104.2.4 Rip rap, where shown on the Drawings shall conform to VDOT Road and Bridge Specifications.

104.3 EXECUTION

104.3.1 Strip existing topsoil, leaf mold and organic materials, meeting topsoil requirements of Section 106 - "Seeding." Deposit in storage piles separate from other excavated material.

104.3.2 Unauthorized excavation consists of the removal of material beyond indicated subgrade elevations or side dimensions without specific approval of the City Engineer. Where unauthorized excavations occur, restore these areas to the elevations and dimensions shown on the Drawings with granular fill.

104.3.3 Where removal of unsatisfactory material is due to fault or negligence of the Contractor, by inadequate shoring or bracing, dewatering, material storage or other failure to meet specified requirements, any work deemed necessary by the City Engineer to correct the faulty condition shall be performed at no additional cost.

104.3.4 Excavation and Bedding

A. Open trenches are limited to 100'.

B. The width of the trench at and below the top of the pipe shall be the outside diameter of the pipe plus 24 inches.

C. The trench width shall be of adequate width to allow for a mechanical compactor between the pipe and the trench wall.

D. Pressure lines shall be installed with bedding as indicated in the Standard Drawings.

E. Gravity sewer lines in good material shall be installed with a modified class B bedding as shown on standard drawing S-8.

F. Dewater excavation as necessary to provide proper protection. If deemed necessary, the Engineer may require continuous dewatering 24 hours per day by adequate pumping or well-points until backfilling is completed.

The method, and equipment used for dewatering shall be subject to the approval of the Engineer.

G. Where unsuitable soil is encountered, excavate to depth determined by the City Engineer and replace with suitable material approved by the City Engineer.

H. Where underground streams or springs are found, provide temporary drainage and notify City Engineer.

I. Remove from the project site and dispose of material unsatisfactory for backfill, trash, and all excess material continuously with the progress of the work.

J. Remove shoring and all form materials, unless otherwise directed.

K. Where rock is encountered which will serve as a foundation for a manhole, vault, or other structure, it shall not be removed. Where only a part of the foundation would bear on rock, excavate to an even depth of 8 inches below the entire structure and backfill with aggregate fill and thoroughly compact. Provide a minimum of 8 inches between rock excavation and sides of structures.

L. Compact pipe bedding by mechanical tamping to prevent settlement.

104.3.5 Sheeting

A. Maintain trench walls in a safe condition at all times. The City Engineer reserves the right to require the use of sheeting and/or shoring at any time the Engineer deems it necessary.

B. Sheeting and shoring left in place shall be cut off to a depth of not less than 18 inches below finish grade.

104.3.6 Compaction

A. Percentage of maximum density requirements: Compact each layer of fill or backfill to not less than the following percentages of the maximum density at optimum moisture content as determined by ASTM D 698 (AASHTO T-99):

1. 100 percent beneath and within 25 feet of buildings and structures, including those shown for future construction.

2. 95 percent beneath pavements, walks, and road shoulders, including those shown for future construction.

3. 90 percent in other unpaved areas.

104.3.7 Backfill

A. Backfill trench to a compacted depth of 1 foot over the pipe with approved earth fill. Backfill shall be properly placed uniformly on each side of the pipe and compacted as required. Do not backfill on muddy or frozen soil, or with muddy or frozen soil.

B. Backfill over any plastic or PVC pipe to 1' over the top of the pipe with VDOT #68 or #58 aggregate.

C. Backfill trench from 1 foot above the pipe to grade with clean earth fill free of stones larger than 6 inches or 1/2 the layer thickness, whichever is smaller. Layers shall not exceed 12 inches, except that under road shoulders and under existing or future paved areas, layers shall not exceed 8 inches. Backfill shall be compacted to the density specified for the areas in which it is located except that minimum compaction in any area shall be to the density of the adjacent soil. Compaction shall be achieved by vibratory mechanical tamping.

D. When specified the trench shall be backfilled full depth with VDOT 21A aggregate.

E. When specified the trench shall be backfilled from 6” above the pipe to the bottom of the pavement repair detail with VDOT Flowable Fill.

F. Excavation depressions caused by removal of stumps or other clearing operations to firm subgrade shall be filled with clean earth fill and compacted as specified.

G. Place backfill materials adjacent to structures evenly. Take care to prevent wedging action of the backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift.

H. Compact backfill materials using equipment suitable for the materials being compacted and the work area locations. Use power-driven hand tampers for compacting materials adjacent to structures.

I. Compact aggregate fill placed under manholes or other structures to required density.

104.3.8 Grading

A. Uniformly grade all areas within the limits designated on the Drawings, including adjacent transition areas.

B. Finish all surfaces to be free from irregular changes.

C. Finish subgrade areas to receive topsoil to within 0.10 foot of required subgrade elevations.

D. Shape subgrade under walks to line, grade, and cross-section to within 0.10 foot of required subgrade elevations.

E. Shape subgrade under pavement to line, grade, and cross-section to required subgrade elevations.

F. Protect newly graded areas from traffic and erosion. Repair and reestablish grade in settled, eroded, or rutted areas to the specified tolerances.

G. Where compacted areas are disturbed by subsequent construction or adverse weather scarify the surface, reshape and compact to the required density. Use hand tamper for re-compaction over underground utilities.

104.3.9 Utilities to be Abandoned or Removed

A. When underground utilities are to be abandoned in place, plug, cap or seal with concrete at the "construction limits" or at points shown.

B. Remove underground utilities indicated on the Drawings to be removed and backfill resulting excavation with suitable material compacted as specified. Plug, cap or seal utilities with concrete, at the construction limits or at points shown.

104.3.10 Clean Up

A. Keep areas of work cleaned up at all times, and promptly remove all materials and debris not intended for incorporation in the work. Broom clean the surfaces of all paved areas immediately after backfilling operations.

B. Maintain backfilled trenches from the nuisance of dust, mud or settling during the entire length of the Contract and for a period of one-year following Final Acceptance of the Work.

C. In the event the Contractor fails to satisfy these requirements to the satisfaction of the City, or otherwise prosecute the Work in a reasonable or proper manner, and after a reasonable period of time has elapsed after notification by the City of unsatisfactory conditions, the City reserves the right to employ outside services to take such corrective action as deemed necessary by the City Engineer. The cost incurred in taking corrective actions will be deducted from any monies due the Contractor by the City or such other means of collection as may be available to the City.

104.3.11 Preparation for Final Inspection

A. Locate and adjust all manholes, valve boxes, etc. to final grade and flush out all gravity pipelines as necessary prior to final inspection by the City Engineer.

104.4 MEASUREMENT AND PAYMENT

104.4.1. Excavation - Excavation for utility work is incidental to all other work. No separate payment is made.

104.4.2. Rip Rap - When specified as a separate bid item, rip rap will be paid for by the ton or square yard for the Class specified.

104.4.3. Backfill - When there is not enough suitable backfill material on site, VDOT 21A Aggregate shall be used and paid for by the ton. Otherwise there is no separate payment for backfill.

END OF TRENCHING & BACKFILLING FOR UTILITIES

SECTION 105
ROCK EXCAVATION

105.1 DESCRIPTION OF WORK

105.1.1 Furnish all labor, material and equipment to excavate rock and dispose of rock as specified herein.

105.2 REQUIREMENTS OF REGULATORY AGENCIES

105.2.1 Observe all municipal ordinances and State and Federal laws relating to the transportation, storage, handling and use of explosives.

105.2.2 Blasters shall be duly licensed and shall have their license on the work site at all time during blasting activities.

105.3 DEFINITION

105.3.1 The word "rock," wherever used as the name of an excavated material or material to be excavated, shall mean solid ledge rock which, in the opinion of the City Engineer, requires, for its removal, drilling and blasting or mechanical hammer.

105.3.2 No soft or disintegrated ledge rock, no loose, shattered, or broken stone, regardless of size, in rock fills or elsewhere; no frozen earth or existing paving; and no rock exterior to the maximum limits of measurement allowed, which may fall into the excavation, will be measured or allowed for payment as rock excavation.

105.4 EXECUTION

105.4.1 Excavate rock to the lines and grades indicated on the drawings and as specified in 105.6 - Measurement and Payment. Dispose of excavated material not suitable for backfill in a location approved by the Owner.

105.4.2 Excavate rock in trenches to 6-inches below the bottom of the pipe to be installed.

105.4.3 Excavate rock in structure excavations to 6" below the bottom of the foundation.

105.4.4 Conduct operations involving explosives by experienced personnel only, with all possible care to avoid injury to persons and damage to property.

105.4.5 Blast only with such quantities and strengths of explosives and in such manner as to break the rock approximately to the intended lines and grades.

105.4.6 Care shall be taken to avoid excessive cracking of the rock upon or against which any pipe or structure will be built, and to prevent damage to existing pipes or other structures and property above or below ground.

105.4.7 Cover rock with blasting mats where required.

105.4.8 Give sufficient warning to all persons in the vicinity of the work before a charge is detonated. Employ flagmen to stop or direct traffic as required.

105.4.9 When required by the City, the contractor shall have a seismograph on site to monitor vibration.

105.5 EXCESS ROCK EXCAVATION

105.5.1 If rock is excavated beyond the limits of excavation indicated on the drawing, specifications, or not authorized in writing by the Engineer, the excess excavation, whether resulting from over breakage or other causes, shall be backfilled, by and at the expense of the Contractor, as specified below.

105.5.2 In pipe trenches, excess excavation below 6" from the bottom of the pipe shall be filled with material of the same type, placement and compaction as specified for the bedding.

105.5.3 In excavations for structures, excess excavation in the rock beneath foundations shall be filled with 3,000 psi concrete. Other excess excavation shall be filled with earth.

105.5.4 If rock below normal depth is shattered due to drilling or blasting operations and such shattered rock is unfit for foundations, the shattered rock shall be removed and the excavation shall be backfilled as described in "EXCESS ROCK EXCAVATION." All such removal and backfilling shall be classified as excess rock excavation.

105.5.5 Keep and submit to the Engineer an accurate record of each blast. The record shall show the general location of the blast, the depth and number of drill holes, the kind and quantity of explosive used, and other data required for a complete record.

105.6 MEASUREMENT AND PAYMENT

105.6.1 When excavation is not Unclassified, the following shall apply; otherwise no additional payment for rock excavation shall be made. The contractor shall notify the owner when rock measurements can be performed. If backfill commences before measurement is made, the contractor will not be paid for that portion of the rock removed. Maximum measurement for rock excavation in pipe trenches shall be to six (6) inches below bottom of pipe with the width of trench at 2'-0" plus the interior diameter of pipe, regardless of the excess width excavated. Maximum measurement for precast and cast-in-place structures shall be structure width plus four (4) feet; structure length plus four (4) feet; and base of structure. Payment shall be the price bid per cubic yard and is to include aggregate fill to bring the ditch to plan grade.

END OF ROCK EXCAVATION

SECTION 106
SEEDING

106.1 GENERAL

106.1.1 Related requirements specified in other Sections of the Specifications:

Section 104 - Trenching & Backfilling

106.1.2 Reference Specifications are referred to by abbreviation as follows:

American Society for Testing and Materials – ASTM

Virginia Department of Transportation – VDOT

106.1.3 Submit two copies of the following:

A. Seed Test Report

B. Fertilizer Analysis

106.1.4 Materials shall be delivered in unbroken containers, clearly marked by the manufacturer as to contents. Seed, lime, and fertilizer shall be labeled as to proportions, analysis and quality. Store all materials in a manner affording protection from damage by weather or vandalism.

106.1.5 Seed only when wind velocity is less than 15 miles per hour.

106.2 PRODUCTS

106.2.1 Topsoil shall be the top 4 inches or original soil from the site, unless otherwise noted on the Drawings. Topsoil obtained off-site shall be fertile, friable loam or silt, containing not less than 2 pct., by weight, of finely divided, decomposed vegetable matter. Topsoil shall be free of subsoil, clay lumps, brush, weeds, roots larger than ½ inch diameter, stones larger than ½ inch diameter and other material toxic or harmful to growth.

106.2.2 Fertilizer shall be 5-10-5 applied at 1000 pounds per acre.

106.2.3 Seed mixture shall be 40% lawn fescue, 40% lawn bluegrass, 10% annual rye grass and 10% white Dutch clover applied at 5 pounds per 1000 square feet unless otherwise specified.

106.2.4 Lime shall be ground agricultural grade lime containing not less than 85 pct. calcium and magnesium carbonates. Fineness shall be such that 100 pct. will pass a No. 20 sieve, not less than 50 pct. will pass a No. 100 sieve. Burnt lime or hydrated lime may be substituted in equivalent carbonates, if requested.

106.2.5 Mulch shall be clean, seed free, loose, unweathered, unchopped small grain straw. Spray mulch of an approved wood cellulose fiber material that is in

accordance with the Virginia Department of Transportation (VDOT) specifications shall be accepted.

106.2.6 Sod shall be composed of at least 70 pct. of Kentucky 31 tall fescue and be cut to provide a minimum thickness of 2 inches. Vegetation more than 5 inches in height shall be cut to 3 inches or less before sod is lifted.

106.3 EXECUTION

106.3.1 Prepare soil for permanent seeding by tilling of topsoil in place to loosen thoroughly and break up all clods to a depth of 6 inches. Remove all stumps and roots, coarse vegetation, stones larger than 1-1/2 inches and all construction debris. Soil shall be worked by suitable agricultural equipment to a depth of not less than 4 inches. Rake to a uniform, smooth and drainable surface.

Apply lime and fertilizer uniformly and mix well into top 4 inches of seed bed. Apply lime at the rate of 100 lbs. per 1000 sq. ft. Apply fertilizer at the rate of 50 lbs. of 5-10-5 per 1000 sq. ft.

106.3.2 Sow permanent grass seed between dates of March 15 and May 31 or August 15 and October 31st unless otherwise approved. Temporary seeding and/or mulching is required at all other times.

106.3.3 Sow seed by mechanical seeder as follows:

A. Mix seed thoroughly with clean dry sawdust and broadcast at rate of 5 lbs. of seed per 1000 sq. ft. in cross directions to ensure uniform distribution. Rake surface lightly and roll with appropriate type of lawn roller weighing maximum of 150 lbs. per foot of width.

B. Protect the complete seeded area against erosion by mulching with straw at a rate of one (1) bale per 1000 square feet or by spray mulching with a wood cellulose fiber material applied by hydro-jet method at a rate of 35 pounds (dry weight) per 1000 square feet, in accordance with the VDOT Standard method.

C. Anchor mulch by the following methods.

(1) In residential areas, apply synthetic mulch binder at rate recommended by manufacturer.

(2) On slopes steeper than 4 horizontals to 1 vertical, fasten heavy jute mesh to wooden stakes.

106.3.4 Remove all soiling or staining of finished walks, drives and parking area resulting from seeding work. Maintain paved areas in clean condition.

106.3.5 Turf grass Maintenance

A. Water as required to keep soil moist during germination period.

B. Mowing

(1) When grass reaches height of 3-1/2 to 4 inches, mow to height to 2-1/2 inches.

(2) Maintain grass height between 2-1/2 and 4 inches.

(3) Do not remove more than 33 pct. of total height of grass in one mowing.

C. Reseed and mulch spots larger than 1 square foot without uniform stand of grass.

D. Mow and maintain all seeded areas until uniform stand of grass is acceptable to Engineer.

E. In the event that growth is not established by final project inspection, continue the specified attention until stand is accepted by Engineer.

F. Correct or repair all undue settling as evidence by complaints received within one year after final inspection.

106.4 HYDROSEEDING

106.4.1 The Contractor may elect the use of approved hydraulic seeder (s) for the application of seed and mulch.

106.4.2 Hydraulic applications shall not begin until the topsoil preparation and the lime application has been completed, as specified herein. The method shall be in accordance with VDOT specifications.

106.4.3 Hydraulic Seeder(s) shall be equipped with an agitation system capable of maintaining all mixture solids in complete suspension and shall be equipped with spray nozzles that produce an even distribution.

106.4.4 Wood Fiber Mulch shall consist of specially prepared wood cellulose fibers. Mulch shall not contain growth or germination inhibiting factors. Mulch shall be dyed an appropriate color to facilitate visual detection during application.

106.4.5 Slurry mix for hydro seeding shall supply the following rates per acre:

Kentucky 31 Tall Fescue (100%) or,	32 pounds
Kentucky 31 Tall Fescue (67%) and,	21.5 pounds
Red Creeping Fescue (33%)	10.5 pounds
Fertilizer 10-20-10	1,000 pounds
Wood Fiber Mulch, or	1,500 pounds
Straw tacked with,	3,000 pounds
Wood Fiber	750 pounds

106.5 INSPECTION AND ACCEPTANCE

106.5.1 At the beginning of the next planting season after that in which the permanent grass crop is sown, the seeded areas will be inspected. Any section not showing dense, vigorous growth at that time shall be promptly reseeded by the Contractor at his own expense. The lawns shall be watered, weeded, cut and otherwise maintained until the end of that planting season, when they will be accepted.

106.6 MEASUREMENT AND PAYMENT

106.6.1 Topsoil and Seeding. Measurement and payment shall be per acre or lump sum as listed on the Bid Schedule. When there is no topsoil and seeding bid item the work is considered incidental to other associated work items.

106.6.2 Sod – when specified sod shall be paid for by square foot.

106.6.3 Maintenance – There shall be no separate payment for maintenance of seeded or sodded areas.

END OF SEEDING

SECTION 107
SANITARY SEWER SYSTEM

107.1 GENERAL

Work included in this Section consists of all gravity sanitary sewers, force mains, manholes, valves, air vents and all related equipment or material as indicated on the construction plans.

107.1.1 Related requirements specified in other Sections of the Specifications:

A. Section 103 - Site Clearing

B. Section 104 - Trenching & Backfilling

C. Section 105 - Rock Excavation

D. Section 106 – Seeding

E. Section 109 - Water Distribution System

107.1.2 Reference Specifications are referred to by abbreviation as follows:

A. American National Standards Institute – ANSI

B. American Society for Testing and Materials – ASTM

C. American Water Works Association – AWWA

D. American Railway Engineering Association - AREA

107.2 PRODUCTS

107.2.1 Submit shop drawings on all products as required by City.

107.2.2 Provide certified test results of pipe testing.

107.2.3 Non-reinforced concrete pipe, fittings and specials in sizes 6 in. through 10 in. shall meet requirements of ASTM C14 Class 2. Pipe ends shall have O-ring gasket groove provided during manufacturing process.

A. Rubber gaskets and joints of concrete pipe shall meet requirements of ASTM C361.

B. Pipe and joints shall be tested in accordance with Section 9 of ASTM C14 and ASTM C443 with test reports submitted to the Engineers.

107.2.4 Reinforced concrete pipe in sizes 12 in. and larger shall meet requirements of ASTM C76 for the class shown on the Drawings. Pipe end shall have O-ring gasket groove provided during manufacturing process.

A. Rubber gaskets and joints of concrete pipe shall meet requirements of ASTM C361.

B. Pipe and joints shall be tested in accordance with Section 9 of ASTM C14 and ASTM C443 with test reports submitted to the Engineers.

107.2.5 Polyvinylchloride (PVC) non pressure pipe and fittings shall meet requirements of ASTM D3034 type SDR-35 for 4" - 15" diameter pipe with elastomeric gasket joints. PVC Pipe 18" and larger must have prior approval from the City. All PVC pipe shall have a smooth interior and exterior wall. Fittings and saddles shall be by the same manufacturer of the pipe.

107.2.6 Conduits of non-ferrous material buried underground shall have a detectable tracer buried in the trench approximately 18 inches above the conduit, but no less than 24 inches below grade. Detectable tape shall have a metallic core, 14 gage or larger, protected by a plastic jacket. The tape shall be continuously marked indicating that a sewer line is buried beneath the tape. Copper wire, 14 gage or larger.

107.2.7 Ductile iron pipe shall meet requirement of AWWA C151 for the pressure and thickness classes shown on the Drawings. Pipe shall have cement-mortar lining and a bituminous seal coat. Thickness shall meet requirements of AWWA C150.

107.2.8 Cast iron and ductile iron fittings shall meet requirements of AWWA C110 or AWWA C153 for the pressure ratings indicated on Drawings. Fittings shall have cement-mortar lining and a bituminous seal coat.

107.2.9 Mechanical joints and jointing materials shall meet requirements of AWWA C111.

A. Mechanical joint retainer glands shall meet requirements of AWWA C111. Retainer gland shall be fitted with set screws.

B. Metal harness shall be galvanized rods and clamps as detailed on Drawings.

107.2.10 Push-on joint and rubber gasket shall meet requirements of AWWA C111.

107.2.11 Flanged joints for ductile iron pipe shall meet requirements of ANSI B16.1.

107.2.12 Flanged joint gaskets shall be full face, made of 1/16 in. thick rubber, and shall meet requirements of ANSI B16.21.

107.2.13 Cement mortar lining with bituminous seal coat for cast iron pipe and fittings or ductile iron pipe shall meet requirements of AWWA C104. Cement mortar lining shall be standard thickness.

107.2.14 Exterior, bituminous coating for cast iron and ductile fittings and ductile iron pipe shall meet requirements of AWWA C106 or AWWA C151 as applicable.

107.2.15 When specified, steel casing pipe for boring or jacking or open cutting under highways and railroads shall meet the requirements of ASTM A139, Grade B. Nominal pipe diameter shall be as indicated on the Drawings. Wall thickness shall be a minimum 0.375". No protective coating or lining will be required. The carrier pipe shall be supported by full diameter, mechanically adjusted spacers, 8" on center.

107.2.16 Manholes

A. Precast reinforced concrete manholes shall be constructed in accordance with Standard Drawings for the type and size of manhole indicated on the Drawings.

B. Provide tongue and groove joints in manhole sections with a pre-formed groove in the tongue for placement of an O-ring type round, rubber gasket.

(1) Gasket shall comply with requirements of ASTM C443.

(2) Gasket shall provide the sole element in sealing the joint from either internal or external hydrostatic pressure.

C. Liners for acid-resistant manholes shall be of fiberglass reinforce polyester or polyvinylchloride construction and shall be installed to protect the precast manhole sections from the inside base of the manhole to the base of the manhole frame.

(1) FRP liners shall consist of 3/16 in. thick fiberglass reinforced polyester with a 15 mil gel coat interior surface. The polyester resin shall be similar to Dion No. 6694. Joints between sections of the liner shall be sealed with joint sealant.

(2) PVC liners shall consist of polyvinylchloride plates, not less than 0.060 in. thick, with integral bonding ribs and shall be similar to Amercoat "T-Lock Amer-Plate." Joints between sections of liner shall be welded in accordance with the manufacturer's instructions.

D. Manhole steps shall be corrosion-resistant and shall be one-inch square cast iron, rubber-covered steel or aluminum. The steps shall conform to the dimensions shown in Standard Drawings.

E. Manhole frames and covers shall be molded of gray cast iron conforming to ASTM A48, Class 30. Castings shall be coated with a coal tar pitch varnish, to which sufficient oil has been added to make a smooth coating, tough and tenacious when cold, but not tacky or brittle. Seating surfaces between frame and cover shall be machined. The dimensions and weights shall conform to the requirements shown in Standard Drawings. Frames and covers to be set in the street shall be set flush with the finished road surface.

F. Flow Lines - The minimum depth of flow channel shall be equal to 3/4 the diameter of the largest sewer in the manhole to which it connects. The channel shall be graded to give a smooth, uninterrupted flow through the manhole. Bench walls shall be pitched a minimum of 1 inch per foot from the inside periphery of the manhole to the edge of the flow channel.

G. Connections to manholes shall be with boot type flexible connectors cast in the manhole. Any relocated or additional connections to a manhole will be by core drilling the manhole wall and installing the flexible boot by an approved expanding mechanism. The connector shall be the size specifically designed for the pipe material and the size being used on the project. Pipe connector shall be by Press Seal Gasket Corporation or approved equal.

107.2.17 Plug valves.

A. Plug valves shall be the non-lubricated eccentric type with resilient faced plugs. The port area shall be at least 80 percent of the full pipe area. Bodies shall be cast iron with welded in nickel, raised seats. Valves shall have permanently lubricated corrosion resistant bearings in the bonnet and body.

B. Packing and packing glands shall be accessible without having to disassemble valves. Packing shall be adjustable.

C. Valves shall have resilient plug facings suitable for the service intended and shall provide dead-tight shutoff. Opening the valve shall cause the plug to be raised off the seat without scraping the seat or body walls.

D. Plug valves shall be gear operated, unless otherwise shown or specified, and shall open counter-clockwise.

E. Plug valves located inside the pumping station shall be provided with hand wheel actuators complete with valve position indicators.

F. The maximum pull required on manual operators shall be 40 pounds.

G. Plug valves for direct buried service shall be provided with right angle worm gear operators. Buried valves shall be provided with adjustable cast-iron valve boxed and extension stems to grade.

H. A tee wrench shall be provided for operation of the buried valve.

I. Inside iron or steel surfaces of valves and exterior surfaces of valves which are to be buried in the ground shall be given two coats of asphalt varnish meeting the requirements of Fed. Spec. TT-V-51a. Exterior iron or steel surfaces of other valves shall be painted as specified for the pipelines in which they are installed.

J. Plug valves shall be Series 100 eccentric valves as manufactured by Dezurik, or equal.

107.2.18 Cleanout cover

A. Traffic bearing cleanout covers shall be 12” diameter, Neenah Foundry R-1791-A or equivalent.

107.3 EXECUTION

107.3.1 Take all precautions necessary to insure that pipe, valves, fittings, and related items are not damaged in unloading, handling and placing in the trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.

A. Keep pipes clean. Exercise care to keep foreign material and dirt from entering pipes during storage, handling and placing in trench. Close ends of in-place pipe at the end of any work period to prevent entry of animals and foreign material.

B. Bed pipe as specified in Section 104 - Trenching & Backfilling.

C. Do not lay pipe when weather or trench conditions are unsuitable.

D. Separation of sanitary sewer lines and water lines shall be in accordance with Virginia Department of Health Regulations.

107.3.2 Lay gravity sewers so as to maintain a true alignment and grade as indicated on Drawings. After completion, the pipe shall be videotaped and recorded for its entire length using a self-propelled camera specifically designed for this service. Reference Section 114 “Television Inspection for Sewer Mains”.

A. Commence laying gravity sewers at the lowest point on a section of line and lay pipe with the bell ends uphill.

B. Pipe Joint. Preparatory to making pipe joints on gravity sewer lines, clean and dry all surfaces of joint pipe and jointing material. Use lubricants, primers, adhesives and similar materials as recommended by the manufacturer. Place, fit, join and adjust the jointing materials or factory fabricated joints as recommended by the manufacturer to obtain the degree of water tightness required. As soon as possible after the joint is made, place sufficient backfill material, as specified under Section 104 - Trenching and Backfilling, along each side of the pipe to resist forces that might tend to move the pipe off line and grade.

Damaged joints or pipe shall be repaired with a solid nonflexible water tight coupling.

C. Complete backfilling as specified under Section 104 - Trenching & Backfilling. Place backfill over the pipe immediately after the pipe has been laid.

107.3.3 Install force main with a minimum depth of cover of 42 in. over the top of the pipe, where no grades are shown on the Drawings.

A. Where grades on the force main conflict with existing pipes or structures, lay force main to additional depth with a uniform vertical curve to provide proper clearance without the use of fittings. No additional payment will be allowed for additional excavation.

B. Lay force main pipe with bell ends facing the direction of laying. Where grade is 10 percent or greater, pipe shall be laid uphill with bell ends upgrade.

107.3.4 Joining Pipe

A. Joining Mechanical Joint Pipe

(1) Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating and other foreign matter from the joint. Paint the bell and spigot with a soap solution (half cup granulated soap dissolved in one (1) gallon water). Slip the cast-iron gland on the spigot end with the lip

extension of the gland toward the end of the pipe. Paint rubber gasket with or dip into the soap solution and place it on the spigot end with thick edge toward the gland.

(2) Push the spigot end forward to seat in the bell. Then carefully press the gasket into the bell so that it is located evenly around the joint. The gland is moved into position, bolts are inserted and nuts screwed up finger tight; then tighten all nuts to torque listed below.

Bolts Size - Inches	Torque Foot-Pounds
5/8	40-60
3.4	60-90
1	70-100
1 1/4	90-120

(3) Tighten nuts on alternate sides of the gland until pressure on the gland is equally distributed.

(4) Permissible deflection in mechanical joint pipe shall not be greater than listed in AWWA C600.

B. Joining push-on joint pipe as follows:

(1) Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter. Flex the rubber gasket and insert it in the gasket recess of the bell socket. Apply a thin film of gasket lubricant supplied by the pipe manufacturer, to either the gasket or the spigot end of the joining pipe.

(2) Start the spigot end of the pipe into the socket with care. The joint shall then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack type device. Field cut pipe shall have the end filed to match the manufactured spigot end.

(3) Permissible deflection in push-on joint pipe shall not be greater than 2/3 of that allowed in AWWA C600.

C. Joint reinforced concrete pipe with rubber gaskets installed as recommended by the manufacturer.

107.3.5 Provide reaction anchors of concrete blocking, metal harness or retainer gland type at all changes in direction of pressure pipelines and as shown on the Drawings.

A. Concrete reaction anchors shall bear against undisturbed earth and shall be of the size and shape indicated on the Drawings.

B. Use metal harness restraints as indicated on Drawings.

107.3.6 When specified encase sewer pipe lines crossing under highways and railways in a larger pipe or conduit used as a casing pipe. Joining of steel casing pipe shall meet requirements of AWWA C206. Install casing pipe by jacking, boring or open cut if permitted. The carrier pipe shall be supported by full diameter, mechanically adjusted spacers, 8’ on center.

The installation shall meet AREA requirements for installation of pipe lines carrying nonflammable substances under railway tracks. Brick up casing pipe ends so as to protect against foreign matter but do not tightly seal. Prior to beginning work, notify the Railroad or Street Department.

107.3.7 Construct service connections from sewer main to property line as follows:

A. Place a tee fitting with 4 or 6-inch outlet in the sewer where service connection is to be constructed. Lay pipe from the tee to the property line on a grade of not less than 1/4 inch per foot. Close the service connection at the property line with a water-tight clean out plug left 2' above finished grade. Provide a water tight plug at the end of the service line.

B. Install service connections on existing sewer mains with a compression type cast iron saddle as manufactured by Romac or approved equal. Secure saddle to the pipe with a 24-gauge stainless steel strap and two nickel-bronze T bolts. Make connections of this type by machine tapping or cutting the pipe. Use mastic sealer type gasket to insure a water-tight connection.

C. Service connections from manholes shall be ductile iron or PVC pipe.

D. Determine the depth of service connection by the deepest of the following criteria:

(1) Provide 5-foot cover at the edge of the road paving or 15 feet from the center line of the street.

(2) Provide 12 inch cover at the bottom of highway ditches.

(3) Provide 5-foot cover at the property line when property is above street.

(4) Provide depth necessary for a 1 percent grade if required to provide service to a property.

107.3.8 Install detectable tracer wire in utility trench above all non-metallic pipes in accordance with manufacturer's recommendations. Install tape approximately 12 to 18 inches above the pipe, not less than 24 inches nor more than 54 inches deep along the side of the trench, in such a manner as not to be broken or otherwise damaged during backfilling or compacting operations. A 14-gauge copper wire shall be installed with all non-metallic pipe and attached to fittings in addition to metallic tape installed above the pipe,

107.4 TESTING

107.4.1 Testing gravity sewer lines and manholes:

A. Sanitary sewer lines 24-inch diameter and smaller shall be tested after backfill using a low-pressure air test in accordance with ASTM C828. Sewer lines larger than 24-inch diameter shall be tested by infiltration or exfiltration as hereinafter detailed. All sewer lines and manholes shall also be tested for final acceptance, using either the infiltration or exfiltration method as directed by and in the presence of the City Engineer. Tests shall be conducted on short sections of sewer line, i.e., between manholes, and/or at the end of each day's work. Provide all labor, materials, tools and equipment necessary to make the tests. All equipment and methods used shall be acceptable to the Engineer. All monitoring gauges shall be subject to City calibration, if deemed necessary by the City Engineer.

B. All main lines shall have a television inspection performed in accordance with section 114 of the City of Staunton Design and Construction Standards, and any applicable NASSCO standards.

C. Low-pressure air test:

(1) Summary of Method: Plug the sections of the sewer line to be tested. Introduce low-pressure air into the plugged line. Use the quantity and rate of air loss to determine the acceptability of the section being tested.

(2) Preparation of the sewer line: Flush and clean the sewer line prior to testing, in order to wet the pipe surface as well as clean out any debris. A wetted interior pipe surface will produce more consistent results. Plug all pipe outlets using approved pneumatic plugs with a sealing length equal to or greater than the diameter of the line being tested to resist the test pressure. Give special attention to laterals.

(3) Ground Water Determination: Install a 1/2 inch capped galvanized pipe nipple, approximately 12 inches long, through the manhole on top of the lowest sewer line in the manhole. Immediately prior to the line acceptance test, the ground water elevation shall be determined by removing the pipe cap and blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic hose to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in the plastic hose.

(4) Procedures: Determine the test duration for the section under test by computation from the applicable formulas shown in ASTM C828. The pressure-holding time is based on an average holding pressure of 3 psi gauge or a drop from 3.0 psi to 2.5 psi gauge.

Add air until the internal air pressure of the sewer line is raised to approximately 3.5 psi gauge. After an internal pressure of approximately 3.5 psig is obtained, allow time for the air pressure to stabilize. The pressure will normally show some drop until the temperature of the air in the test section stabilizes.

When the pressure has stabilized (5-minute minimum) and is at or above the starting test pressure of 3.0 psi gauge, commence the test. Before starting the test, the pressure may be allowed to drop to 3.0 psig. Record the drop in pressure for the test period. If the pressure has dropped more than 0.5 psi gauge during the test period, the line shall be presumed to have failed. The test may be discontinued when the prescribed test time has been completed even though the 0.5 psig drop has not occurred.

The test procedure may be used as a presumptive test which enables the installer to determine the acceptability of the line prior to backfill and subsequent construction activities.

If the pipe to be tested is submerged in ground water, the test pressure shall be increased to 1.0 psi for every 2.31 feet the ground water level is above the invert of the sewer.

(5) Safety: The air test may be dangerous if, because of lack of understanding or carelessness, a line is improperly prepared. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts.

As a safety precaution, pressurized equipment shall include a regulator or relief valve set at perhaps 10 psi or less to avoid

over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

D. Manhole Tests

(1) Manholes shall be tested by vacuum test, after assembly but prior to backfilling. Test shall comply with ASTM standard C1244, latest revision. Manholes shall be tested by vacuum, only if constructed of precast concrete. Testing shall include the joint between the concrete cone and spacer ring.

(2) Stub outs, manhole boots and pipe plugs shall be secured to prevent movement while vacuum test is drawn.

(3) Installation and operation of vacuum equipment and indicating devices shall be in accordance with equipment specifications for which performance information has been provided by the manufacturer and approved by the Virginia State Department of Health.

(4) A measured vacuum of 10 inches of mercury shall be established in the manhole. The time for the vacuum to drop to nine inches of mercury shall be recorded.

(5) Acceptance standards for leakage shall be established from the elapsed time for a negative pressure change from 10 to 9 inches of mercury. The maximum allowable leakage rate for a four-foot diameter manhole shall be in accordance with the following:

Manhole Depth	**Minimum Elapsed Time for a Pressure Change of 1 Inch Hg**
10ft. or less	60 seconds
>10ft. but <15ft.	75 seconds
>15ft. but <25ft.	90 seconds

For manholes five feet in diameter, add an additional 15 seconds and for manholes six feet in diameter, add an additional 30 seconds to the time requirements for four-foot diameter manholes.

(6) If the manhole fails the test, necessary repairs shall be made and the test repeated one time.

(7) If a manhole fails the second test or if the joint mastic is completely pulled out during the vacuum test, the manhole shall be disassembled and the mastic replaced

E. Test for leakage of gravity sewers using either the infiltration or exfiltration test. Allowable leakage shall be 100 gallons per inch of pipe diameter per mile per 24 hours up to a maximum of 2,400 gallons per mile per 24 hours.

(1) Use the infiltration test when ground water is at least 4 feet above pipe crown along entire length of line to be tested. Plug the pipe at the upper manhole. Install a suitable measuring device at the next lowest manhole. Measure the amount of water flowing through the outlet after flow has been stabilized.

(2) Ground water determination: Use same procedure as "low pressure air test" above.

(3) Use the exfiltration test when ground water is less than 4 feet above the pipe crown. Plug the pipe at the lower manhole. Fill the line and the manhole to 4 feet above pipe crown or top of the manhole whichever is less. Let the water stand until pipe has reached maximum absorption and until all trapped air has escaped, 4-hour minimum. After maximum absorption is reached, refill the manhole to original level. After 30 minutes, record difference in level and convert to gallons. Subtract the manhole loss to obtain pipe line loss. Manhole loss is found by plugging inlet and out let and filling manhole with water to 4 feet above pipe crown or top of manhole whichever is less. Let water stand one hour to reach maximum absorption. Refill to the original level. After 30 minutes, check difference in the level and convert to gallons. Manhole leakage shall not exceed 1/2 gallon per hour.

107.4.2 Force Main tests shall be as follows:

A. Supply the pumps, water, calibrated gauges and meters, and all the necessary apparatus. Notify the City Engineer at least 48 hours in advance of the test date and perform tests in presence of the City Engineer.

B. Hydrostatic pressure test. After the line has been backfilled and at least seven days after the last concrete anchor block was poured, a hydrostatic pressure test shall be performed. Carefully fill the system with water at a velocity of approximately 1 foot per second while necessary measures are taken to eliminate all air. After the system has been filled, raise the pressure by pump to 50 psi above working pressure indicated on Drawings. Measure pressure at lowest point in system with gauge

compensated for elevation maintain this pressure for at least two hours. If pressure cannot be maintained determine the cause; repair and repeat the test until successful.

C. A leakage test shall be conducted concurrently with the pressure test. Leakage shall be determined with a calibrated test meter, furnished by the Contractor. Leakage is defined as the quantity of water required to maintain a pressure within 5 psi of the specified test pressure after air has been expelled and the pipe filled with water. Leakage shall not exceed 10 gallons per day per mile per inch of diameter. If leakage exceeds that specified, find and repair the leaks and repeat the test until successful.

D. All visible leaks shall be repaired regardless of the amount of leakage.

107.5 MEASUREMENT AND PAYMENT

107.5.1 Sewer Line - Pipe measurement shall be parallel to the pipe including the lengths occupied by appurtenances. The bid price is to include all excavation, bedding and backfill as shown on the plans or standard drawings. Payment shall be per linear foot for the size and type specified. When indicated on the Bid Schedule, payment will be per linear foot for the size and type specified.

107.5.2 Service Line - Pipe measurement shall be parallel to the pipe including the length occupied by appurtenances. The bid price is to include excavation, bedding, backfill, and any intermediate bends and cleanouts. Payment shall be per linear foot for the size and type specified.

107.5.3 Service Connection - Service connections shall be paid per each for the size specified. The bid price is to include all excavation bedding, backfill, saddles, sleeves, coupling, cleanout and other appurtenances necessary for a complete service connection.

107.5.4 Manhole - Manhole measurement will be from the bottom of the frame and cover to the flow line. The bid price is to include the manhole, steps, invert, flexible boot and any excavation and backfill required to complete installation. Payment will be per vertical foot.

107.5.5 Manhole Frame and Cover - this will be measured and paid for per each for the type specified (Standard or Watertight).

107.5.6 Drop Manhole - Measurement and Payment will be by the vertical footage the pipe drops. This is in addition to the vertical foot cost of the manhole.

END OF SANITARY SEWER SYSTEM

SECTION 108
STORM DRAINAGE SYSTEM

108.1 GENERAL

All materials and workmanship in this section shall be installed per the current VDOT Road and Bridge Standards and Specifications and in accordance with Title 13 of Staunton's City Code and the current Virginia Stormwater Management Handbook unless otherwise specified.

108.1.1 Related requirements specified in other Sections of the Specifications:

A. Chapter 8 - General Construction Standards
B. Section 103 - Site Clearing
C. Section 104 - Trenching & Backfilling
D. Section 106 – Seeding
E. Section 107 - Sanitary System (for pipe installation)

108.1.2 Reference Specifications are referred to by abbreviation as follows:

A. American National Standards Institute – ANSI
B. American Society for Testing and Materials – ASTM
C. American Water Works Association – AWWA
D. American Railway Engineering Association - AREA

108.2 PRODUCTS

108.2.1 Submit shop drawings on all products as required by City.

108.2.2 Provide certified test results of pipe testing.

108.2.3 Pipe material shall only be Class III reinforced concrete or corrugated, smooth interior, high density polyethylene (ADS N12 or equal) with bell and spigot joints.

108.2.4 Reinforced concrete pipe is required for the following applications:

A. Over 10' or less than 3' of cover.
B. Subject to velocities over 10 fps.
C. Non-residential streets.
D. Pipe diameter greater than 30".
E. Areas subject to chemical/gasoline leaks.

108.2.5 Manholes

A. Precast reinforced concrete manholes shall be constructed in accordance with Standard Drawings for the type and size of manhole indicated on the Drawings.

B. Provide tongue and groove joints in manhole sections with a preformed groove in the tongue for placement of an O-ring type round, rubber gasket.

(1) Gasket shall comply with requirements of ASTM C443.

(2) Gasket shall provide the sole element in sealing the joint from either internal or external hydrostatic pressure.

C. Manhole steps shall be corrosion-resistant and shall be one-inch square cast iron, rubber-covered steel or aluminum. The steps shall conform to the dimensions shown in Standard Drawings.

D. Manhole frames and covers shall be molded of gray cast iron conforming to ASTM A48, Class 30 and shall be labeled "storm". Castings shall be coated with a coal tar pitch varnish, to which sufficient oil has been added to make a smooth coating, tough and tenacious when cold, but not tacky or brittle. Seating surfaces between frame and cover shall be machined. The dimensions and weights shall conform to the requirements shown in Standard Drawings. Frames and covers to be set in the street shall be set flush with the finished road surface.

E. Flow Lines - All structures shall have flow lines. The minimum depth of flow channel shall be equal to 3/4 the diameter of the largest sewer in the manhole to which it connects. The channel shall be graded to give a smooth, uninterrupted flow through the manhole. Bench walls shall be pitched a minimum of 1 inch per foot from the inside periphery of the manhole to the edge of the flow channel.

108.2.6 Drainage Structures shall be specified on the plans in accordance with VDOT Standards.

108.2.7 Stormwater Management facilities shall be specified on the plans in accordance with Title 13 of Staunton's City Code and the current Virginia Stormwater Management Handbook

108.3 EXECUTION

108.3.1 All pipe shall be installed per the manufacturer's recommendations or as shown on the plans.

108.3.2 Lay gravity storm drains so as to maintain a true alignment and grade as indicated on Drawings. After completion, the pipe shall exhibit a full circle of light when lighted at one manhole and viewed from the next.

A. Commence laying gravity storm drains at the lowest point on a section of line and lay pipe with the bell ends uphill.

B. Pipe Joint. Preparatory to making pipe joints on gravity storm drain lines, clean and dry all surfaces of joint pipe and jointing material.

Use lubricants, primers, adhesives and similar materials as recommended by the manufacturer. Place, fit, join and adjust the jointing materials or factory fabricated joints as recommended by the manufacturer to obtain the degree of water tightness required. As soon as possible after the joint is made, place sufficient backfill material, as specified under Section 104 - Trenching and Backfilling, along each side of the pipe to resist forces that might tend to move the pipe off line and grade.

C. Complete backfilling as specified under Section 104 - Trenching & Backfilling. Place backfill over the pipe immediately after the pipe has been laid.

108.4 TESTING

108.4.1 All lines shall have a television inspection performed in accordance with section 114 of the City of Staunton Design and Construction Standards, and any applicable NASSCO standards.

108.5 MEASUREMENT AND PAYMENT

108.5.1 Storm Drain Pipe - Measurement shall be parallel to the pipe including the lengths occupied by appurtenances. The bid price is to include all excavation bedding and backfill. Payment shall be per linear foot for the size and type specified.

108.5.2 Tees and Bends - Measurement and Payment shall be per each for the size specified.

108.5.3 Manholes - Measurement and Payment shall be per each. The bid price is to include the manhole, steps, invert, flexible boot and any excavation and backfill required for complete installation. There is no separate payment for frame and cover.

108.5.4 Drainage Structure - Measurement and Payment shall be per each. The bid price is to include the structure, steps, invert, flexible boot, all excavation, bedding, backfill and other incidental materials and workmanship. There is no separate payment for frame and cover.

END OF STORM DRAIN SYSTEM

SECTION 109
WATER DISTRIBUTION SYSTEM

109.1 GENERAL

Work in this Section includes all water system piping including all valves, hydrants, fittings, anchors, air vents and other appurtenances or material as indicated on the construction plans

109.1.1 Related requirements specified in other Sections of the Specifications:

A. Chapter 8 - General Construction Standards

B. Section 103 - Site Clearing

C. Section 104 - Trenching & Backfilling

D. Section 106 - Seeding

E. Section 107 - Sanitary Sewer System

109.1.2 Reference Specifications are referred to by abbreviation as follows:

A. American National Standards Institute - ANSI

B. American Railway Engineering Association - AREA

C. American Society for Testing and Materials - ASTM

D. American Water Works Association - AWWA

109.2 EXISTING FACILITIES

109.2.1 Domestic Water Service - It shall be the Contractor's responsibility to maintain water service to residents during the life of this project; however, during different phases of construction, it will be necessary to temporarily disrupt water service. Any disruption of water service shall be to the Owner's approval and the Contractor shall give residents sufficient warning of the disruption.

109.2.2 Abandoned Facilities - The Contractor shall abandon the existing water lines by closing valves, cutting/sleeving lines, removing valve boxes, and plugging the lines as directed by the City or as shown on the plans. The Contractor shall remove abandoned fire hydrants as directed. All salvageable materials will be delivered to the City's storage yard. All work associated with this Article will be considered incidental to the project and will have no separate pay item unless specifically identified on the bid schedule.

109.3 PRODUCTS

Submit shop drawings on all products as required by the City. Provide certified test results of pipe testing.

109.3.1 Ductile iron pipe shall meet requirements of AWWA C151, Class 350. All pipe shall have a cement mortar lining on the interior and a bituminous coating on the exterior. Unless otherwise noted, all joints shall be slip joints.

109.3.2 Copper tubing shall meet requirements of ASTM B88 for Type "L" copper, hard drawn, for above ground and Type "K" hard drawn for below ground.

109.3.3 Polyethylene (PE) Pressure Pipe and tubing shall meet requirements of AWWA C904 and NSF/ANSI 61, 1/2 inch (13mm) through 3 inches (76mm) for Water Service. PE tubing shall be minimum pressure class 200, copper tube size, meeting the requirements pf AWWA C904. Couplings for use in joining gravity pipe of differing materials and/or sizes shall be push on type.

109.3.4 2" thru 3" Water Line - To be galvanized steel pipe, exceeding requirements of ASTMAS3, threaded joint, with malleable iron fittings.

109.3.5 Steel casing pipe for boring, jacking, or open cutting under highways and railroads shall meet the requirements of ASTM A139, Grade B. Nominal pipe diameter shall be as indicated on the Drawings. Wall thickness shall be a minimum of 0.375”: No protective coating or lining will be required.

109.3.6 Fittings shall be ductile iron. Ductile iron fittings shall be in accordance with AWWA C110 or C153. Pressure rating shall be 350 psi All fittings shall be mechanical joint, or mechanical joint plain end unless otherwise approved by the Engineer. All fittings shall have a cement mortar lining on the interior and a bituminous coating on the exterior in accordance with AWWA C104.

109.3.7 Ductile Iron Fittings - To be ANSI & AWWA Specification, cement line, Class 350 with mechanical joints.

A. Mechanical joint retainer glands shall meet requirements of AWWA C111 except that retainer gland shall be modified to accommodate set screws.

B. Locked type mechanical joints may be used where restrained joints are required.

109.3.8 Push-on joint and rubber gasket shall meet requirements of AWWA C111. Restrained push-on joints may be used where restrained joints are required.

109.3.9 Flanged joints for ductile iron pipe shall meet requirements of ANSI B16.1.

109.3.10 Flanged joint gaskets shall be full-face, made of rubber, and shall meet requirements of ANSI B16.21.

109.3.11 Cement mortar lining with bituminous seal coat for ductile iron pipe and fittings shall meet requirements of AWWA C104. Cement mortar lining shall be standard thickness.

109.3.12 Exterior, bituminous coating for ductile iron pipe and fittings and shall meet requirements of AWWA C106 or AWWA C151 as applicable.

109.3.13 Metal harness shall be galvanized rods and clamps as detailed on Drawings.

109.3.14 Detector Check Valves shall be epoxy coated UL and FM approved, hot dipped galvanized cast iron with brass by-pass meter trim. Valves shall be ITT Grinnell/Kennedy Model 1371G, or 1369G Hersey Model EDC, Mueller #4-2133-6, Viking Model E-1, Ames 3000 DCDA 4"-10", Wilkins 950 DA 2-1/2"-10", Grinnell Model B-2 detector check valves, or approved equal.

109.3.15 Gate valves, smaller than 12 inches shall be iron body, nonrising bronze stem and resilient wedge gates meeting the requirements of AWWA C509 or AWWA C515. Valve ends shall be mechanical joint for underground service or flanged for meter vaults and above ground service. Valves shall open counter-clockwise and shall be equipped with a 2-inch square AWWA operating nut. Valves shall be factory tested in accordance with AWWA C509 and upon request the manufacturer shall furnish certified copies of test reports.

A. Valves shall be American Flow Control, Clow, Dresser, Kennedy, Mueller, A.P. Smith, or approved equal meeting this Specification.

109.3.16 Butterfly valves, 12 inches through 24 inches shall be of the rubber-seated tight closing type meeting requirements of AWWA C504, Class 250B.

A. Valve ends shall be mechanical joint in accordance with AWWA C111. Accessories (bolts, glands, and gaskets) shall be supplied by the valve manufacturer.

B. Valve operators shall be of the traveling-nut type, sealed, gasketed and lubricated for underground service. Operators shall be capable of withstanding an input torque of 450 ft. lbs. at full open or closed position, without damage to the valve and valve operators.

C. A rubber seat may be applied to the body or the disc.

D. Valves shall open counter clockwise and shall be equipped with a 2-inch square AWWA operating nut.

E. Valves shall be factory tested in accordance with Section 5 AWWA C504 specification; and upon request, the manufacturer shall furnish certified copies of test reports.

F. Valves shall be American-Darling, Dresser "450", Mueller “Lineseal XP”, Pratt “HP 250II”, or approved equal.

109.3.17 “Hot Tap” valves shall be the equivalent of The Romac 7.00 310-0700010 Quickvalve and sleeve. Valves shall open counter clockwise and shall be equipped with a 2” square operating nut.

109.3.18 Valve boxes shall be 2-piece adjustable screw type, cast iron, Tyler Model No. 562-S or Capitol Foundry Model No. 562-S-HD.

109.3.19 Pressure Reducing Valve.

A. Valves shall be hydraulically operated and shall generally function to reduce high upstream pressure to a preset lower downstream pressure without shock or hammer.

B. The valve body shall be cast iron with 125 lb. flanges. The piston shall be guided above and below the seat. The piston, seat, and guide shall slide on replaceable "leathers." No metal to metal sliding contact will be allowed.

C. The valve body shall be constructed to allow the removal and servicing of all parts without removing the valve body from the water line. An indicator shall be furnished as an integral part of the valve to show piston position within the body.

D. The working pressure (both HIGH PSI and LOW PSI) shall be determined by the Engineer, approved by the City and shown on the Plans. The valve shall be ordered with the PSI specified and the factory shall preset the pilot for the specified pressure.

E. The external pilot (although preset to the specified pressure when shipped from the factory) shall be field adjustable between 40 and 100 PSI.

F. The valve shall be a Cla-Val or approved equal.

109.3.20 Tapping Sleeve and Valves shall be Mueller H-615 tapping sleeve with duck tipped end gasket and H-667 tapping valve open left, or approved equal. The contractor shall provide all material and labor with the exception that the City will use its tapping machine to make the tap. The contractor needs to schedule this service with the City's Utilities Superintendent. An alternate tapping sleeve can be all stainless steel (18-8 type 304) Style FAST as manufactured by Ford Meter Company, or approved equal.

109.3.21 Flexible couplings shall be of gasketed, sleeve type. Each coupling shall consist of a steel middle ring, two steel followers, two rubber compounded wedge section gaskets and sufficient galvanized track, head steel bolts to

properly compress the gaskets. Couplings shall be of the type to match piping in which installed. Couplings shall be manufactured by Dresser Manufacturing Division of Dresser Industries, Smith-Blair, Ford, or approved equal.

109.3.22 Fire Hydrants shall be Mueller "Centurion" Model A-421 or Kennedy "Guardian" with 6" shoe, mechanical joint, two 2 1/2" hose nozzles, or approved equal, and one 4 1/2" pump connection with National Standard outlet threads, left turn open with 1 1/2" pentagon operating nut. Hydrant bury mark to match ground surface. One cubic foot stone pocket to be installed at Hydrant Drain. Hydrants to be painted according to AWWA standards. All paints currently being used are Pittsburg Paints Interior/Exterior Gloss Oil, other equivalent paints are acceptable. The colors and Pittsburg code follows:

Blaze Orange	6-313
Black	6-253
Safety Yellow	6-330
Brilliant Red	6-306
Ivy Green	#7013

109.3.23 Flanged adapters for joining plain-end pipe to flanged items shall be Style 128 or 127 as manufactured by Dresser Manufacturing Division of Dresser Industries or Smith-Blair Type 912 or 913, or approved equal.

109.3.24 Pressure gauges shall be open front case type with bronze bourdon tube soldered to socket and tip, stainless steel movement, and a 4-1/2-inch white coated dial graduated from 0 to 100 psi. Gauges shall be similar to Ashcroft No. 1279.

109.3.25 Concrete Thrust Blocks - Install concrete thrust blocks at all appurtenances except under valves. Concrete to be Class C1-1500 psi using Type I cement. Contractor may use retainer glands in lieu of concrete thrust blocks for 11 1/4 and 22 1/2 bends. The MEGAlug by Ebba Iron, INC., or approved equal, is an acceptable alternate.

109.3.26 Service Connection

A. The Type I service connection shall include corporation stop, water main tap, replacement of meter yoke assembly and box (furnished by the City), connection of service line to both sides of yoke assembly, and connection to the existing service line behind the meter with check valve installed.

B. The Type II connection shall include water main tap, corporation stop, and connection of the service line to the existing service line at its point of connection to the existing water main with a three-part union

or compression coupling. All galvanized service lines encountered shall be treated as a Type I service connection.

C. The Type III Service Connection includes a 1" Corporation Stop, water main tap, splitting the service line with a "Y", placement of two (2) meter yokes assembly and box and connection of service line to both sides of the yoke assembly and connection to the existing service line behind the meter with check valve.

109.4 EXECUTION

109.4.1 Pipe Laying

A. Take all precautions necessary to insure that pipe, valves, fittings, and other accessories are not damaged in unloading, handling, and placing in trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.

B. Exercise care to keep foreign material and dirt from entering pipe during storage, handling, and placing in trench. Close ends of in-place pipe at the end of any work period to preclude the entry of animals and foreign material.

C. Bedding of pipe shall be as specified in Section 104 - Trenching & Backfilling.

D. Do not lay pipe when the trench bottom is muddy or frozen, or has standing water.

E. Use only those tools specifically intended for cutting the size, material, and type pipe involved. Make cuts to prevent damage to pipe or lining and to leave a smooth end at right angles to the axis of the pipe.

F. Lay pipe with bell ends facing the direction of laying. Where grade is 10 percent or greater, lay pipe uphill with bell ends upgrade.

G. Separation of sanitary sewer lines and water lines shall be in accordance with Virginia Department of Health and Regulations.

109.4.2 Joining Mechanical Joint Pipe

A. Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating and other foreign matter. Paint the bell and the spigot with soap solution (half cup granulated soap dissolved in 1-gallon water). Slip cast-iron gland on spigot end with lip extension of gland toward end of pipe. Paint rubber gasket with or dip into the soap solution and place on the spigot end with thick edge toward the gland.

B. Push the spigot end forward to seat in the bell. Then press the gasket into the bell so that it is located evenly around the joint. Move the gland into position, insert bolts and tighten nuts finger tight. Then tighten all nuts to the torque listed below:

Bolt Size - Inches	Torque Foot-Pounds
5/8	40-60
3/4	60-90
1	70-100
1-1/4	90-120

Tighten nuts on the alternate side of the gland until pressure on the gland is equally distributed.

C. Join lock-type mechanical joint pipe according to manufacturer's recommendations.

D. Permissible deflection in mechanical joint pipe shall not be greater than 2/3 of that listed in AWWA C600.

E. Permissible deflection in lock-type mechanical joint pipe shall be as recommended by manufacturer.

109.4.3 Joining Push-On Joint Pipe

A. Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter. Flex the rubber gasket and insert it in the gasket recess of the bell socket. Apply a thin film of gasket lubricant supplied by the pipe manufacturer, to either the gasket or the spigot end of the joining pipe. Start the spigot end of the pipe into the socket with care. Then complete the joint by forcing the plain end of the bottom of the socket with a forked tool or jack-type device. File the end of field cut pipe to match the manufactured spigot end.

B. Join restrained push-on joints according to the manufacturer's recommendations.

C. Permissible deflection in push-on joint pipe shall not be greater than 2/3 of that listed in AWWA C600.

D. Permissible deflection in restrained push-on joint pipe shall be as recommended by the manufacturer.

109.4.4 Setting Valves and Valve Boxes

A. Install valves with operator stems in the vertical plane through the pipe axis and perpendicular to the pipe axis. Locate valves where shown on Drawings. Thoroughly clean valves before installation. Check valves for satisfactory operation before and after installation.

B. Equip all underground valves with valve boxes where shown on the Drawings. Set valve boxes in accordance with Standard Drawings. Set the valve box in alignment with the valve stem centered on the valve nut. Set the valve box to prevent transmitting shock or stress to the valve. Set the box cover flush with the finished ground surface or pavement. PVC extensions shall not be permitted.

109.4.5 Locate Fire Hydrants as shown on Drawings and in accordance with Standard Drawings. The bottom flange of the fire hydrant shall be at finish grade with an acceptable allowance of up to 6” above finish grade.

109.4.6 Provide air and vacuum valves at locations shown on Drawings. Install gate valves between the water main and relief valves. Construct manholes for air and vacuum relief valve as shown on Drawings.

109.4.7 Use sleeves where pipes, valve stem extensions or equipment parts pass through concrete or masonry walls or slabs. Sleeves shall be either cast iron or schedule 40 steel of sufficient size to allow sealing around pipes and clearance for valve stems or equipment. Extend vertical sleeves through slabs 1 inch above top surface.

A. Use cast iron sleeves with intermediate collars to anchor and provide a water stop on outside of sleeves that go through exterior walls below grade.

B. Provide “link-seal" pipe to wall closures manufactured by Thunderline Corp., Wayne, Michigan, or approved equal, where shown on Drawings. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to fill annular space between pipe and wall opening to provide water-tight seal between pipe and wall opening.

109.4.8 Provide reaction thrust blocks as shown on typical details

A. Concrete reaction anchors shall bear against undisturbed earth and shall be of the size and shape shown on the typical details.

B. Use metal harness restraints as shown on Drawings.

C. "Mega-Lug" retainer glands may be used on bends of 22 ½ degrees or less in lieu of a concrete thrust block.

D. Where retainer glands are used, extreme care shall be taken so that each set screw is tightened as recommended by the manufacturer before the pipe is backfilled and tested.

109.4.9 When specified, encase water pipelines crossing under highways and railways in a larger pipe or conduit called a casing pipe. Joining of steel casing pipe shall meet requirements of AWWA C206. Install by jacking, boring or open cut if permitted. The carrier pipe shall be supported by full diameter, mechanically adjusted spacers, 8' on center. The installation shall meet requirements of AREA Standards for installation of pipelines carrying nonflammable substances under railway tracks. Brick up casing pipe ends to protect against foreign matter, but do not tightly seal. Prior to beginning work, notify the Railroad or Street Department.

109.4.10 Installation of Tapping Sleeves and Tapping Valves

A. All tapping sleeves shall be set to avoid interference with existing pipe joints.

B. The contractor shall provide and install the tapping sleeve and valve. Unless otherwise noted the City will make the tap for main lines (no service taps will be made by the City). This service must be scheduled with the Department 48 hours in advance of the tap.

109.4.11 Acceptance Tests

A. When water is available at the site; the owner will supply water at no cost for testing potable water lines only.

B. After the line has been backfilled and at least seven days after the last concrete reaction anchor has been poured, subject the line or any valved section of the line to a hydrostatic pressure test in accordance with AWWA C600, except as modified herein. Fill the system with water at a velocity of approximately 1 foot per second while necessary measures are taken to eliminate all air. After the system has been filled, raise the pressure by pump to 1.5 x the working pressure. Test pressures shall: (1) Not be less than 1.50 x the working pressure at the highest point along the test section, (2) not exceed thrust restraint pressure, (3) not vary by more than + or - 5 psi, (4) not exceed twice the rated pressure of the valves or hydrants when the test includes closed gate valves, (5) not

exceed rated pressure of valves if resilient-seated butterfly valves are used, (6) be at least 100 psi. Measure pressure at the low point on the system compensating for gauge elevation. Maintain this pressure for two hours. If the pressure cannot be maintained, determine the cause, make repairs and repeat the test until successful.

C. A leakage test shall be conducted concurrently with the pressure test. Leakage is defined as the quantity of water required to maintain a pressure within 5 psi of the specified test pressure, after air has been expelled and the pipe is filled with water. Leakage shall not exceed 10 gallons per day per mile per inch of diameter. If leakage exceeds that specified, find and repair the leaks, and repeat the test until successful.

D. All visible leaks shall be repaired regardless of the amount of leakage.

109.4.12 Disinfect, flush and test water mains and accessories in accordance with the procedures listed below. The water used in the disinfecting process shall be potable water from an approved supply. If water is to be transported to the subject site, then the tank on the truck must also be properly disinfected prior to transporting water. Disinfection of the vehicle should also include all appurtenances used such as valves, hoses, etc.

A. Preliminary Flushing: The main shall be flushed prior to disinfection, except when the tablet method is used. Flushing shall be at a velocity of not less than 2.5 feet/second. Adequate provisions shall be made for drainage of flushing water.

B. Form of chlorine for Disinfection:

(1) Liquid chlorine shall be used only when suitable equipment is available and only under the direct supervision of a person familiar with the physiological, chemical, physical properties of this element, and who is properly trained and equipped to handle any emergency that may arise. Introduction of chlorine-gas directly from the supply cylinder is unsafe and shall not be permitted.

(2) Calcium hypochlorite contains 70 percent available chlorine by weight. It shall be either granular or in tablet form. The tablets, 6-8 to the ounce, are designed to dissolve slowly in water. A chlorine-water solution shall be prepared by dissolving the granules in water in the proportion requisite for the desired concentration.

(3) Sodium hypochlorite is supplied in strengths from 5.25 to 16 percent available chlorine. The chlorine-water solution shall be prepared by adding hypochlorite to water. Product deterioration

shall be reckoned with in computing the quantity of sodium hypochlorite required for the desired concentration.

(4) Application: The hypochlorite solutions shall be applied to the water main with a gasoline or electrically-powered chemical feed pump designed for feeding chlorine solutions. For small applications, the solutions may be fed with a hand pump, for example, a hydraulic test pump. Feed lines shall be of such material and strength as to withstand safely the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the hypochlorite solution is applied to the main.

C. Methods of Chlorine Application:

(1) Continuous Feed Method: Water from the existing distribution system or other approved sources of supply shall be made to flow at a constant, measured rate into the newly-laid pipeline. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two rates shall be proportioned so that the chlorine concentration in the water in the pipe is maintained at a minimum of 50 MG/L available chlorine. To assure that this concentration is maintained, the chlorine residual shall be measured at intervals not exceeding 2,000 feet in accordance with the procedures described in the current edition of "Standard methods" and AWWA M12-"simplified procedures for water examination." In the absence of a meter, the rate may be determined either by placing a pilot gauge at the discharge or by measuring the time to fill a container of known volume. Table 1 gives the time to fill a container of known volume, and gives the amount of chlorine required for each 100 feet of pipe of various diameters. Solutions of 1 percent chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. The latter solution requires approximately 1 lb. of calcium hypochlorite in 8.5 gallons of water.

TABLE 1
CHLORINE REQUIRED TO PRODUCE 50 MG/L CONCENTRATION IN 100 FT. OF PIPE - BY DIAMETER

100 PERCENT PIPE SIZE	CHLORINE	1 PERCENT CHLORINE SOLUTIONS
IN.	LB.	GAL.
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88
16	0.430	5.12
20	0.675	8.00

During the application of the Chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the line supplying the water. The chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24-hour period, the treated water shall contain no less than 25 MG/L chlorine throughout the length of the main.

(2) Slug Method (use only if authorized by the Utilities Department): Water from the existing distribution system or other approved source of supply shall be made to flow at a constant, measured rate into the newly laid pipeline. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two rates shall be proportioned so that the concentration in the water entering the pipeline is maintained at no less than 300 MG/L. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it passes along the line, expose all interior surfaces to a concentration of at least 300 MG/L for at least 3 hours. The application shall be

checked at a tap near the upstream end on the line by chlorine residual measurements.

As the chlorinated water flows past tees and crosses, related valves and hydrants shall be operated so as to disinfect appurtenances.

(3) Tablet Method: Use only when scrupulous cleanliness has been exercised, because preliminary flushing cannot be used. Do not use this method if trench water or foreign material has entered the main or if the water is below 41 deg. F (5 deg. C). This method may be used for mains up to 12 inches in diameter and where the total length of the main is less than 2,500 feet. Tablets shall not be used with PVC pipe.

Place tablets in each section of pipe and also in hydrants, hydrant branches, and other appurtenances. Attach tablets using Permatex No. 1 adhesive or other adhesive approved by the engineer, except for the tablets placed in hydrants and in the joints between the pipe sections. Tablets shall be free of adhesive except on the one broad side to be attached. Place all tablets at the top of the main. If the tablets are attached before the pipe section is placed in the trench, mark the position of the tablet in the pipe and assure that the pipe is placed with the tablet at the top.

The following table shows the number of 5 grain HTH tablets necessary per joint of pipe to obtain 50 PPM chlorine:

PIPE SIZE	TABLETS PER 18-20 FEET JOINT
3 IN	1
4 IN	1
6 IN	2
8 IN	3
10 IN	4
12 IN	7

When installation is completed, fill the main with water at a velocity of less than 1 foot per second. The water shall remain in the pipe for at least 24 hours. Operate valves so that the strong

chlorine solution will not flow back into the line supplying the water.

D. Final Flushing: After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration is no higher than that generally prevailing in the system, or less than 1 MG/L. Chlorine residual investigation shall be made to ascertain that the heavily chlorinated water has been removed from the pipeline. Flushing shall be through a fire hydrant. When a fire hydrant is not available for complete flushing, it shall be through a minimum 2" tap to ensure removal of any debris in the pipe.

E. Bacteriologic Tests:

(1) After final flushing, and before the water main is placed in service, samples shall be collected and tested for bacteriological quality and shall show the absence of coliform organisms. At least two samples shall be collected at least 24 hours apart at intervals not exceeding 2,000 feet and tested by a State Health Department approved laboratory and the results shall be submitted to the engineer.

(2) Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate. If laboratory results indicate the presence of coliform bacteria, the samples are unsatisfactory and disinfection shall be repeated until the samples are satisfactory. Cleaning, disinfection and testing shall be the responsibility of the contractor. Water for these operations will be furnished by the owner, but the contractor shall include in his bid the cost of loading, hauling, and discharging the water.

(3) A sampling tap consisting of a corporation cock with metal pipe shall be installed within two feet of valves. The corporation stop inlet shall be male, one inch in size, and the outlet shall have one inch I.P. threads and a cap.

F. Testing and disinfection of the completed sections shall not relieve the contractor of his responsibility to repair or replace any cracked or defective pipe. All work necessary to secure a tight line shall be at the contractor's expense.

109.5 MEASUREMENT AND PAYMENT

109.5.1 Waterline - Measurement shall be parallel to the pipe including the length occupied by appurtenances. Bid price shall include all excavation bedding and backfill. Payment shall be per linear foot for the size and type specified.

109.5.2. Valves - Measurement shall be per each installed. The bid price shall include all incidental materials, including the valve box. Payment shall be per each for the size and type specified.

109.5.3 Bends, Plugs, and Reducers - Measurement for ductile iron fittings shall be based on the weight of the fitting only (no miscellaneous hardware). Payment shall be at the bid price per pound. The price shall include all incidental work and thrust blocks.

109.5.4 Tees and Crosses - Measurement and payment shall be per each for the size specified. All incidental materials and work shall be included.

109.5.5 Tapping Sleeve and Valve – Measurement and payment shall be per each for the size specified. All incidental materials and work shall be included.

109.5.6 Fire Hydrant - Measurement and payment shall be per each. The cost of fire hydrant extensions is to be included in the bid price. All other incidental materials and workmanship shall be included. The cost of valves, tees, and water line shall be paid for separately.

109.5.7 Service Line - Measurement will be per lineal foot of line installed including all associated work. Payment will be the bid price per lineal foot installed for the size indicated.

109.5.8 Air Release Valve - Measurement and payment shall be per each including all incidental materials and workmanship. The bid price shall also include the valve vault. Service line shall be paid for separately.

109.5.9 Service Connections - Measurement will be per each type connection made including all miscellaneous materials and associated work. Payment shall be the bid price per each for the appropriate type. Service line shall be paid for separately.

109.5.10 Existing Line Abandonment - When specified as a separate item on the Bid Schedule, payment shall be lump sum for all efforts and material to locate the existing line and performing the directed abandonment. Line abandonment shall be identified as being valve closure or remove and splice.

109.5.11 Connection to existing water system – Measurement and payment shall be per each with no regard to size. This work involves connecting the new water system with the existing water lines after line testing and acceptance. Separate payment will be made for all related pay items such as pipe, bends, valves, etc. This pay item is separate from a main line wet tap.

109.5.12 Blow Off – Measurement and payment shall be per each and shall include the tee, valve, and pipe, blow off and box.

109.5.13 Check Valve – Measurement and payment shall be per each and include installation of the check valve and vault.

109.5.14 Concrete Restoration - All concrete sidewalk, curb and gutter disturbed during construction, shall be replaced at the Contractor's expense. Full sections will be replaced. Payment is incidental unless a separate pay item is listed.

END OF WATER DISTRIBUTION SYSTEM

SECTION 110
CURB & GUTTER, SIDEWALK, MISCELLANEOUS CONCRETE

110.1 GENERAL

Work included in this Section consists of all new and/or replacement/repair of curb and gutter, curb, sidewalk and other miscellaneous concrete work.

110.1.1 Referenced Specification by Abbreviation:

Virginia Department of Transportation-(VDOT)

110.1.2 All materials and workmanship associated with this Section will be accordance with VDOT's Road and Bridge Standards and Specifications unless otherwise noted.

110.2 PRODUCTS

110.2.1 Submit shop drawings of all products as by the City.

110.2.2 Provide Certified test results and/or mix designs.

110.2.3 Concrete shall be VDOT A-3 unless otherwise noted.

110.2.4 Base aggregate shall be VDOT 21A unless otherwise noted.

110.2.5 Brick pavers shall be standard 4" x 8" x 2-3/8" Pine Hall Pathway or Lawrenceville I-875.

110.2.6 Concrete pavers shall be 4”x 8” Holland Stone Interlocking Paving System.

110.3 EXECUTION

110.3.1 Regular excavation shall include removal and disposal of all existing concrete and asphalt, existing steps as required, as well as earth and all other materials associated with normal excavation to a depth to allow for the installation of the proposed project. All bituminous concrete paved surface immediately adjacent to the excavated areas must be saw cut in a straight line so that when excavation procedures are performed, existing paved surfaces will not be damaged. All concrete surfaces adjacent to the proposed project shall be saw cut in a neat straight line.

All areas beneath the proposed construction shall be excavated and/or graded to a smooth uniform surface and compacted prior to installation procedures. All excavation shall be disposed of off the project by the Contractor. All excavation shall be considered incidental to the contract.

Unstable Subgrades and Fill - Concrete shall be placed on the earth subgrade if the said subgrade is stable. In unstable areas, the subgrade shall be undercut and replaced with approved material to provide a sound subbase. All fill

material required on this project shall be VDOT 21-A compacted to 95% modified proctor density.

110.3.2 Formwork shall be in accordance with VDOT Road and Bridge Specifications.

110.3.3 Protection and Curing shall be in accordance with VDOT Road and Bridge Specifications. Curing compound shall be white.

110.3.4 Sidewalks shall be the combination curb and walk type as shown on the detail drawing. Brick veneer sidewalks are to be constructed at locations designated by the Owner.

110.3.5 Sidewalks are to be installed so that the back of the walk is on the street right-of-way line, or as directed by the Owner.

110.3.6 All sidewalk slabs shall receive a steel trowel float and broom finish and all curbs shall receive a broom finish.

110.3.7 All concrete sidewalks shall receive a score line in finished surface every five feet (5'). Depth of the score line shall be a minimum of 5/8".

110.3.8 Expansion material shall be installed every 40' in sidewalks and between all existing and proposed concrete surfaces. Along areas where the new walk abuts against an existing uneven retaining wall expansion material shall be installed 4.5' behind and parallel to the face of curb or as directed by the Owner. Concrete shall then be poured behind the expansion material to fill the void area between the face of the walls and expansion. This is done to allow the expansion material to be installed in a smooth straight line. Expansion material shall be of a type equal to the asphalt impregnated fiberboard conforming to ASTM c 175 for exterior work. Expansion material shall extend full depth of slab, less 1/2" at top of slab.

110.3.9 After front forms have been removed along the edge of pavement, the contractor shall rub the face of newly installed curb to fill any voids and remove rough spots from the face of curb. In addition, the contractor shall place 21-A aggregate in the void area between the face of curb and the edge of pavement to an elevation which will match the grade of the existing pavement.

110.3.10 All curb and gutter shall be CG-6 or “roll-top” when specified.

110.3.11 All curb shall be CG-2.

110.3.12 Expansion material shall be installed every 100' in curb and gutter. Expansion material shall be of a type equal to the asphalt impregnated fiberboard conforming to ASTM C 175 for exterior work. Expansion material shall extend full depth of curb and gutter, less 1/2" at top of concrete.

110.3.13 All properties which have existing entrance ways shall have new entrances installed at their present location. Entrances will vary in width depending upon field conditions but the standard width shall be 12’ at the back. On all existing concrete driveways, the contractor shall tie the driveway into the back of the new entrance using concrete to provide a smooth ride across the entrance onto the existing driveway. The contractor shall perform all asphalt driveway connections to the back of the new entrance. The contractor will be required to place stone behind the new entrance for all driveway connections, both concrete and asphalt, as a temporary measure to allow for the use of the entrance prior to its final completion. The exact number of entrances may vary from those shown on the proposal. Entrances may be added or deleted from those anticipated thus affecting the quantities for both entrances, sidewalks, and curb and gutter. The contractor shall schedule entrance construction to inconvenience property owners no more than necessary.

110.3.14 All existing walks and steps that serve private residences, businesses, etc., shall be tied to the back of the newly installed sidewalk. In performing this portion of the work, the Contractor will encounter a multiple of different situations due to grade problems, height and number of steps, etc. For bidding purposes, the contractor shall base his bid on the following breakdown:

A. All existing sidewalk connections which are tied flush to the newly installed sidewalk shall be paid as miscellaneous concrete installation. Payment shall be based on field measurements.

B. All steps constructed to facilitate a connection to back of the new sidewalk shall be paid for on a per each basis. Steps for this project shall be defined as any step with a minimum rise of 4", a maximum width of 5' and a maximum tread of 2'. A change in elevation from the new sidewalk to an existing walk or step is not considered a step for payment purposes. All steps shall be constructed using the same type material as that of the existing walk. If no walk exists, steps shall be constructed using concrete.

110.3.15 All yard areas immediately behind newly installed sidewalks shall be topsoiled and seeded so as to provide a smooth tie in with the existing yard and back of the walk.

110.3.16 Brick sidewalks are to be installed per the Standard Drawing. Base stone shall be VDOT 21A.

The bricks shall be set in a minimum 1/2" mixture of dry 1-part cement and 3 parts sand. Sand shall be swept between the brick joints. Brick pavers shall have a smooth surface that is flush with the curbing.

110.3.17 Detectable warning surface shall be constructed at each street intersection and/or as directed by the City. They shall be VDOT standard CG-12.

110.3.18 Existing limestone curb is to be adjusted for a straight alignment and raised to provide a 6" curb height. Thoroughly compact 21-A aggregate under all disturbed limestone curb.

110.3.19 When an entrance is required across a brick sidewalk, it shall be a herringbone design. The standard concrete entrance shall be modified to leave a depth equal in thickness to the brick paver and mortar bedding with a 4" wide lip on the back. The brick pavers shall tie in flush with the front curb, back lip and adjacent sidewalk.

110.3.20 The Contractor shall be responsible for both the adjustment and relocation of water meter boxes. Adjustment means the vertical and/or minimal horizontal adjustment of the meter box only. Relocated water meters will be any meter that will require cutting into the existing service lines. The City will provide the yoke assembly and box for relocations.

110.4 MEASUREMENT AND PAYMENT

110.4.1 Sidewalk - Measurement shall be the horizontal surface area (including curb on monolithic curb and sidewalk) of sidewalk. Work is to include excavation, backfill, and materials, etc. Payment shall be at the bid price per square yard.

110.4.2 Curb and Gutter - Measurement shall be parallel to the curb and gutter excluding entrances. There shall be no separation between straight and radial curb and gutter. Work is to include all excavation, backfill, and materials. Payment shall be at the bid price per linear foot.

110.4.3 Curb - Measurement includes entrances. There shall be no separation between straight and radial curb. Work is to include all excavation, backfill, and materials. Payment shall be at the bid price per linear foot.

110.4.4 Sidewalk Entrance - Measurement shall be the horizontal area (including curb on monolithic curb and sidewalk) of entrance. Work is to include all excavation, backfill and materials. Payment shall be the bid price per square yard.

110.4.5 Curb and Gutter Entrance - Measurement shall be parallel to the curb and gutter entrances. There shall be no separation between straight and radial curb and gutter entrances. Work is to include all excavation, backfill, and materials. Payment shall be at the bid price per linear foot.

110.4.6 Brick Sidewalk - Measurement shall be the horizontal surface of brick sidewalk. Work is to include all excavation, backfill and materials. Payment shall be the bid price per square yard.

110.4.7 Detectable Warning Surface - Measurement shall be per each in addition to payment for sidewalk. Payment shall be the bid price per each.

110.4.8 Steps - Measurement shall be per each 5' in width. Steps created by increasing the height of the sidewalk are not a pay item. Work is to include excavation, backfill, and all associated for concrete steps. Payment shall be per the bid price for each concrete step constructed.

110.4.9 Miscellaneous Concrete - Measurement shall be the horizontal surface area of concrete adjacent to the street sidewalk (private, walks, driveways, etc.) Work includes all excavation backfill, work and materials required. Payment shall be the bid price per square yard of miscellaneous concrete installed.

110.4.10 Stone Base - Measurement shall be by the ton of base stone placed under sidewalk, curb and gutter, gutter, miscellaneous concrete and street patch. Work is to include all excavation and incidental work. Payment shall be the bid price per ton.

110.4.11 Saw Cut - Measurement shall be parallel to the saw cut. Payment is for concrete saw cuts only as directed by the City and when identified as a separate pay item. Payment will be the bid price per linear foot.

110.4.12 Stone Curb - Measurement shall be per linear foot measured parallel to the sidewalk. Payment shall be the bid price per linear foot only for those curbs adjusted.

110.4.13 Concrete Entrance with Brick veneer - Measurement shall be the horizontal surface of brick veneer entrance. Payment shall be the bid price per square yard and shall include all excavation, backfill, concrete entrance and brick veneer. There shall be separate payment for linear footage of curb across the entrance. There shall be no separate payment for concrete entrance.

END OF CURB & GUTTER, SIDEWALK, MISCELLANEOUS CONCRETE

SECTION 111
STREET CONSTRUCTION AND REPAIR

111.1 GENERAL

Work covered by this section includes all work associated with construction of a new street and the repair or patching of an existing street.

111.1.1 Referenced Specifications by Abbreviation:

Virginia Department of Transportation - (VDOT)

111.1.2 All materials and workmanship associated with this Section shall be in accordance with VDOT's Road and Bridge Standards and Specifications unless otherwise noted.

111.2 PRODUCTS

111.2.1 Submit shop drawings of all products as by the City.

111.2.2 Provide Certified test results and/or mix designs.

111.2.3 All materials shall meet the specifications of VDOT's Road and Bridge Specifications.

111.3 EXECUTION

111.3.1 All excavation, backfill, base stone, and plant mix for new streets shall be constructed in accordance with VDOT's Road and Bridge Specifications.

111.3.2 The typical street section shall be as shown on the plans.

111.3.3 The street shall be graded to the right-of-way line before beginning cut and fill slopes. Protection and Curing shall be in accordance with VDOT Road and Bridge Specifications.

111.3.4 Street repair/patching shall be in accordance with the Standard Drawing or Plans.

111.3.5 Make a neat saw cut on all sides of a street repair/patch. Square up all patches.

111.3.6 Maintain all street excavations to a smooth transition until final street repair/patch is complete.

111.3.7 A temporary repair/patch of prime and double seal is permitted when plant mix is not available.

111.4 MEASUREMENT AND PAYMENT

111.4.1 Excavation and Fill for new streets shall be in accordance with VDOT Standards.

111.4.2 Base Stone for new streets shall be in accordance with VDOT Standards.

111.4.3 Bituminous Concrete for new streets shall be in accordance with VDOT Standards.

111.4.4 Street Repair/Patch - Measurement shall be for the horizontal area of pavement not exceeding the pay limits. Work is to include all excavation, saw cut, stone base, and bituminous concrete required to complete the repair/patch. Payment shall be the bid price per square yard. There are no separate payments for stone, bituminous concrete or saw cut.

END OF STREET CONSTRUCTION AND REPAIR

SECTION 112
EARTHWORK

112.1 GENERAL

Work included in this section includes all work associated with earth moving operations and grading.

112.1.1 Related requirements specified in other sections of the Specifications:

A. Section 103 - Site Clearing

B. Section 106 - Seeding

C. Section 110 - Curb and Gutter, Sidewalk, Misc. Concrete

D. Section 111 - Street Construction & Repairing/Patching

112.2 EXECUTION

112.2.1 The work includes demolition, clearing and grubbing the site, dewatering, stripping and storing of topsoil, excavation, filling and backfilling, rough and finish grading over the areas indicated, erosion control, distribution of topsoil, and utility earthwork. Any water that accumulates in the excavations shall be promptly removed.

112.2.2 Any existing structures shall be carefully demolished and removed from the site. The demolition work shall be done carefully so as to not disrupt the Owner's operations, and so as to not endanger or harm adjacent property, structures or the public.

112.2.3 The entire area within the limit of work shall be cleared and grubbed and shall be cleaned of all debris. Topsoil shall be stripped from all areas to be graded, paved and built upon to the depth encountered and stored for reuse later in the work. Under the structures, paved, and fill areas, stumps, roots, logs, matted roots and other debris not suitable for foundation purposes shall be removed to a minimum depth of eighteen (18) inches below any subgrade. The resulting hole shall be backfilled with suitable material and compacted as specified hereinafter for backfill. Cleared material shall be completely removed from the site, and disposed of by the Contractor, at his expense. All areas to receive fill shall be stripped of root mat five feet beyond toe of anticipated fills. Topsoil, all vegetation, such as roots, brush, heavy sods, heavy growth of grass, and all decayed vegetable matter, rubbish and other debris within the area upon which fill is to be placed, shall be stripped or otherwise removed before the fill is started. In no case will such objectionable material be allowed to remain in or under the fill area. Sloped ground surfaces steeper than one vertical to four horizontals on which fill is to be placed shall be plowed, stepped, benched, or broken up in such manner that fill material will bond with the existing surface,

as directed. Before starting the fill or before placing structures or pavement, the area shall be proof rolled with a rubber tired vehicle, typically a loaded dump truck. Any soft, pumping, or rutting spots that are discovered shall have the soft material excavated and the void filled with suitable material, compacted as hereinafter specified.

112.2.4 Topsoil shall be carefully stripped to its full depth from all areas indicated to be graded, or to be built upon. Stripped topsoil shall be stored and protected for reuse later.

112.2.5 The Contractor shall store and use explosives in accordance with the Occupational Safety and Health Act and with other Federal, State and Local ordinances and regulations. The Contractor shall hold the Owner harmless for any injuries and for all damage caused by the explosives and shall satisfactorily correct and pay for all injuries and damage resulting from his use of explosives. Prior to firing blasts, the Contractor shall have a competent man, carrying a red flag, stationed at a reasonable distance from the blast at each avenue of approach to give warning of the blast. Blasting in the vicinity of any existing utilities shall be done carefully and with the knowledge and approval of the owner of the utility. The Contractor shall conduct pre-blasting inspection of nearby facilities and structures, and vibration monitoring during blasting.

112.3 EXCAVATIONS

112.3.1 All excavations shall be performed to the grades, slopes, and elevations indicated. All excavated materials which are not considered suitable for fill and any surplus of excavated material which is not required for fill shall be disposed of by the Contractor. Excavations shall extend a sufficient distance away from the walls to permit erection and removal of forms and installation of drains and other permanent work. Excavations shall be carefully made to the depths indicated, with the bottoms level, free of loose material, and free of all loam, organic material and other unsuitable material as hereinafter specified. All excavations shall be approved by the Engineer prior to the placing of any concrete. Sloping rock shall be stepped, as directed. Excavations carried below the required depth, other than that specified for occasional rock outcropping, shall be backfilled with trench stabilization material, except general rock areas where the backfill shall be concrete.

112.3.2 The Contractor shall clear and grub all vegetation, debris and any other material encountered within the limits of grading and as required for trenches and ditches indicated to be worked on, but where grading contours are not shown. All material from the demolition, the clearing and grubbing and debris removal shall be disposed of off the site by the Contractor at his expense.

112.3.3 Filling, Backfilling, and Compaction

A. Suitable material for fill, backfill and subgrade preparation shall be GW, GP, GM, GC, SW, SP, SM, ML, CL, or SC as classified in the Unified Soil Classification System in accordance with ASTM D 2487-69 (R1975). The suitability of material to be used as fill shall be determined by the classification method specified and by the moisture density tests in accordance with ASTM D698. Testing shall be by an independent soils laboratory, at the Owner's expense, and the results shall be approved by the Engineer prior to the soil's use. Suitable material removed from the excavation shall be used in forming the necessary fill. Material shall be free of debris, roots and organic matter. Frozen material shall not be used as fill or backfill. Any additional material necessary for establishing the indicated grades shall be excavated from the approved borrow sites as shown on the plans by the Contractor and approved by the Engineer as part of this contract. The maximum particle size shall be six inches largest dimension, except in the uppermost lift, where the maximum particle size shall be two inches largest dimension. Fill material shall be placed in successive horizontal layers not to exceed eight (8) inches of loose material, and then thoroughly compacted as hereinafter specified.

B. Fill or backfill adjacent to the foundation and retaining walls shall be placed in eight (8) inch horizontal layers, each layer being moistened or dried and compacted as hereinafter specified. Special care shall be taken to prevent wedging action as the backfill proceeds.

C. Embankment slopes shall be constructed by filling one (1) foot beyond the proposed finished slope surface for each lift. Compaction equipment shall work to the edge of each lift. After the entire fill is placed and compacted, the outside foot of the slope shall be trimmed to the design slope with a dozer. No slopes shall be steeper than 3 horizontals to 1 vertical.

D. Unsuitable materials shall be those materials not meeting the requirements specified hereinbefore for suitable materials.

112.3.4 Compaction and Testing

A. Compaction shall be performed by hand compaction equipment adjacent to the structures. General area compaction equipment shall be the Contractor's option, subject to the approval of the Engineer. The compaction in grassed areas shall be 90 percent of maximum density obtained in the procedure in ASTM D698. The compaction under pavement areas shall be 98 percent of maximum density in ASTM D698. The materials shall be aerated or moistened, as required to provide a moisture content that falls within 3 percentage points of either side of optimum, unless otherwise approved by the Engineer. Moisture

determinations shall be made. Field density tests and moisture tests shall be performed at the Contractor's expense by an independent soils testing laboratory, approved by the Engineer, on each lift at locations selected by the Engineer to assure that the correct compaction has been performed. If any test fails, additional testing at the Contractor's expense shall be performed to determine the extent of the improperly compacted material. The improperly compacted material shall then be removed, replaced and re-compacted, and the area shall then be retested to insure proper compaction.

112.3.5 Finish Grading

A. Finish grading shall be done as required to establish the slopes indicated. The grades shall be formed to easy contours sloping toward inlets and ditches. The grading shall eliminate low spots and pockets that do not drain. Ditches shall be excavated to the sections and elevations shown and shall be excavated on smooth slopes to avoid low spots and pockets that do not drain.

B. The surface of all excavations and fill and all disturbed areas shall be finished to a smooth surface, with the grades sloping away from the buildings. Swales and ditches shall be finished so that effective drainage results. Proper allowance shall be made for topsoil and for pavement thickness. Any settling or washing prior to acceptance of the work shall be repaired at no additional expense to the Owner. Topsoil and seeding of all disturbed areas shall be performed in accordance with the Section "Seeding."

112.4 MEASUREMENT AND PAYMENT

112.4.1 Measurement shall be either lump sum and per cubic yard, whichever is indicated on the Bid Schedule. Unless otherwise indicated all excavation is unclassified.

112.4.2 Payment will be made as a percentage of lump sum excavation complete or if bid by the cubic yard, actual quantity excavated.

END OF EARTHWORK

SECTION 113
BYPASS PUMPING

113.1 GENERAL

Work included in this section includes all work associated with bypass pumping operations.

113.1.1 SCOPE

A. Under this item the Contractor is required to furnish all materials, labor, equipment, power, maintenance, etc. to implement temporary piping and pumping systems for the purpose of diverting the existing sanitary sewage, as well as surface and ground water flow around the work area for the duration of the project.

B. The design, installation and operation of the temporary pumping systems shall be the Contractor's responsibility. The Contractor shall employ the services of a vendor who can demonstrate to the Engineer that he specializes in the design and operation of temporary bypass pumping systems. The vendor shall provide at least five (5) references of projects of a similar size and complexity as this project performed by his firm within the past three (3) years. The bypass systems shall meet the requirements of all codes and regulatory agencies having jurisdiction.

C. Contractor will be required to operate and maintain all temporary bypass piping and pumping operations during the project installation. The contractor will be allowed to use the existing gravity sewer system only when it is not necessary to have the bypass systems operational for manhole/pipe installation.

113.1.2 SUBMITTALS

A. The Contractor shall prepare with the vendor a specific, detailed description of the proposed temporary piping and pumping systems and the vendor's references. This submittal information shall include temporary bypass pumping operation details for the sewer throughout the project area including branch sewer systems, and service laterals.

B. The Contractor shall submit to the Engineer detailed plans and descriptions outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing storm water and wastewater flow. This plan must be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and/or required to insure proper protection of the facilities, including protection of the access and bypass pumping locations from damage due to the discharge flows, and

compliance with the requirements and permit conditions specified in these Contract Documents. No construction shall begin until all provisions and requirements have been reviewed and approved by the Engineer.

C. The bypass plans shall include but not be limited to details of the following:

1. Staging areas for pumps;

2. Sewer plugging method and types of plugs;

3. Surface water damming;

4. Number, size, material, location and method of installation of suction piping;

5. Number, size, material, method of installation and location of installation of discharge piping;

6. Bypass pump sizes, capacity, number of each size to be on site and power requirements;

7. Calculation of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted);

8. Standby power generator size, location;

9. Downstream discharge plan;

10. Method of protecting discharge manholes or structures from erosion and damage;

11. Thrust and restraint block sizes and locations;

12. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill;

13. Method of noise control for each pump and/or generator;

14. Any temporary pipe supports and anchoring required;

15. Design plans and computation for access to bypass pumping locations indicated on the drawings;

16. Calculations for selection of bypass pumping pipe size;

17. Schedule for installation of and maintenance of bypass pumping lines;

18. Plan indicating selection location of bypass pumping line locations.

113.1.3 EQUIPMENT

A. All temporary bypass piping shall be HDPE SDR 32.5 or an approved equal.

B. All pumps used shall be fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps in the priming system. The pumps may be electric or diesel powered. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows. All pumps and/or generators must be constructed with acoustical enclosures that shall reduce pump and engine noise to 69 dB or less at a distance of 30 feet.

C. The Contractor shall provide the necessary stop/start controls for each pump.

D. The Contractor shall include one stand-by pump of each size to be maintained on site. Back-up pumps shall be on-line, isolated from the primary system by a valve.

E. Discharge Piping – In order to prevent the accidental spillage of flows, all discharge systems shall be temporarily constructed of rigid pipe with positive, restrained joints. Under no circumstances will aluminum "irrigation" type piping or glued PVC pipe be allowed. Discharge hose will only be allowed in short sections and by specific permission from the Engineer.

113.1.4 SYSTEM DESCRIPTION

A. Design Requirements:

1. Bypass piping systems for the sanitary sewer and surface or ground water throughout the project area shall have sufficient capacity to convey the overall capacity of the existing sewer lines. The Contractor shall provide all pipeline plugs, pumps of adequate size to handle peak flow, and temporary discharge piping to ensure that the total flow of the sewer main can be safely diverted around the section to be lined.

2. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an

emergency or breakdown. One standby pump for each size pump utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.

3. Bypass pumping systems shall be capable of bypassing the flow around the work area and releasing any amount of flow up to peak flow as necessary for satisfactory performances of work.

4. The Contractor shall make all arrangements for bypass pumping during the time when the sewer main is shut down for any reason.

B. Performance Requirements:

1. It is essential to the operation of the sewerage system that there is no interruption in the flow of sewage throughout the duration of the project. Therefore, the Contractor shall provide, maintain and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the sewage flow before it reaches the point where it would interfere with his work, carry it past his work area and return it to the existing tunnel and sewer system downstream of his work.

2. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

3. The Contractor shall provide all necessary means to safely convey the sewage past the work area. The Contractor will not be permitted to stop or impede the main flows under any circumstances.

4. The Contractor shall maintain sewer flow around the work area in a manner that will not cause surcharging of sewers, damage to sewers and that will protect public and private property from damage and flooding.

5. The Contractor shall protect water resources such as adjacent wetlands and other natural resources.

113.2 FIELD QUALITY CONTROL AND MAINTENANCE

A. Test:

The Contractor shall perform leakage and pressure tests of the bypass pumping discharge piping using clean water prior to actual operation. The Engineer will be given 24 hours' notice prior to testing.

B. Inspection:

Contractor shall inspect bypass piping and pumping systems every two hours to ensure that the system is working correctly. Any visible leaks shall be repaired by the contractor immediately and the owner's representative notified.

C. Maintenance Service:

The Contractor shall insure that the temporary pumping system is properly maintained and a responsible operator shall be on hand at all times when pumps are operating.

D. Extra Materials:

1. Spare parts for pumps and piping shall be kept on site as required.

2. Adequate hoisting equipment for each pump and accessories shall be maintained on the site.

113.2.1 PREPARATION

A. Precautions

1. Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines. The Contractor shall locate his bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from the City and the Engineer. All costs associated with relocating utilities and obtaining all approvals shall be paid by the Contractor.

2. During all bypass pumping operation, the Contractor shall protect the main and all adjacent sewer lines from damage inflicted by any equipment. The Contractor shall be responsible for all physical damage to the main and all adjacent sewer lines caused by human or mechanical failure.

113.2.2 INSTALLATION AND REMOVAL

A. The Contractor shall make connections to the existing sewer and construct temporary bypass pumping structures as may be required to provide adequate suction and/or bypass conduit.

B. When working inside manholes, the Contractor shall exercise caution and comply with OSHA requirements when working in the presence of sewer gases, combustible oxygen-deficient atmospheres, and confined spaces.

C. The pipeline must be located such that main line traffic and entrances are not adversely affected. When the bypass pipeline crosses local streets and private driveways, the contractor must place the bypass pipelines in trenches and cover with temporary pavement. Upon completion of the bypass pumping operations, and after the receipt of written permission from the Engineer, the Contractor shall remove all the piping, restore all property to pre-construction condition and restore all pavement. The Contractor is responsible for obtaining any approvals for placement of the temporary pipeline within public ways from the City.

113.3 MEASUREMENT AND PAYMENT

A. When listed as a separate bid item, bypass pumping will be paid for as a lump sum item. The bid price is to include all pumps, piping and other appurtenances as necessary to divert sewer around the work area for the duration of the project.

END OF BYPASS PUMPING

SECTION 114 – VIDEO INSPECTION FOR MAIN SEWERS

114.1 General

Work included in this Section consists of all work associated with television inspection for main sewer lines

114.1.1 After cleaning, the manhole sections shall be visually inspected by means of closed circuit television. The inspection will be done one manhole at a time and the flow in the section being inspected will be suitably controlled. (The upstream line segment shall be plugged while the downstream sections are being televised.)

114.1.2 The video camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the Owner's representative: and if unsatisfactory, equipment shall be removed and no payment will be made for an unsatisfactory inspection.

114.1.3 The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and power rewinds, or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the video camera will not pass through the entire manhole section, the contractor shall set up his equipment so that the inspection can be performed from the opposite manhole. If, again the camera fails to pass through the entire manhole section, the inspection shall be considered complete and no additional inspection will be required.

114.1.4 When manually operated winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two manholes of the section being inspected to insure good communications between members of the crew.

114.1.5 The importance of accurate distance measurement is emphasized. Measurement for location of defects shall be above ground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Accuracy of the

distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to the owner's representative.

114.1.6 Documentation of the television results shall be as follows:

A. Video Inspection Logs: Printed location records shall be kept by the contractor and will clearly show the location in relation to an adjacent manhole of each infiltration point observed during inspection. In addition other points of significance such as locations of building sewers, unusual conditions, roots, storm sewer connections, broken pipe, presence of scale or corrosion, and other discernable features will be recorded and a copy of such records will be supplied to the owner.

B. Photographs: Instant developing, 35mm or other standard sized photographs of the television picture of problems shall be taken by the contractor upon request of the owner's representative, as long as such photographing does not interfere with the contractors operations.

C. Video Recording: The purpose of video recording shall be to supply a visual and audio record of problem areas of the lines that may be replayed. Video recording playback shall be at the same speed that it was recorded. Slow motion or stop motion playback features may be supplied at the option of the contractor. The contractor shall have all DVD's and necessary playback equipment readily accessible for review by the owner during the project.

SECTION 01 1100
SUMMARY OF WORK

1. GENERAL

1.1 DESCRIPTION

A. This Section includes requirements of a general nature applicable to the Contract.

B. The Work includes but is not limited to the following:

1. The construction of approximately 1,500 linear feet of 15″ sanitary sewer, a replacement wastewater pump station, 5,600 linear feet of 12″ sewer force main, and all necessary structures and appurtenances to serve the existing Staunton Crossing development in City of Staunton, Virginia.

1.2 REFERENCE DOCUMENTS

A. Applicable Codes, Specifications, and Standards:

1. All references to codes, specifications, and standards referred to in the Contract Documents shall be the latest edition, amendment and/or revision of such reference standard in effect as of the date of Bid Opening for this Contract.

2. These Codes, Specifications and Standards are by reference incorporated into these contract documents. In the event of a conflict, the more stringent as determined by the Engineer shall prevail.

B. Documents on the Site

1. The Contractor shall maintain, on the site, copies of all appropriate documents including codes, specifications, permits, and reference standards referred to for this project.

1.3 ABBREVIATIONS AND SYMBOLS

1.	AASHTO	American Association of State Highway and Transportation Officials
2.	ACI	American Concrete Institute
3.	ANSI	American National Standards Institute
4.	ASCE	American Society of Civil Engineers
5.	ASME	American Society of Mechanical Engineers
6.	NHI	National Hydraulics Institute
7.	ASTM	American Society for Testing and Materials
8.	AWWA	American Water Works Association
9.	BOCA	Building Officials Code Administration, Inc.
10.	NACE	National Association of Corrosion Engineers
11.	NEC	National Electrical Code
12.	OSHA	Occupational Safety and Health Administration
13.	VAUSBC	Virginia Statewide Unified Building Code
14.	VDOT	Virginia Department of Transportation
15.	VSWCC	Virginia Soil and Water Conservation Board

1.4 CONTRACTOR'S RESPONSIBILITIES

A. The Contractor shall, at his own expense, obtain any and all permits and surety required and shall be responsible for all submittals necessary to obtain said permits required in the Contract Documents.

B. Use of Premises and Off-Site Work

1. Facility Property – The Contractor may use the areas shown on the plans for the staging and storage of materials and equipment. The Contractor may access the other areas of the site for the purpose of construction and installation. The Contractor is required to coordinate the use of areas with the Owner in accordance with Section 01 3100 Coordination.

2. Lands by Contractor - Any land and access thereto not furnished by the Owner that the Contractor deems necessary for the work, temporary construction facilities, access and egress, or for storage of materials shall be provided by the Contractor at no cost to the Owner. The Contractor shall confine his apparatus and storage to such additional areas as he may provide at his expense. The Contractor shall obtain permits and written approvals from the appropriate jurisdictional agency and or property owner for use of the premises not furnished as described above, and all off-site areas which include but are not limited to off-site borrow pits and waste areas. Such permits and approvals must specify treatment of said areas during and at the completion of construction. Copies of all permits and approvals shall be furnished to the Engineer before utilization of the areas.

3. Private and Public Property - The Contractor shall not enter upon private property for any purpose without obtaining written permission from the property owner. Letters of permission from property owners shall be filed with the Engineer prior to entering private property.

C. The Contractor shall not load nor permit any part of any structure to be loaded with weights that could endanger the structure, nor shall he subject any part of the work to stresses or pressures that could endanger it.

D. Public Convenience

1. The Contractor shall, at all times, so conduct his work as to ensure the least possible obstruction to traffic and inconvenience to the Owner, the general public, and the businesses and residences in the vicinity of the work, and to ensure the protection of persons and property. Fire hydrants on and adjacent to the work shall be kept accessible to fire fighting equipment at all times. Temporary provisions shall be made by the Contractor to ensure the use of sidewalks and the proper functioning of all gutters, stormwater systems, drainage ditches, and culverts, etc. such that they shall not be obstructed.

E. Measurements

1. All dimensions shown on existing work and all dimensions required for work that is to connect to existing work shall be verified by the Contractor by actual measurement of the existing work. Any discrepancies between the Contract Documents and the existing conditions shall be referred to the Engineer before any work affected thereby has been completed.

F. Coordination

1. Phases of the construction of the project which involve the temporary interruption of essential services (water, electricity, etc.) shall be scheduled in consultation with the Engineer, and shall be not of longer duration than essential to accomplish the purpose for such interruptions. Liaison with the Engineer in this matter shall be a salient feature of this Contract.

2. The Contractor shall notify the Engineer and the Owner not less than 48 hours in advance of commencing work. The Owner shall be given no less than 48 hours

notice in advance of the time and date of making any connections and will advise the Contractor as to a suitable time and date.

G. The Contractor, at his own expense, shall retain the services of a registered Land Surveyor to establish the necessary horizontal and vertical control in order to construct the proposed work in the proper location. Cut sheets performed by a registered Land Surveyor shall be delivered to the Engineer 48 hours prior to installation of any work.

H. Contractor Checklist: This checklist is intended to be a guide and to assist the Contractor in determining what items need to be submitted to the Owner/Engineer or what services need to be performed by the Contractor. The checklist is not intended to be an all-inclusive list of services to be performed by the Contractor, and does not relieve the Contractor of the responsibilities stipulated within these specifications.

Contractor Checklist for Major Items to be Performed and/or Submitted

Required as Part of This Contract		Description of Submittal Item or Service to be Performed	Check Once Item is Completed
Yes		Diagram of location of fuel storage areas on plans	
Yes		Diagram of location of temporary sanitary Facilities on plans	
	No	Statement of payment of taxes	
Yes		Affidavit of payment of debts and claims	
Yes		Affidavit of release of liens	
Yes		Construction schedule of work prior to the commencement of any work	
Yes		Updates of the construction schedule if work does not follow the original schedule	
	No	Schedule of values (shows the value of each kind of work) prior to first application for payment	
Yes		Schedule of shop drawing submittals	
	No	Schedule of estimated monthly payments (within 30 days after contract date	
Yes		Material and products schedule (include in construction schedule)	
Yes		List of product substitutions (for a period of 30 days after contract date)	
Yes		All required permits (e.g., building permit, land disturbance permit, etc.)	
	No	Field office located at project site with the following equipment: 1) Telephone 2) Message recording unit 3) Water and sanitary facilities Temporary field office for use by the Engineer that is approximately 150 square feet and includes: 1) One stick file 2) One drawing table 3) One stool 4) One non-folding desk chair 5) One desk 6) One four-drawer lockable filing cabinet	

Required as Part of This Contract		Description of Submittal Item or Service to be Performed	Check Once Item is Completed
Yes		Shop drawings and product data	
	No	Samples	
Yes		Layout data/schedule for pipe joining and special connections	
Yes		Copies of survey cut sheets	
	No	Diary or log book recording significant construction activities, meetings, weather conditions, etc.	
Yes		Progress reports submitted with each application for payment	
Yes		Test results (e.g., concrete cylinder tests, compaction tests, etc.)	
Yes		One signed original and 3 copies of inspections or approvals of work required to be inspected by local code or law	
	No	Project photographs (a minimum of 10 photos per month during contract) that include two glossy color prints (8 in. x 10 in.) and each negative	
Yes		Product guarantees, certificates, and warranties	
Yes		Contractor's one-year standard warranty for all work	
Yes		Operation and Maintenance Manuals	
Yes		Spare parts and maintenance materials	
Yes		One complete set of contract drawings and one project manual recording all changes to the work to indicate actual installation	
Yes		Application and Certificate for Payment in appropriate format	
Yes		Monthly progress meetings	
	No	Preliminary inspection and testing (a demonstration that individual components of equipment/work have been completed) scheduled a minimum of 20 days before the pre-final inspection is scheduled.	
Yes		Pre-final inspection (a demonstration that all individual project components function and are coordinated with other systems) scheduled a minimum of 20 days before the final inspection.	
Yes		Final inspection (a demonstration that all elements of the project are ready to be placed in operation and all work has been substantially completed) scheduled a minimum of 20 days before completion date.	
	No	Calibration test results performed by competent experienced test engineers	
Yes		Nameplates on all devices	
	No	Brass tags on each field mounted device	
Yes		List of manufacturers, suppliers, and subcontractors who participated in the construction of the project	

2. PRODUCTS – NOT USED

3. EXECUTION – NOT USED

END OF SECTION

SECTION 01 3100
COORDINATION

1. GENERAL

1.1 SUBMITTALS

A. Informational

1. Statement of Qualifications (SOQ) for Land Surveyor or Civil Engineer.

1.2 UTILITY NOTIFICATION AND COORDINATION

A. The Contractor will coordinate the Work with various utilities within the Project limits. The Contractor will notify applicable utilities prior to commencing work and if damage occurs, or if conflicts, or emergencies arise during execution of the Work.

1.3 FACILITY OPERATIONS

A. Continuous operation of the Owner's facilities is of critical importance. The Contractor shall schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified.

B. The Contractor shall perform the Work continuously during critical connections and changeovers, and as required to prevent interruption of the Owner's operations.

C. When necessary the Contractor shall plan, design, and provide various temporary services, utilities, connections, temporary piping, access, and similar items to maintain continuous operation of the Owner's facility.

D. The Contractor shall not close lines, open or close valves, or take other actions which would affect the operations of the existing systems, except as specifically required by the Contract Documents and after authorization by the Owner and Engineer. Such authorization will be considered within 48 hours after receipt of the Contractor's written request.

E. Contractor shall not proceed with work affecting the facility's operation without obtaining Owner's and Engineer's advanced approval.

1.4 REFERENCE POINTS AND SURVEYS

A. Contractor's Responsibilities:

1. Check and establish exact location of existing facilities prior to construction of new facilities and any connections thereto.

2. In the event of a discrepancy in data the Contractor shall request clarification before proceeding with the Work.

3. The Contractor shall retain the services of a Professional Land surveyor or Civil Engineer registered in the State of Virginia, who shall perform or supervise the engineering and surveying necessary for the construction staking and layout.

4. The Contractor shall maintain a complete and accurate log of the survey Work as it progresses as a Record Document.

5. On request of the Engineer, the Contractor shall submit documentation.

6. The Contractor shall provide competent employee(s), tools, stakes, and other equipment and materials as Engineer may require to:
   a) Establish control points, lines, and easement boundaries.
   b) Check layout, survey and measurement Work performed by others.
   c) Measure quantities for payment purposes.

2. PRODUCTS – NOT USED

3. EXECUTION

3.1 CUTTING FITTING AND PATCHING

A. Cut, fit, adjust, or patch Work and work by others, including excavation and backfill as required, to make the Work complete.

B. Obtain prior written authorization from the Engineer before commencing the Work to cut or otherwise alter:

1. Structural reinforcing steel, structural column or beam, elevated slab, trusses, or other structural member.
2. Weather – or moisture-resistant elements.
3. Efficiency, maintenance, or safety element.

C. Work of others.

1. Refinish surfaces to provide an even finish.
2. Refinish continuous surfaces to nearest intersection.
3. Refinish entire assemblies.
4. Finish restored surfaces to such planes, shapes, and textures that no transition between existing work and Work is evident in finished surfaces.
5. Restore existing work, underground facilities, and surfaces that are to remain in completed Work including concrete-embedded piping, conduit, and other utilities as specified and as shown.
6. Make restorations with new materials and appropriate methods as specified for new Work of similar nature; if not specified, use recommended practice of manufacturer or appropriate trade association.
7. Fit Work airtight pipes, sleeves, ducts, conduit and other penetrations through surfaces and fill voids.
8. Remove specimens of installed Work for testing when requested by the Engineer.

END OF SECTION

SECTION 01 3119
PROJECT MEETINGS

1. GENERAL

1.1 REQUIREMENTS INCLUDED

A. Contractor participation in preconstruction conferences.

B. Contractor participation of progress meetings and pre-installation conferences.

1.2 PRECONSTRUCTION CONFERENCES

A. Engineer will administer preconstruction conference for execution of Owner-Contractor Agreement and exchange of preliminary submittals.

B. Attendance: Owner, Engineer, Contractor, major Subcontractors, representatives of Quality Control firm(s).

1.3 PROGRESS MEETINGS

A. Engineer shall schedule and administer project meetings throughout progress of the work at maximum monthly intervals, as well as administer called meetings, and pre-installation conferences.

B. Engineer shall make physical arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes, and distribute copies within seven (7) days to Contractor, participants, and those affected by decisions made at meetings.

C. Attendance: Contractor's Superintendent, Contractor's Project Manager, major Subcontractors and Suppliers; Owner and Engineer as appropriate to agenda topics for each meeting.

D. Suggested Agenda: Review of Work progress, status of progress schedule and adjustments thereto, delivery schedules, submittals, maintenance of quality standards, pending changes and substitutions, and other items affecting progress of Work.

1.4 PRE-INSTALLATION CONFERENCES

A. When required in individual specification Section, Contractor shall convene a pre-installation conference prior to commencing work of that Section.

B. Require attendance of entities directly affecting, or affected by, work of the Section.

C. Review conditions of installation, preparation and installation procedures, and coordination with related work.

2. PRODUCTS – NOT USED

3. EXECUTION – NOT USED

END OF SECTION

SECTION 01 3300
SUBMITTALS

1. GENERAL

1.1 REQUIREMENTS INCLUDED

A. Procedures

B. Schedule of Submittals

C. Construction Progress Schedules

D. Shop Drawings

E. Product Data

F. Manufacturer's Instructions

G. Operation & Maintenance Manuals

1.2 PROCEDURES

A. Contractor is required to provide submittals for all materials and equipment furnished and installed under this contract.

B. Contractor shall deliver submittals to Engineer.

C. Transmit each item with Submittal cover attached.

1. Number submittals by specification section and revision number (e.g. 013000-1 for initial submission of schedule of submittals.)

2. Submit only one item per cover. Highlight all deviations from the Contract Documents, and provide explanation/justification for deviation.

3. Complete all portions of the form above the Contractor's signature line. Incomplete submittals or submittals with unhighlighted deviations will be returned unreviewed.

D. Submit initial progress schedules, and schedule of submittals in duplicate within 15 days after date of Owner-Contractor Agreement. After review by Engineer revise and resubmit as required. Submit revised schedules with each Application for Payment, reflecting changes since previous submittal.

E. Comply with progress schedule for shop drawings, product data, and manufacturer's instructions related to Work progress, and coordinate submittal of related items.

F. Allow a minimum of two weeks' review time.

G. Distribute copies of reviewed submittals to appropriate parties. Instruct recipients to promptly report any inability to comply with provisions.

1.3 SCHEDULE OF SUBMITTALS

A. Contractor to provide to Engineer a Schedule of Submittals for all products used during construction 2 weeks prior to the start of work.

B. Submit the number of copies required by the Contractor, plus three for the Engineer to retain.

1.4 CONSTRUCTION PROGRESS SCHEDULES

A. Submit horizontal bar chart with separate bar for each major trade or operation, identifying first work day of each week. Show relationships between critical path items and indicate lead times for equipment and materials delivery, etc.

B. Show complete sequence of construction by activity, identifying work of separate stages and other logically grouped activities. Show projected percentage of completion for each item of Work as of time of each Application for Progress Payment.

C. Construction schedule shall consider the following typical number of weather days, (i.e. > 0.10" of precipitation) as well as days following during which site conditions may impede progress of the work. The Contractor will not be allowed a time extension due to inclement weather conditions if the total number of inclement weather days for the duration of the project is less than the total inclement weather days indicated below.

J	F	M	A	M	J	J	A	S	O	N	D
6	6	7	6	6	6	8	6	5	5	5	6

D. Submit the number of copies required by the Contractor, plus three for the Engineer to retain.

E. Determination of actual rain days will be based on data published by NOAA for the gauging station nearest the project site, which will be identified at the pre-construction meeting.

F. At each monthly progress meeting, prepare a Monthly Project Summary Report (form included with this section) and attach to the revised project schedule.

1.5 SHOP DRAWINGS

A. Submit the number of copies required by the Contractor, plus three for the Engineer to retain.

1.6 PRODUCT DATA

A. Mark each copy to identify applicable products, models, options, and other data; supplement manufacturer's standard data to provide information unique to the Work.

B. Submit the number of copies required by the Contractor, plus three for the Engineer to retain.

1.7 MANUFACTURER'S INSTRUCTIONS

A. Submit manufacturer's printed instructions for delivery, storage, assembly, installation adjusting, and finishing.

B. Submit the number of copies required by the Contractor, plus three for the Engineer to retain.

2. PRODUCTS – NOT USED

3. EXECUTION

3.1 SHOPDRAWINGS AND SUBMITTALS

A. Contractor shall keep a copy of all shop drawings and submittals on the project site for the duration of the contract.

END OF SECTION

(See Monthly Project Summary Report which follows)
(See Submittal Cover which follows)

MONTHLY PROJECT SUMMARY REPORT

MEETING DATE: _____

Is the project on Schedule? _____ Yes _____ No

Number of weeks AHEAD of Schedule _____

Number of weeks BEHIND Schedule _____

List items from Schedule which are **AHEAD OF SCHEDULE**:

_____

List items from Schedule which are **RIGHT ON SCHEDULE**:

_____

List items from Schedule which are **BEHIND SCHEDULE**:

_____

If behind, what is the Contractor doing to get back on schedule?

_____

_____

When does the Contractor anticipate the Project to be back on Schedule? Date: _____

Are there any outstanding change order items? _____ Yes _____No

If so, list them:

_____

_____

Adverse Weather Summary

	J	F	M	A	M	J	J	A	S	O	N	D
Scheduled												
Actual												
Balance												

SUBMITTED:_____ DATE: _____

SIGNED: _____ TITLE: _____

Submittal Cover

No. ___-___

Project: Project #:

To: Timmons Group
Attn:
1001 Boulders Parkway, Suite 300
Richmond, Virginia 23225

From:

Date Submitted: Review Requested Not Later Than:

Submittal Information and Contractor's Representation

Subject: _____

Pursuant to Specification Section(s): _____ Drawing No(s). _____

Submitted as: ☐ Specified Item ☐ "Equal" Item ☐ Substitution ☐ _____

Items Submitted: _____

_____

The Contractor's submittal of items for the Engineer's review and approval constitutes a representation that the items proposed have been reviewed thoroughly by the Contractor and found to be in conformance with the requirements of the Contract Drawings and Specifications. All deviations have been clearly listed in the submittal package and an explanation provided for the deviation.

Contractor's Reviewer (sign): Date:

Review Information

Timmons Group:
Received on: _____ Forwarded for review to: _____

Reviewer:
Received On: _____ Reviewed by: _____

Review is for general compliance with the Contract Documents. Nothing in this review shall be taken as permitting variation from the Contract Documents, unless specifically stated by the reviewer in writing. Sole responsibility for correctness of dimensions, options, details, quantities, and safety during fabrication and erection shall remain with the Contractor. EVALUATION OF INSTALLATION FOR FINAL ACCEPTANCE WILL BE BASED ON THE CONTRACT DOCUMENTS, NOT THE SUBMITTALS, EXCEPT AS SPECIFICALLY APPROVED OTHERWISE IN WRITING.

☐ No Exceptions Taken ☐ Rejected ☐ Resubmission Not Required

☐ Revise and Resubmit ☐ Submit Specified Item ☐ _____

Comments: _____

_____

_____

_____

_____

Returned to Timmons Group: Returned to Contractor:

SECTION 01 4333
MANUFACTURER'S SERVICES

1. GENERAL

1.1 DEFINITIONS

A. Person-Day: One person for 8 hours within regular Contractor working hours.

1.2 SCOPE

A. Work under this section defines the minimum scope of services to be provided by the Contractor using factory representatives of the Manufacturers of the equipment to be installed during installation, start-up, and operator training.

B. Equipment Manufacturers assigned unit responsibility for systems comprised of several components shall provide the service of a factory representative for each component Manufacturer to perform the duties required under these Specifications. The equipment Manufacturer assigned unit responsibility shall be responsible for coordinating the activities of the system component Manufacturers.

1.3 SUBMITTALS

A. Preliminary Training Plan: Submit within 90 days after Notice-to-Proceed.

B. Final Training Plan: Submit not less than 60 days prior to equipment start up.

C. Training Schedule: Submit not less than 21 days prior to equipment installation and revise as necessary for acceptance.

D. Training Materials:

1. Final training materials must be approved by the Engineer prior to equipment startup and training.

2. Furnish complete outlines of proposed training session, operation and maintenance data for each trainee in attendance.

E. Quality Control Submittals: As required in the individual Specifications, submit:

1. The qualifications of Manufacturer's Representative performing specified services.

2. The Manufacturer's Certificate of Compliance

3. The Manufacturer's Certificate of Proper Installation using form provided by Engineer.

4. The Manufacturer's Written Warranty

1.4 QUALIFICATIONS

A. Qualification of the representatives for installation, startup, and operator training purposes shall mean an authorized representative of the Manufacturer, factory trained, and experienced in the technical applications, installation, operation and maintenance of the equipment being installed and shall be subject to the approval of the Engineer. No substitutions of approved representatives will be allowed without the prior written approval of the Engineer.

B. References in various equipment sections of the terms "factory representative" or "field representative" shall mean an employee or contractor of the equipment Manufacturer who is trained, articulate, capable of coordinating and expediting training, and familiar with operation and maintenance manual information specified in Section 01 7823, OPERATING AND MAINTENANCE DATA.

1.5 COORDINATION

A. The Contractor shall notify the Engineer 72 hours prior to any impending visit by factory representatives so that the Engineer may be present.

B. The Engineer may approve the services of a Manufacturer's representative for more than one system during the same site visit.

C. The Contractor shall perform the necessary inspections to ensure that all conditions necessary for successful training and/or startup services have been met prior to scheduling the Manufacturer's onsite services.

1.6 MINIMUM MANUFACTURER'S SERVICES REQUIREMENTS

A. Qualified factory representatives shall furnish Manufacturer's services as specified in the Contract Documents.

B. Where time is specified in the Contract Documents for Manufacturer's services, the specified time shall be considered a minimum time and any time in excess of the specified time stated in the specifications to perform the required Manufacturer's services shall be considered incidental work. Days of service, approved by the Engineer, will be credited to fulfill the specified minimum Manufacturer's services.

C. The Contractor's training and startup schedule shall coordinate the Manufacturer's services to avoid conflicting with other onsite testing or other Manufacturer's services.

D. The Manufacturer's services will include the following, as applicable to the specific system or equipment items:

1. Installation assistance including observation, guidance, instruction of the Contractor's assembly, erection, installation or applications.
2. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by the Manufacturer and necessary to furnish written approval of installation.
3. Additional site visits as necessary to address problems and until installation and operation are acceptable to the Engineer.
4. Perform, coordinate, and assist during functional and performance testing and startup demonstration, and until product acceptance by the Engineer.
5. Training of the Owner's personnel in the operation and maintenance of respective product as required.
6. Completion of the Manufacturer's Certificate of Proper Installation with applicable certificates for proper installation and initial, interim, and final test or service.

1.7 SCHEDULE

A. List specified equipment and systems with respective Manufacturers that require training services of Manufacturers' representatives and show:

1. Estimated dates for installation completion.
2. Estimated training dates to allow for multiple sessions when several shifts are involved.

B. Adjust training schedule to ensure training of appropriate personnel as deemed necessary by the Owner, and to allow full participation by the Manufacturers' representatives. Adjust schedule for interruptions in operability of equipment.

1.8 TRAINING PLAN

A. Training Plan: Submit for each proposed course:

1. Title and objectives
2. Schedule of training courses including dates, durations, and locations of each class
3. Recommended types of attendees (e.g., managers, engineers, operators, maintenance)
4. Course description and outline of course content
5. Duration
6. Instruction materials and equipment requirements
7. Detailed course schedule for each day showing time allocated to each topic

1.9 TRAINING OWNER'S PERSONNEL

A. Prestartup Training:

1. Coordinate training sessions with operating personnel and the Manufacturers' representatives, and with submission of operation and maintenance manuals in accordance with Section 01 7823, OPERATING AND MAINTENANCE DATA.
2. Complete at least 14 days prior to actual startup.

B. Post-Startup Training: If required in Specifications, furnish and coordinate training of the Owner's operating personnel by respective Manufacturer's representatives.

2. PRODUCTS – NOT USED

3. EXECUTION – NOT USED

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND ENVIRONMENTAL PROTECTION

1. GENERAL

1.1 TEMPORARY FACILITIES

A. General:

1. Temporary facilities and protective devices include, but are not limited to, the following items: temporary barricades, fences, bridges, guards, temporary utilities, steel plates over trenches, maintenance of traffic and project identification signs.
2. All materials used in construction of the above mentioned items of work shall be of such size, shape and strength as to be suitable for the use intended.
3. The Contractor shall conduct construction operations in such a manner as to cause as little inconvenience as possible to the general public, and the Owner. Wherever required, the Contractor shall erect and maintain signs, fences, barricades, and pedestrian bridges and provide guards and flagmen for the protection of the public.
4. The Contractor shall take positive measures to prevent at all times, entry to the site of the work and storage areas by children, animals, and unauthorized adults.

B. Furnish and construct temporary fencing as needed to fence off excavation, storage, and operating areas. All temporary fences erected by the Contractor shall be substantially constructed, and neat in appearance.

1. Barricade or close all openings in roadways, floors, walls, or other parts of structures or walkways while the openings are not in regular use. Barricades shall be substantial and neat in appearance.

C. Unless otherwise specified, the existing systems shall remain in service during the entire construction period for the project. The Contractor shall provide temporary measures as necessary to maintain operation of the system. The Contractor shall provide water at no cost to the Owner. The Contractor shall assure the availability of drinking water for his work force.

D. The Contractor shall make the necessary arrangements and provide all temporary electrical service and lighting required during the entire construction period. The cost of electricity used shall be borne by the Contractor. The electrical service shall be sufficient capacity and characteristics to supply the proper current for the various types of construction tools, motors, welding machines, lights, heating plant, pumps, and other work required. All necessary temporary wiring, panel boards, outlets, switches, lamps, fuses, controls, and accessories shall be provided.

E. The Contractor shall provide and maintain an adequate number of temporary toilets with proper enclosures as necessary for use of workmen during construction. The Contractor shall keep toilets clean and comply with local and State health requirements and sanitary regulations. Toilet facilities shall be the prefabricated chemical type unless otherwise permitted.

F. The Contractor shall be responsible for provisions of temporary heating, including all costs of equipment and installation, fuel and attendance, whenever and for such periods as such heating may be required, either because of general weather conditions to prevent freezing, to provide suitable working conditions, or to assure progress of the operation within the established scheduled time for curing of concrete.

1.2 MAINTENANCE OF TRAFFIC

A. The Contractor shall be responsible for maintaining a normal through traffic flow in accordance with County and VDOT requirements.

B. The Contractor shall provide temporary facilities as required for pedestrian and vehicular access to properties adjacent to or contiguous to the project. Should it be necessary to temporarily interrupt access, the Contractor shall so notify the Engineer, and after securing the Engineer's approval, the Contractor shall notify all affected parties of the time, extent, and duration of the interruption.

C. The Contractor shall not obstruct any driveway longer than two (2) hours without providing an alternate temporary access to the property.

1.3 ENVIRONMENTAL PROTECTION

A. The Contractor shall be responsible for furnishing all necessary items for fulfilling the Work described herein for Environmental Protection including prevention and control of erosion and sedimentation that results directly or indirectly from the project. The Contactor shall also be responsible for compliance with the Erosion and Sediment Control Plan shown on the approved contract drawings.

B. Prevention of Water Pollution:

1. The Contractor shall take all such precautions in the conduct of his operations as may be necessary to avoid contaminating the water in adjacent watercourses or water storage areas.

2. All earthwork, moving of equipment, and other operations likely to create silting, shall be conducted so as to minimize pollution of water courses and water storage areas.

3. Water used during the work which has become harmful and contaminated with oil, bitumins, or objectionable chemicals, sewage or other pollutants, shall be disposed of so as to avoid affecting all nearby waters and lands. Under no circumstances shall the Contractor discharge pollutants into any watercourse or water storage area. The Contractor shall not allow water used in aggregate processing, concrete curing, foundation, and concrete lift cleanup, or any other waste, to enter a stream. When water from adjacent natural sources is used in the Work, intake methods shall be such to avoid contaminating the source of supply or becoming a source of erosion.

C. Noise and Air Pollution Control

1. The Contractor shall conduct his operations so as not to violate any applicable ordinances, regulations, rules, and laws in effect in the area pertaining to noise and air pollution.

D. Preservation of Natural Resources

1. All construction operations, cleanup, and the condition of the adjacent terrain upon completion of the work shall fully comply with all applicable regulations and laws concerning the preservation of natural resources.

E. Dust Control

1. Throughout the entire construction period, maintain dust control by use of water sprinklers or chemical dust control binder as may be approved by the Engineer and VDOT.

1.4 CONFINED SPACE REQUIREMENTS

A. The Contractor shall be responsible for all practices and procedures, either singularly or in combination, required for entry into a confined space area as defined by the Virginia Occupational Safety and Health Codes Board. Such practices include, but are not limited to:

1. Preparation
2. Atmospheric Testing
3. Attendants and Rescue Teams
4. Permit Systems
5. Training
6. Special Equipment and Tools
7. Tripods, Safety Harnesses, Retrieval Lines, and Respiratory Protection

B. The Contractor shall be required to conform to requirements stipulated in the Occupational Safety and Health Administration regulations.

1.5 CLEANING DURING CONSTRUCTION

A. Control accumulation of waste materials and rubbish; periodically dispose of off-site.

B. Clean areas prior to start of finish work; maintain areas free of dust and other contaminants during finishing operations.

2. PRODUCTS – NOT USED

3. EXECUTION – NOT USED

END OF SECTION

SECTION 01 6000
MATERIAL AND EQUIPMENT

1. GENERAL

1.1 DEFINITIONS

A. Products:

1. New items for incorporation in the Work whether purchased by Contractor or Owner for the Project, or taken from previously purchased stock and may also include existing materials or components required for reuse.

2. Includes the terms material, equipment, machinery, components, subsystem, system, hardware, software, and terms of similar intent and is not intended to change meaning of such other terms used in Contract Documents, as those terms are self-explanatory and have well recognized meanings in construction industry.

3. Items identified by Manufacturer's product name, including make or model designation, indicated in Manufacturer's published product literature, that is current as of the date of the Contract Documents.

1.2 DESIGN REQUIREMENTS

A. Where Contractor design is specified, design of installation, systems, equipment, and components, including supports and anchorage, shall be in accordance with provisions of latest edition of Virginia Statewide Uniform Building Code.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Altitude: Provide materials and equipment suitable for installation and operation under rated conditions at elevations shown on Drawings.

B. Provide equipment and devices installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of 0 °F to 104 °F.

1.4 PREPARATION FOR SHIPMENT

A. When practical, have the factory assemble products, mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with strippable protective coating.

B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, name of Project and Contractor, equipment number, and approximate weight. Include complete packing list and bill of materials with each shipment.

C. Extra Materials, Special Tools, Test Equipment, and Expendables:

1. Furnish as Required by Individual Specifications.

D. Schedule:

1. Ensure that shipment and delivery occur concurrently with shipment of associated equipment.

2. Transfer to the Owner shall occur immediately subsequent to the Contractor's acceptance of equipment from Supplier and any required O&M Manuals have been delivered to and approved by the Engineer.

E. Packaging and Shipment:

1. Package and ship extra materials and special tools to avoid damage during long term storage in original cartons insofar as possible, or in appropriately sized, hinged-cover, wood, plastic, or metal box.

F. Prominently Displayed on Each Package, the Following:

1. Manufacturer's part nomenclature and number, consistent with the Operation and Maintenance Manual identification system.
2. Applicable equipment description.
3. Quantity of parts in package.
4. Equipment Manufacturer.

G. Delivery of Materials:

1. Notify the Engineer upon arrival for transfer of materials. Replace extra materials and special tools found to be damaged or otherwise inoperable at time of transfer to the Owner.
2. Request a minimum 7-day advance notice of shipment from the Manufacturer. Upon receipt of the Manufacturer's advance notice of shipment, promptly notify the Engineer of anticipated date of equipment arrival.
3. Factory Test Results: Reviewed and accepted by the Engineer before product shipment as required in individual Specification Sections.

1.5 DELIVERY AND INSPECTION

A. Deliver products in accordance with accepted current Progress Schedule and coordinate to avoid conflict with the Work and conditions at the Site. Deliver anchor bolts and templates sufficiently early to permit setting prior to placement of structural concrete.

B. Deliver products in undamaged condition, in the Manufacturer's original container or packaging, with identifying labels intact and legible. Include on label, date of manufacture and shelf life, where applicable.

C. Unload products in accordance with the Manufacturer's instructions for unloading or as specified, and record receipt of products at Site. Promptly inspect for completeness and evidence of damage during shipment.

D. Remove damaged products from the Site, and expedite delivery of identical new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

1.6 HANDLING, STORAGE, AND PROTECTION

A. Handle and store products in accordance with the Manufacturer's written instructions and in a manner to prevent damage. Store in approved storage yards or sheds provided in accordance with Section 01 5000, TEMPORARY FACILITIES AND ENVIRONMENTAL PROTECTION.

B. Provide the Manufacturer's recommended maintenance during storage, installation, and until products are accepted for use by the Owner.

C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration. Keep running account of products in. storage to facilitate inspection and to estimate progress payments for products delivered, but not installed in the Work.

D. Store electrical, instrumentation, and control products, and equipment with bearings in weather-tight structures maintained above 60 °F. Protect electrical, instrumentation, and control products, and insulation against moisture, water, and dust damage. Connect and operate continuously all space heaters furnished in electrical equipment.

E. Store fabricated products above ground on blocking or skids, prevent soiling or staining, and store loose granular materials in well-drained area on solid surface to prevent mixing with foreign matter. Cover products that are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.

F. Store finished products that are ready for installation in dry and well-ventilated areas. Do not subject to extreme changes in temperature or humidity.

G. After installation, provide coverings to protect products from damage due to traffic and construction operations. Remove coverings when no longer needed.

H. Hazardous Materials: Prevent contamination of personnel, storage building, and Site. Meet requirements of product specification, codes, and Manufacturer's instructions.

2. PRODUCTS

2.1 GENERAL

A. Provide the Manufacturer's standard materials suitable for service conditions unless otherwise specified in the individual Specifications.

B. Where product specifications include a named Manufacturer, with or without model number, and also include performance requirements, named Manufacturer's products must meet the performance specifications.

C. Like items of products furnished and installed in the Work shall be end products of one Manufacturer and of the same series or family of models to achieve standardization for appearance, operation and maintenance, spare parts and replacement, Manufacturer's services, and implement same or similar process instrumentation and control functions in same or similar manner.

D. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

E. Provide interchangeable components of the same Manufacturer, for similar components, unless otherwise specified.

F. Equipment, Components, Systems, Sub-systems: Design and manufacture with due regard for health and safety of operation, maintenance, and accessibility, durability of parts, and shall comply with applicable OSHA, State, and local health and safety regulations.

G. Regulatory Requirement: Coating materials shall meet Federal, State, and Local requirements limiting the emission of volatile organic compounds and for worker exposure.

H. Safety Guards: Provide for all belt or chain drives, fan blades, couplings, or other moving or rotary parts. Cover rotating part on all sides. Design for easy installation and removal. Use 16-gauge or heavier; galvanized steel, aluminum coated steel, or galvanized or aluminum coated ½" mesh expanded steel. Provide galvanized steel accessories and supports, including bolts. For outdoors application, prevent entrance of rain and dripping water.

I. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with AHJ's adopted edition of the Virginia Uniform Statewide Building Code. Where required by the VUSBC, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the VUSBC in order to provide a basis for approval under NEC.

2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.

J. Equipment Finish:

1. Provide the Manufacturer's standard finish and color, except where specific color is indicated.

2. If the Manufacturer has no standard color, provide equipment with gray finish as approved by the Engineer.

K. Special Tools and Accessories: Furnish to the Owner, upon acceptance of equipment, all accessories required to place each item of equipment in full operation. These accessory items include, but are not limited to, adequate oil and grease (as required for first lubrication of equipment after field testing), light bulbs, fuses, hydrant wrenches, valve keys, hand wheels, chain operators, special tools, and other spare parts as required for maintenance.

L. Lubricant: Provide initial lubricant recommended by the equipment Manufacturer in sufficient quantity to fill lubricant reservoirs and to replace consumption during testing, startup, and operation until final acceptance by the Owner.

2.2 FABRICATION AND MANUFACTURE

A. General:

1. Manufacture parts to U.S.A. standard sizes and gauges.

2. Two or more items of the same type shall be identical, by the same Manufacturer, and interchangeable.

3. Design structural members for anticipated shock and vibratory loads.

4. Use 1/4" minimum thickness for steel that will be submerged, wholly or partially, during normal operation.

5. Modify standard products as necessary to meet performance Specifications.

B. Lubrication System:

1. Require no more than weekly attention during continuous operation.
2. Convenient and accessible Oil drains with bronze or stainless steel valves and fill-plugs easily accessible from the normal operating area or platform are required.
3. Locate drains to allow convenient collection of oil during oil changes without removing equipment from its installed position.
4. Provide constant-level oilers or oil level indicators for oil lubrication systems.
5. For grease type bearings, which are not easily accessible, provide and install stainless steel tubing; protect and extend tubing to convenient location with suitable grease fitting.

2.3 SOURCE QUALITY CONTROL

A. Where Specifications call for factory testing to be witnessed by the Engineer, notify the Engineer not less than 14 days prior to scheduled test date, unless otherwise specified.

B. Calibration Instruments: Bear the seal of a reputable laboratory certifying instrument has been calibrated within the previous 12 months to a standard endorsed by the National Institute of Standards and Technology (NIST).

C. Factory Tests: Perform in accordance with accepted test procedures and document successful completion

3. EXECUTION

3.1 INSPECTION

A. Inspect materials and equipment for signs of pitting, rust decay, or other deleterious effects of storage. Do not install material or equipment showing such effects. Remove damaged material or equipment from the Site and expedite delivery of identical new material or equipment. Delays to the Work resulting from material or equipment damage that necessitates procurement of new products will be considered delays within Contractor's control.

3.2 INSTALLATION

A. Equipment Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.

B. No shimming between machined surfaces is allowed.

C. Install the Work in accordance with NECA Standard of Installation, unless otherwise specified.

D. Repaint painted surfaces that are damaged prior to equipment acceptance.

E. Do not cut or notch any structural member or building surface without specific approval of Engineer.

F. Handle, install, connect, clean, condition, and adjust products in accordance with the Manufacturer's instructions, and as may be specified. Retain a copy of the Manufacturer's instruction at the Site, available for review at all times.

G. For material and equipment specifically indicated or specified to be reused in the Work:

1. Use special care in removal, handling, storage, and reinstallation to assure proper function in the completed Work.

2. Arrange for transportation, storage, and handling of products that require offsite storage, restoration, or renovation. Include costs for such Work in the Contract Price.

3.3 LUBRICANTS

A. Fill lubricant reservoirs and replace consumption during testing, startup, and operation prior to acceptance of equipment by the Owner.

END OF SECTION

SECTION 01 7000
CLOSEOUT PROCEDURES

1. GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including but not limited to the following :

1. Inspection procedures
2. Warranties
3. Final cleaning

B. See Divisions 2 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 SUBSTANTIAL COMPLETION

A. Record Drawings: The Contractor shall maintain an accurate set of Record Drawings and Specifications throughout the Work. The Contractor shall prepare marked prints showing the installed locations and sizes of all underground or concealed portions of the Work that are different from those shown in the Contract Documents. These Drawings shall be based on the set kept at the project site and shall also show any other changes made to the project during construction. These Drawings shall be submitted to the Engineer at completion of the Work.

1. Size, horizontal and vertical location of any existing utilities uncovered during the course of the Work. This shall include telephone cables and conduits, fiberoptic cables and conduits, television cables, electrical cables and conduits, gas lines, water lines, sewer force mains, sanitary sewers, storm sewers, and the like.
2. To all cleanouts new and existing, size of service lines installed, and the like.
3. Location of lines plugged or capped.
4. Sizes and types of materials used and changes in sizes and types of materials. Rims and inverts of all manholes installed or tied into shall be provided.
5. The Record Documents are a specific contract requirement of the Contractor. Final payment will not be issued until said documents have been submitted to the Engineer in an acceptable form.

B. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in the request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise the Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit the Project Record Documents, final completion construction photographs and photographic negatives if available, damage or settlement surveys, property surveys, and similar final record information.

6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with the Manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to the Owner. Advise the Owner’s personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from the Project site, along with mockups, construction tools, and similar elements.
11. Advise the Owner of changeover in heat and other utilities.
12. Submit changeover information related to the Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

1.3 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of the 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 the Contractor that are outside the limits of construction.
   1. Organize list of spaces in sequential order.
   2. Organize items applying to each space by major element, including categories for individual walls, and equipment, and building systems.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting the final inspection for determining date of Final Completion, complete the following:
   1. Submit a final Application for Payment according to the General Conditions.
   2. Submit a certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by the Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Instruct the Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training DVD’s.
B. Inspection: Submit a written request for Final Inspection for acceptance. On receipt of request, the Engineer will either proceed with inspection or notify the Contractor of unfulfilled requirements. The Engineer will prepare a final Certificate for Payment after inspection or will notify the Contractor of construction that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

2. PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by the 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.

3. EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal, State and Local environmental and antipollution regulations.

B. Cleaning: Clean each surface or unit to condition equal to original plant condition. Comply with the Manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Final Completion for entire Project or for a portion of Project:

a) Clean Project site, yard, and grounds, in areas disturbed by construction activities, of rubbish, waste material, litter, and other foreign substances.

b) Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

c) Remove tools, construction equipment, machinery, and surplus material from the Project site.

d) 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.

e) Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

f) Sweep concrete floors broom clean in unoccupied spaces.

g) Remove labels that are not permanent.

h) Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

i. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

i) Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

j) Replace parts subject to unusual operating conditions.

k) Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

l) Clean light fixtures, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

m) Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the Project site and dispose of lawfully.

3.2 SUBSTANTIAL COMPLETION

A. Contractor shall demonstrate to the Owner and Engineer that each until process functions and performs in accordance with the plans, specifications, and the Manufacture’s design criteria.

B. The Contractor shall coordinate the date, time, and duration of the performance testing and demonstration with the Owner and Engineer.

C. The Contractor shall correct deficiencies identified by the Owner or Engineer during performance demonstration prior to rescheduling a subsequent performance demonstration.

D. Once the Contractor has demonstrated that each unit process functions and performs as required, the Engineer shall advice the Contractor in writing as to the date of Substantial Completion.

E. The punch list of items to be corrected before the date of the final completion will be attached to the notification of substantial completion.

3.3 FINAL COMPLETION

A. The Contractor shall coordinate with the Owner and Engineer confirmation that each item appearing on the punch list has been corrected.

B. Once all punch list items have been corrected, the Engineer shall issue the Certificate of Final Completion.

END OF SECTION

SECTION 01 7823
OPERATING AND MAINTENANCE DATA

1. GENERAL

1.1 REQUIREMENTS

A. Operation and Maintenance Manuals are required for all materials and equipment provided and installed in the Project.

B. Information included in the O & M Manual shall be specific to the equipment or item installed. Data sheets that include information not pertinent to the specific equipment or product should be omitted. Where data sheets have multiple information, all non- pertinent information shall be edited out and the pertinent information shall be highlighted to make it clear which information applies.

C. Drawings shall be provided which clearly indicate the item and the installation. These should include plan views, elevation views and section views as required. Drawings should be scaled and dimensioned. Drawings from the approved submittals should be included and corrected if required to indicate the "as-built" condition.

D. Information shall include name plate data, serial numbers, order numbers, dates, contact information and other pertinent information that are required to trace a piece of equipment back to the Manufacturer.

E. Operation and Maintenance Manuals shall contain complete operation and maintenance instructions including but not limited to the following:

1. Equipment warranties
2. Operating and maintenance data
3. Troubleshooting information and procedures
4. Lubrication information and schedules
5. Nameplate data (model numbers and serial numbers for all equipment and motors)
6. Wiring diagrams
7. Assembly drawings with part numbers
8. Approved shop drawings (plan elevation and section drawings showing all details as equipment has been installed)
9. All appurtenances provided with equipment including (pipe, valves, fittings, supports and brackets)
10. All electrical components, control panels, switches, floats, electronic components, relays, sensors, starters, contactors and enclosures
11. Names, telephone numbers, and addresses of applicable subcontractors, equipment and service suppliers and manufacturers
12. Adequate information to satisfy State regulatory agency requirements
13. Any other information concerning operation or maintenance of equipment readily available to the Contractor and as required to repair and order parts

F. At a minimum, operating and maintenance data shall be supplied for the following equipment:

1. Control systems
2. Process equipment and devices

3. Pumps
4. Electrical Devices
5. Check Valves
6. Mechanical gate and butterfly valves
7. Pipe valves and fittings
8. Instrumentation
9. SCADA systems
10. Flow measuring devices
11. Pressure measuring devices
12. Sensors
13. Unit Heaters
14. Lighting
15. Air Handling Equipment
16. Electrical switch gear

2. PRODUCTS – NOT USED

3. EXECUTION

3.1 A digital copy of each manual shall be submitted to the Engineer for review prior to the date of shipment of the equipment. Four final copies of each Operation and Maintenance Manual shall be prepared and delivered to the Owner not later than 30 days prior to placing the equipment in operation. Final manuals, and all other parts lists and information, shall be bound in a loose-leaf type manual, properly indexed and bound in hard back, three-ring binder(s) with covers and spines bearing suitable identification. A table of contents and index tabs shall be furnished for all volumes containing data for three or more items of equipment. All material shall be marked with the Manuals.

END OF SECTION

SECTION 01 7836
STARTUP WARRANTIES AND GUARANTEES

1. GENERAL

1.1 STARTUP SERVICES

A. The Contractor shall provide startup services for all equipment and systems as required to test and demonstrate a complete operating system. Starting up individual pieces of equipment separately does not constitute startup of the system. The Contractor shall demonstrate running of all systems and equipment together as a unit. The Contractor shall provide all labor and materials, Manufacturers′ representatives, field service technicians and coordination between all parties as required. This shall include coordination between suppliers of different equipment. All startup services shall be coordinated with the Owner and Engineer and a representative of either shall be present.

B. The Contractor shall supply all expendables including but not limited to electric power, fuel, lubricating oils, grease, filters and chemicals to provide all start up services. Any expendables supplied by the Owner shall be replaced by the Contractor at no cost to the Owner.

1.2 TIE-INS AND OPERATION OF OWNER'S EQUIPMENT

A. The Contractor shall not make any tie-ins to existing systems whether in service or not without pre-approval from the Owner and without an Owner's representative present. The Contractor shall not operate any valves and/or equipment belonging to the Owner without prior approval.

1.3 WARRANTIES AND GUARANTEES

A. The Contractor shall provide Warranties and Guarantees on all materials, equipment, workmanship, installations, labor and operation items provided and /or installed by the Contractor or any of its Subcontractors and /or suppliers.

B. Warranties and Guarantees shall be for a minimum period of one year after:

1. Being placed in service by the Owner before substantial completion of the Project.
2. Date of substantial completion of the Project.
3. Being installed after substantial completion of the Project.

C. Equipment installed does not constitute being "in service".

D. Warranties specifically stated in individual specification sections that are longer in duration than stated above shall apply.

E. The Contractor is required to submit the Manufacturer's Written Warranty on all equipment, devices and materials used to construct and assemble the Project.

1.4 STORAGE

A. The Contractor shall store all materials and equipment in accordance with all manufacturers' recommendations. Contractor shall include in his submittal package the Manufacturers' recommended long term and short term storage procedures. Storage procedures shall extend to equipment installed but not put into service and shall continue until project completion.

2. PRODUCTS – NOT USED

3. EXECUTION

3.1 The Contractor shall provide a written document from the Manufacturer of all equipment installed and/or provided by the Contractor that their equipment has been installed correctly and all warranties and guarantees are in effect.

3.2 Startup shall be performed under typical service operating conditions.

3.3 Written documentation shall contain various check-off items as recommended by the Manufacturer and include but not be limited to:

A. Ampere readings on all electrical motors

B. Correct lubrication

C. Correct operating temperatures and pressures

D. Correct vibration levels

E. Coupling alignment

F. Correct supports

G. Correct flange loadings (equipment piping or attachments shall be disconnected from equipment and affirmed that the piping is supported independent from equipment)

3.4 In the event one or more components fail to perform as specified or is proven defective in service during the warranty period, the Contractor shall provide replacement parts and labor to make all repairs without cost to the Owner.

3.5 The Warranty shall not cover any item that has been subjected to external damage, disassembled and/or repaired by unauthorized persons, flooded or otherwise mistreated. Items normally consumed in service such as grease, oil, v-belts, fuses, filters, seals, etc., shall not be warranted.

END OF SECTION

SECTION 02 0000
SITE CONDITIONS

1. GENERAL

1.1 DESCRIPTION

A. Existing utility facilities and structures are shown in accordance with the best available information. The Engineer and / or the Owner shall not be responsible for the completeness or accuracy thereof nor for any deductions, interpretations, or conclusions drawn there from. Forty-eight hours in advance of work in the vicinity of existing facilities, the Contractor shall notify "Miss Utility" by calling 800-552-7001. The Contractor shall verify to his own satisfaction, the actual locations of existing facilities prior to construction in their vicinity.

1. Should the Contractor, in the course of his operations, encounter any underground utilities, the presence of which was not previously known or of a different type than shown, he shall immediately notify the Engineer and take all precautions necessary to support and protect the utility and maintain continuous service until said utilities can be adjusted by the appropriate owners or other corrective measures taken.

2. Relocations by others arranged by and for the convenience of the Contractor shall be at no additional cost to the Owner.

3. The Contractor shall be responsible for filing all requests with public utility corporations, jurisdictional agencies, or other owners to make all adjustments to public utility fixtures and appurtenances within or adjacent to the limits of construction. Furnish copies of all such requests and replies to the Engineer. The Contractor shall be responsible for coordinating his activities with said body. Additional costs resulting from a lack of coordination between the utilities and Contractor shall be at no additional cost to the Owner, and extension of time, therefore, will not be granted.

4. Damage caused to utilities either directly or indirectly by the Contractor shall be repaired and the facilities restored to their original condition to the satisfaction of the Engineer and the utility owner, at no additional cost to the Owner.

B. Work in the Vicinity of Existing Utilities

1. At least 48 hours prior to starting work in the vicinity of utility structures and appurtenances, the Contractor shall notify "Miss Utility" as stated hereinbefore. The Contractor, at his own expense, shall support and protect all utility structures and appurtenances in accordance with the Contract Documents and/or the Owner's requirements and shall take any other steps necessary to protect the structures from disturbance and damage.

C. Access to Utilities Facilities

1. The Contractor shall at all times permit free and clear access to the various affected facilities by personnel of the utility for the purpose of inspection, maintenance, providing additional service requirements and the construction of new facilities. When personnel of the utility are working within the limits of work to be performed by the Contractor, the Contractor will not be relieved of his responsibility for the maintenance and protection of such facilities.

D. When local codes or laws require notification of work to agencies or departments, the Contractor shall be responsible for providing such notification.

2. PRODUCTS – NOT USED

3. EXECUTION – NOT USED

END OF SECTION

SECTION 02 2200
SELECTIVE DEMOLITION

1. GENERAL

1.1 DESCRIPTION OF WORK

A. Site demolition work is described in a general nature on the Drawings - exact extent of the site demolition may not be fully indicated. Determine the nature and extent of site demolition that will be necessary by comparing the Contract Documents with existing conditions. Perform all work of a demolition nature that may be required or necessary to a full completion of the Work, whether or not shown or specified.

B. Except as permitted in writing by the Owner, do not interrupt existing utilities serving facilities occupied and used by the Owner or others, nor disrupt the Owner's operations at adjacent facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction (including fire authorities). Protect existing utilities, site improvements, appurtenances, and landscaping to remain.

C. Before start of work, obtain and pay for all permits required by authorities having jurisdiction. All work shall comply with Federal, State and Local laws and regulations concerning hauling and disposal of demolition debris.

D. Notify and coordinate demolition with all involved utility companies.

1.2 JOB CONDITIONS

A. The Owner assumes no responsibility for the actual condition of site improvements to be demolished.

1.3 SUBMITTALS

A. Identify and accurately depict capped utilities and other subsurface structural, electrical, or mechanical conditions on Record Drawings.

1.4 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, remove demolished materials from the site.

B. Storage or sale of removed items or materials on-site will not be permitted.

C. Historical items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner, which may be encountered, remain the Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.

2. PRODUCTS – NOT USED

3. EXECUTION

3.1 SALVAGE, STORAGE AND HANDLING

A. Prior to beginning demolition, inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged and turned over to the Owner.

B. Salvage items designated by the Owner for salvage. Clean, list, and tag those items for storage. Protect from damage and deliver to the Owner at a location designated by the Owner. Salvage each item with auxiliary or associated equipment required for operation.

3.2 DEMOLITION

A. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level.

B. Provide neat sawcuts to full depth at the limits of asphalt and concrete payment removal indicated.

C. Blasting is not allowed unless approved by the Owner in writing.

3.3 DISPOSAL OF DEMOLISHED MATERIALS

A. Transport materials removed from demolished structures weekly, weather permitting, and legally dispose of off the site such as an approved landfill.

B. Burning of removed materials from demolished structures will not be permitted.

3.4 CLEAN UP

A. Remove all debris, rubbish, materials, dirt, and dust resulting from cutting, demolition or patching operations from adjacent areas and structures.

B. Promptly repair damage caused to adjacent facilities by demolition operations to the satisfaction of the Owner.

END OF SECTION

SECTION 03 2500
CONCRETE ANCHORS

1. GENERAL

1.1 SCOPE

A. All anchor bolts embedded in concrete shall be of the epoxy adhesive type whether specifically called out on the drawings or not. No expansion type, "red head" or any type of insert will be allowed without approval of the Engineer and Owner.

2. PRODUCTS

2.1 CAPSULE ADHESIVE ANCHORING SYSTEM

A. Capsule adhesive anchor system shall consist of an all-thread rod, nut, washer and adhesive capsule.

B. Anchor rod shall be provided with a 45-degree chisel or cut point to provide proper mixing of the adhesive components. Anchor rods shall be manufactured to meet the following requirements of AISI 304 or AISI 316 stainless steel meeting the mechanical requirements of ASTM F 593. Washers of nuts shall meet the same requirements as the rods. Rods, washers and nuts shall be furnished by the system manufacturer for compatibility with the system.

C. The adhesive capsules shall consist of a dual chamber foil capsule. The resin material shall be vinyl urethane methacrylate.

D. System shall be Hilti HVA Capsule Adhesive Anchoring System or approved equal.

2.2 INJECTABLE ADHESIVE ANCHORING SYSTEM

A. Injectable adhesive anchoring system shall consist of an all-thread rod, nut, washer and a two-component epoxy adhesive.

B. Anchor rods shall be furnished with chamfered ends so that either end will accept a nut and washer. Alternatively, anchor rods shall be furnished with a 45-degree chisel point on one end to allow for easy insertion into the adhesive filled hole. Anchor rods shall be manufactured to meet the following requirements of AISI 304 or AISI 316 stainless steel meeting the mechanical requirements of ASTM F 593. Washers of nuts shall meet the same requirements as the rods. Rods, washers and nuts shall be furnished by the system manufacturer for compatibility with the system.

C. Injection adhesive is a hybrid adhesive consisting of a methacrylate resin, hardener, cement and water. The system consists of adhesive refill packs, a mixing nozzle and a dispenser.

D. Injection adhesive shall be Hilti HIT-HY 150 or HIT-ICE.

3. EXECUTION

3.1 INSTALLATION

A. Capsule Adhesive Anchoring System

1. Adhesive anchors shall be installed in holes drilled using the specified diameter carbide tipped drill bit or matched tolerance diamond core bit.

2. Hole depth shall be as indicated in the manufacturer's instructions.

3. Hole must be cleaned to remove dust, debris, water, oil, chemicals and any other foreign matter or contaminants.

4. Place the capsule or capsules in hole. Ensure the capsule is inserted in the direction indicated on the capsule.
5. Using the setting tool on the rotary hammer drill, drive the rod in to the prescribed depth, Stop the drill immediately after the prescribed depth is reached. Do not disturb the anchor until the adhesive has fully cured.
6. After the adhesive has cured the anchor may be put in service. Do not over torque the rod.

B. Injectable Adhesive Anchoring System

1. Anchor holes shall be drilled with a carbide bit. Contact Manufacturer for drilling holes with a diamond bit.
2. Hole must be cleaned to remove dust, debris, water, oil, chemicals and any other foreign matter or contaminants.
3. Using the dispenser with static mixer inject adhesive into hole.
4. Install rod and allow adhesive to cure.
5. After the adhesive has cured the anchor may be put in service. Do not over torque the rod.

C. All anchors shall be installed in strict accordance with manufacturer's instructions.

D. Minimum Embedment depths shall be:

Anchor Bolt Dia.	Embedment Depth
3/8"	3-1/2"
1/2"	4-1/4"
5/8"	5"
3/4"	6-5/8"
7/8"	7-1/2"
1"	8-1/4"

E. Thread Length

1. All anchor bolts, rods and fasteners shall be cut off after installation so that no more than three (3) threads are exposed past the nut or hold down device.

END OF SECTION

SECTION 03 3000
CAST-IN-PLACE CONCRETE

1. GENERAL

1.1 SUMMARY

A. Consult the precast building manufacturer for specific foundation design and construction requirements.

B. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for Building and Environmental Structures as follows:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Suspended slabs.
5. Concrete toppings.
6. Building frame members.
7. Building walls.
8. Liquid Retaining Structures.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

E. Samples: For waterstops.

F. Welding certificates.

G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

H. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Waterstops.
6. Curing compounds.
7. Floor and slab treatments.
8. Bonding agents.
9. Adhesives.
10. Vapor retarders.
11. Repair materials.

I. Minutes of preinstallation conference.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

C. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301-99, "Specification for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

F. Preinstallation Conference: conduct conference at Project site to comply with requirements in Division I.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. 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.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

2. PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a) High-density overlay, Class 1 or better.

b) Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

c) Structural 1, B-B or better; mill oiled and edge sealed.

d) B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4-by-3/4 inch, minimum.

E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will 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.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed when welding is indicated.

C. Plain-Steel Wire: ASTM A 82, as drawn.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars 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. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II, gray. Supplement with the following:
   a) Fly Ash: ASTM C 618, Class C.
   b) Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal except as otherwise limited by ACI 318-99, paragraph 3.3.2..
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing more

than 0.1% chloride ions.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

C. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

2.6 WATERSTOPS

A. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals. Factory fabricate corners, intersections, and directional changes.

1. Products:
   a) JP Specialties, Inc.; Earth Shield TPE-Rubber.
   b) Vinylex Corp.; PetroStop.
   c) WESTEC Barrier Technologies, Inc.; 600 Series TPE-R.
2. Profile: Ribbed with center bulb.
3. Dimensions: 4 inches by 3/16 inch thick; nontapered.

2.7 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class C, or polyethylene sheet, ASTM D 4397, not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

2.8 FLOOR AND SLAB TREATMENTS

A. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture when indicated.

B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces when indicated.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

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 C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

2.10 RELATED MATERIALS

A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

C. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

D. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.12 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, according to ACI 301.

1. Use a qualified independent 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.

2. Ground Granulated Blast-Furnace Slag: 50 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to 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 corrosion-inhibiting admixture in concrete mixtures when indicated.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.13 CONCRETE MIXTURES FOR NON-ENVIRONMENTAL BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.

2. Slump Limit: 4 inches; 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.

3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery

B. Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Slump Limit: 4 inches; 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.

3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery.

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Slump Limit: 4 inches, plus or minus 1 inch.

3. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

4. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd.

D. Suspended Slabs: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Slump Limit: 4 inches, plus or minus 1 inch.

3. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

4. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd.

E. Concrete Toppings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Slump Limit: 4 inches, plus or minus 1 inch.

3. Air Content: Do not allow air content of troweled finished toppings to exceed 3 percent.

4. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd.

2.14 CONCRETE MIXES FOR ENVIRONMENTAL AND LIQUID RETAINING STRUCTURES

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Slump Limit: 4 inches; 8 inches for concrete with verified slump of 2 to 4 inches before adding high range water-reducing or plasticizing admixture, plus or minus 1 inch.

3. Air Content: 6 percent plus or minus 1.5 percent at point of delivery.

B. All other concrete: Proportion normal weight concrete mixture as follows:

1. Minimum compressive strength: 4000 psi at 28 days.

2. Maximum Water-Cementitious Material Ratio: 0.45.

3. Minimum Cementitious Materials Content: 540 lbs/cu. yd.

4. Slump Limit: 4 inches plus or minus 1 inch.

5. Air Content: 6 percent plus or minus 1.5 percent at point of delivery. Do not allow air content of troweled finished floors to exceed 3 percent.

2.15 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.16 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

3. EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment,

elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.

2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.

2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 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. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

2. 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.

3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: 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, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 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. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.4 SHORES AND RESHORES

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.

3.5 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.6 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. 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 would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps. Lace overlaps with wire.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Isolation Joints in Slabs-on-Grade: After removing formwork, install bond break strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend bond break strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

2. Terminate full-width bond break strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.

3. Install bond break strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

D. 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.

3.8 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Notify Soils Engineer to permit inspection of sub-base a minimum of 24 hours prior to placement of reinforcing steel and concrete. Owner's Soils Engineer shall inspect and approve all foundation subgrades prior to placing concrete (See Division 2).

C. Notify Owner's Inspection service to permit inspection of reinforcing steel a minimum of 24 hours prior to concrete placement. Notify Owner 24 hours prior to any scheduled concrete pour.

D. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.

   1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. 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. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

   2. Maintain reinforcement in position on chairs during concrete placement.

   3. Screed slab surfaces with a straightedge and strike off to correct elevations.

   4. Slope surfaces uniformly to drains where required.

   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures:

   1. 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.

   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

H. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Forms used for formed concrete shall produce a smooth formed finish.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces to receive a rubbed finish and to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. 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.

2. Apply to concrete surfaces exposed to view or permanently exposed to process liquids.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.

1. Apply scratch finish to surfaces indicated and to receive: concrete floor toppings; to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed

terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/8 inch.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after trowel finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

F. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:

1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer.

2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.

3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a) Water.

   b) Continuous water-fog spray.

   c) Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. 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. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

   a) Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

   b) Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

   a) After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

3.14 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.

2. Do not apply to concrete that is less than 28 days' old.

3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half 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 in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. 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 will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include 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.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low

areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to 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. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Testing Agency shall provide certification of field and laboratory technicians for qualifications required in ACI 318-08, Section 5.6.1.

B. Inspections:

1. Steel reinforcement placement.

2. Steel reinforcement welding.

3. Headed bolts and studs.

4. Verification of use of required design mixture.

5. Concrete placement, including conveying and depositing.

6. Curing procedures and maintenance of curing temperature.

7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172, as modified in these specifications, shall be performed according to 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 will provide 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 C 143/C 143M; 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. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; 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 C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M. Samples shall be taken from concrete pump discharge hose when concrete is transported by concrete pump.
    a) Cast and laboratory cure two sets of two 6 x 12 cylinder specimens or two sets of three 4 x 8 cylinder specimens for each composite sample. Test specimen size shall be agreed upon by A/E and testing agency before construction.
    b) Cast and field cure two sets of cylinder specimens for each composite sample for formed elevated slab or beam elements.
6. Compressive-Strength Tests: ASTM C 39-05.
    a) 6 x 12 Specimens: Test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    b) 4 x 8 Specimens: Test one set of three laboratory-cured specimens at 7 days and one set of three specimens at 28 days.
    c) A compressive-strength test shall be the average compressive strength from a set of specimens obtained from same composite sample and tested at age indicated.
7. 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.
8. 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.
9. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: 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 Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.

12. Additional testing and inspecting will be at Contractor's expense.
13. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

END OF SECTION

SECTION 03 4000
PRECAST CONCRETE

1. GENERAL

1.1 SCOPE

A. The Work covered by this Section consists of furnishing all labor, equipment, and materials necessary to install all required precast concrete structures shown in the Contract Drawings. The Contract Documents apply to this Section.

1.2 SUBMITTALS

A. Shop drawings and product data for all precast structures and related accessories.

B. All shop drawing shall be signed by a Professional Engineer registered in the Commonwealth of Virginia.

1.3 REFERENCE SPECIFICATIONS

A. American Society of Testing and Materials; ASTM.

B. American Association of State Highway and Transportation Officials; AASHTO.

C. American Concrete Institute; ACI.

1.4 QUALITY ASSURANCE

A. Comply with all applicable codes and regulations as required by regulatory agencies having jurisdiction over this Work. Comply with the pertinent sections of the following standards:

1. American Society of Testing and Materials
2. American Association of State Highway and Transportation Officials
3. American Concrete:

2. PRODUCTS

2.1 Refer to SECTION 107 – SANITARY SEWER SYSTEM.

3. EXECUTION

3.1 BEDDING

A. Unless otherwise noted, all precast structures shall be placed on a compacted VDOT No. 57 stone bed with a minimum thickness of 6 inches.

3.2 PLACEMENT

A. Precast structures shall not be placed on muddy or frozen sub grade.

B. The excavation for the structure shall be dry when the structure is placed.

C. The Contractor is responsible for insuring that the invert elevations specified in the Contract Drawings can be met by the Precast Structure.

END OF SECTION

SECTION 03 6000
GROUT

1. GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment, and incidentals as shown, specified and required to furnish and install grout.
2. The types of grout include the following:
   a) Non-Shrink Grout: This type of grout is to be used wherever grout is shown in the Contract Documents, unless another type is specifically referenced. Two classes of non-shrink grout (Class I and II) and areas of application are specified herein.
   b) Non-Shrink Epoxy Grout (Class III).
   c) Grout Fill, Topping Grout.
   d) Construction Joint Grout.

B. Application: The following is a listing of typical applications and the corresponding type of grout, which is to be used. Unless otherwise indicated, grouts shall be provided as listed below whether called for on the Drawings or not.

Application	Type of Grout
Beam and column (1 or 2 story) base plates and precast concrete bearing less than 16-inches in the least dimension.	Non-shrink Class II.
Column base plates and precast concrete bearing (greater than 2 story or larger than 16- inches in the least dimension).	Non-shrink Class I.
Base plates for storage tanks and other non-motorized equipment and machinery less than 30 horsepower.	Non-shrink Class I.

Application	Type of Grout
Machinery over 30 horsepower and equipment under 30 horsepower but subject to severe shock loads and high vibration.	Non-shrink Class III.
Filling blockout spaces for embedded items such as railing posts, gate guide frames, etc.	Non-shrink Class II (Class I where placement time exceeds 15 minutes).
Toppings and concrete fill less than 4-inches thick.	Grout Fill, Topping Grout.
Toppings and concrete fill greater than 4-inches thick.	Class "A" Concrete in accordance with Section 033000, Cast-In-Place Concrete.

All anchor bolts and reinforcing steel set in grout.	Refer to Section 031500, Concrete Anchors
Any application not listed above, where grout is called for on the Drawings.	Non-shrink Class I, unless noted otherwise.

1.2 REFERNCES

A. Standards referenced in this Section are listed below.

1. American Concrete Institute, (ACI).

a) ACI 211.1, Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

b) ACI 301, Specification for Structural Concrete (Includes ASTM Standards referred to herein).

2. American Society for Testing and Materials, (ASTM).

a) ASTM C 33, Specification for Concrete Aggregates.

b) ASTM C 109, Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2 in. or 50 mm. Cube Specimens).

c) ASTM C 150, Specification for Portland Cement.

d) ASTM C 230, Specification for Flow Table for use in Tests of Hydraulic Cement.

e) ASTM C 531, Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical- Resistant Mortars, Grouts, and Monolithic Surfacings.

f) ASTM C 579, Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings and Polymer Concretes.

g) ASTM C 827, Test Method for Early Volume Change of Cementations Mixtures.

h) ASTM C 882, Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete.

i) ASTM C 937, Specification for Grout Fluidifier for Preplaced-Aggregate Concrete.

j) ASTM C 939, Text Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).

k) ASTM C 1107, Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).

l) ASTM C 1181, Test Method for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts.

m) ASTM D 696, Test Method for Coefficient of Linear Thermal Expansion of Plastics.

1.3 QUALITY ASSURANCE

A. Field Tests:

1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the ENGINEER to ensure continued compliance with these Specifications. The specimens will be made by the ENGINEER or its representative.

2. Compression tests and fabrication of specimens for non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the ENGINEER. A set of three specimens will be made for testing at seven days, 28 days, and each additional time period as appropriate.

3. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by the ENGINEER. A set of three specimens will be made for testing at seven days, and each earlier time period as appropriate.

4. The cost of all laboratory tests on grout will be borne by the OWNER, but CONTRACTOR shall assist the ENGINEER in obtaining specimens for testing. However, CONTRACTOR shall be charged for the cost of any additional tests and investigation on Work performed which does not conform to the requirements of the Specifications. CONTRACTOR shall supply all materials necessary for fabricating the test specimens.

1.4 SUBMITTALS

A. Shop Drawings: Submit the following:

1. For Grout Fill and Construction Joint Grout, copies of grout design mix and laboratory test reports for grout strength tests.

B. Reports and Certificates, submit for approval the following:

1. For proprietary materials, submit copies of manufacturer’s certification of compliance with the specified properties for Class I, II, and III grouts.

2. Submit certified testing lab reports for ASTM C 1107, Grade B and Grade C (as revised herein) requirements for Class I and II grouts tested at a fluid consistency for temperatures of 45, 73.4, 90°F with a pot life of 30 minutes at fluid consistency.

3. Submit certification that materials conform to the Specifications requirements for nonproprietary materials.

4. Submit certifications that all grouts used on the project are free of chlorides or other chemicals causing corrosion.

5. Manufacturer's specifications and installation instructions for all proprietary materials,

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Grout materials from manufacturers shall be delivered in unopened containers and shall bear intact manufacturer's labels.

B. Storage of Materials: Grout materials shall be stored in a dry shelter and shall be protected from moisture.

2. PRODUCTS

2.1 GROUTS

A. General: Non-shrink grout shall be a prepackaged, inorganic, flow able, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout specified herein shall be that recommended by the manufacturer for the particular application.

B. Class I, Non-Shrink Grout:

1. Class I, non-shrink grouts shall have a minimum 28-day compressive strength of 7,000 psi. This grout is for precision grouting and where water-tightness and non-shrink reliability in both plastic and hardened states are critical. Refer to areas of application as specified herein.

2. Shall meet the requirements of ASTM C 1107 Grade C and B (as modified below) when tested using the amount of water required to achieve the following properties:

   a) Fluid consistency (20 to 30 seconds) in accordance with ASTM C 939.

   b) At temperatures of 45, 73.4, and 95°F.

3. The length change from placement to time of final set shall not have a shrinkage greater than the amount of expansion measured at 3 or 14 days. The expansion at 3 or 14 days shall not exceed the 28-day expansion.

4. The non-shrink property is not based on a chemically generated gas or gypsum expansion.

5. Fluid grout shall pass through the flow cone, with a continuous flow, one hour after mixing.

6. Products and Manufacturer: Provide one of the following:

   a) Masterflow 928, as manufactured by Master Builders, Inc.

   b) Five Star Grout, as manufactured by Five Star Products, Inc.

   c) Hi-Flow Grout, as manufactured by the Euclid Chemical Company.

   d) Or equal.

C. Class II Non-Shrink Grout:

1. Class II, non-shrink grouts shall have a minimum 28 day compressive strength of 7,000 psi. This grout is for general purpose grouting applications as specified herein.

2. Shall meet the requirements of ASTM C 1107 and the following requirements when tested using the amount of water required to achieve the following properties.

   a) Flowable consistency (140 percent flow on ASTM C 230, five drops in 30 seconds).

   b) Fluid working time of at least 15 minutes.

   c) Flowable for at least 30 minutes.

3. The grout when tested shall not bleed at maximum allowed water.

4. The non-shrink property is not based on a chemically generated gas or gypsum expansion.

5. Products and Manufacturer: Provide one of the following.
    a) Set Grout, as manufactured by Master Builders, Inc.
    b) NBEC Grout, as manufactured by Five Star Products, Inc.
    c) NS Grout, as manufactured by the Euclid Chemical Company.
    d) Or equal.

D. Class III Non-Shrink Epoxy Grout:

1. Epoxy grout shall be a pourable, non-shrink, 100 percent solids system. The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted, unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged. The following properties shall be attained with the minimum quantity of aggregate allowed by the manufacturer.
2. Products and Manufacturer: Provide one of the following:
    a) Euco High Strength Grout, as manufactured by The Euclid Chemical Company.
    b) Sikadur 42 Grout Pak, as manufactured by Sika Corporation.
    c) Five Star Epoxy Grout, as manufactured by Five Star Products, Incorporated.
    d) Or equal.
3. The vertical volume change at all times before hardening shall be between 0.0 percent shrinkage and 4.0 percent expansion when measured according to ASTM C 827 (modified for epoxy grouts by using an indicator ball with a specific gravity between 0.9 and 1.1). Alternately, epoxy grouts which maintain an effective bearing area of not less than 95 percent are acceptable.
4. The length change after hardening shall be negligible (less than 0.0006 in/in) and the coefficient of thermal expansion shall be less than 0.00003 in/in/F when tested in accordance to the requirements of ASTM C 531.
5. The compressive creep at one year shall be negligible (less than .001 in/in) when tested under a 400-psi constant load at 140°F in accordance to the requirements of ASTM C 1181.
6. The seven day compressive strength shall be a minimum of 14,000 psi when tested in accordance to the requirements of ASTM C 579
7. The grout shall be capable of maintaining at least a flow able consistency for a minimum of 30 minutes at 70°F.
8. The shear bond strength to portland cement concrete shall be greater than the shear strength of the concrete when tested in accordance to the requirements of ASTM C 882.
9. The effective bearing area shall be a minimum of 95 percent.

E. Grout Fill, Topping Grout:

1. Grout for topping of slabs and concrete fill for built up surfaces of tank, channel, and

basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed as specified herein. All materials and procedures specified for normal concrete in Section 033000, Cast-In-Place Concrete, shall apply except as noted otherwise herein.

2. Topping grout and concrete fill shall contain a minimum of 564 pounds of cement per cubic yard with a maximum water cement ratio of 0.45. Where concrete fill is thicker than 4-inches, Class "A" concrete, as specified in Section 033000, Cast-In-Place Concrete, may be used when accepted by the ENGINEER.

3. Coarse aggregate shall be graded as follows.

U.S. STANDARD SIEVE SIZE	PERCENT BY WEIGHT PASSING
1/2-inch	100
3/8-inch	90 to 100
No. 4	20 to 55
No. 8	5 to 30
No. 16	0 to 10
No. 30	0

4. Final mix design shall be as determined by trial mix design under supervision of the approved testing laboratory.

5. Strength: Minimum compressive strength of grout fill at the end of 28 days shall be 4000 psi

F. Construction Joint Grout:

1. Construction Joint Grout approximates Class "A" concrete, as specified in Section 033000, Cast-In-Place Concrete, with aggregate coarser than 1/2-inch removed. The mix shall be designed as flow able with a high mortar content. It is intended to be placed over construction joints and mixed with Class "A" concrete as specified in Section 033000, Cast-In-Place Concrete. The mix requirements are as follows:

   a) Compressive Strength: 4,500-psi minimum at 28 days.

   b) Maximum Water Cement Ratio: 0.45 by weight.

   c) Coarse Aggregate: ASTM C 33, No. 8 size.

   d) Fine Aggregate: ASTM C 33, approximately 60 percent by weight of total aggregate.

   e) Air Content: 8±1 percent.

   f) Minimum Cement Content: 752 pounds per cubic yard.

G. Requirements for Grout Fill and Construction Joint Grout:

1. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the Project for grout required. Comply with ACI 211.1 and report to ENGINEER the following data:

   a) Complete identification of aggregate source of supply.

   b) Tests of aggregates for compliance with specified requirements.

c) Scale weight of each aggregate.

d) Absorbed water in each aggregate.

e) Brand, type and composition of cement.

f) Brand, type and amount of each admixture.

g) Amounts of water used in trial mixes.

h) Proportions of each material per cubic yard.

i) Gross weight and yield per cubic yard of trial mixtures.

j) Measured slump.

k) Measured air content.

i. Compressive strength developed at seven days and 28 days, from not less than three test specimens cast for each seven day and 28-day test, and for each design mix.

2. Submit written reports to ENGINEER of proposed mix of grout at least 30 days prior to start of the Work. Do not begin grout production until mixes have been approved by ENGINEER.

3. Laboratory Trial Batches: When laboratory trial batches are used to select grout proportions, prepare test specimens and conduct strength tests as specified in ACI 301, Section 4 Proportioning. However, mixes need not be designed for greater than 125 percent of the specified strength, regardless of the standard deviation of the production facility.

4. Field Experience Method: When field experience methods are used to select grout proportions, establish proportions as specified in ACI 301, Section 4.

5. Admixtures: Use air-entraining admixture in all grout. Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities and types of admixtures as required to maintain quality control. Do not use admixtures which have not been incorporated and tested in the accepted design mix, unless otherwise authorized in writing by ENGINEER.

2.2 CURING MATERIALS

A. Curing materials shall conform to the requirements of Section 033000, Cast-in-Place Concrete, and as recommended by the manufacturer of prepackaged grouts.

2.3 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable, but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

B. The slump for topping grout and grout fill shall be adjusted to match placement and finishing conditions, but shall not exceed 4-inches.

C. The slump for Construction Joint Grout shall be 7 ± 1-inches.

3. EXECUTION

3.1 INSPECTION

A. CONTRACTOR shall examine the substrate and conditions under which grout is to be placed and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

A. General:

1. Place grout as shown and in accordance with manufacturer's instructions. If manufacturer's instructions conflict with these Specifications, do not proceed until ENGINEER provides clarification.

2. Manufacturers of proprietary products shall make available upon 72 hours notification the services of a qualified, full time employee to aid in assuring proper use of the product under job conditions.

3. Placing grout shall conform to temperature and weather limitations in Section 033000, Cast-In-Place Concrete.

4. Grout shall be cured following manufacturer’s instructions for prepackaged grout and the requirements in Section 033000, Cast-In-Place Concrete, for grout fill and topping grout.

B. Columns, Beams and Equipment Bases:

1. Epoxy grout: After shimming equipment to proper grade, securely tighten anchor bolts. Properly form around the base plates, allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with the epoxy grout.

2. Non-shrink, non-metallic grout: After shimming columns, beams and equipment to proper grade, securely tighten anchor bolts. Properly form around the base plates allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with the non-shrink, non-metallic grout.

C. Handrails and Railings:

1. After posts have been properly inserted into the holes or sleeves, fill the annular space between posts and sleeve with the non-shrink, non-metallic grout. Bevel grout at juncture with post so that moisture flows away from post.

D. Construction Joints:

1. Place a 6-inch minimum thick layer of Construction Joint Grout over the contact surface of the old concrete at the interface of horizontal construction joints as specified in Section 033000, Cast-In-Place Concrete.

E. Topping Grout:

1. All mechanical, electrical, and finish work shall be completed prior to placement of topping grout. The base slab shall be given a roughened textured surface by sandblasting or hydroblasting exposing the aggregates to ensure bonding to the base slab.

2. The minimum thickness of grout topping shall be 1-inch.

3. The base slab shall be thoroughly cleaned and wetted prior to placing topping and fill. No topping concrete shall be placed until the slab is complete free from standing pools or ponds of water. A thin coat of neat Type II cement slurry shall be broomed into the surface of the slab and topping or fill concrete shall be placed while the slurry is still wet. The topping and fill shall be compacted by rolling or tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures as recommended by the equipment manufacturer after the grout is brought to the established grade.
4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
5. The surface shall be tested with a straight edge to detect high and low spots which shall be immediately eliminated. When the topping has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand troweling. During finishing, no water, dry cement or mixture of dry cement and sand shall be applied to the surface.
6. Cure and protect the grout topping as specified in Section 033000, Cast-In-Place Concrete.

F. Grout Fill:

1. All mechanical, electrical, and finish work shall be completed prior to placement of grout fill. Grout fill shall be mixed, placed, and finished as required in Section 033000, Cast-In-Place Concrete.
2. The minimum thickness of grout fill shall be 1-inch. Where the finished surface of grout fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3 1/2-inches wide by 1 1/2-inches deep.
3. The surface shall be tested with a straight edge to verify that the surface slopes uniformly to drain and to detect high and low spots which shall be immediately eliminated. When the grout fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. During finishing, no water, dry cement, or mixture of dry cement and sand shall be applied to the surface

END OF SECTION

SECTION 08 1116
ALUMINUM ACCESS HATCHES

1. GENERAL

1.1 SUMMARY

A. Scope

1. This section includes providing and installing aluminum access hatches as shown on the Drawings and as specified herein.

1.2 SUBMITTALS

A. Provide submittals for selected equipment.

B. Shop Drawings

1. The Contractor shall submit complete shop drawings of all equipment furnished for this project as covered by these specifications. The Contractor's submittal must include a certification that the submitted material describes exactly the equipment to be provided or a list of deviations from the specifications with an explanation of each deviation.

1.3 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer’s Qualifications:

a) Manufacturers regularly engaged in the manufacture of the equipment as specified herein and who can demonstrate equipment of this specified design, in actual service for a period of not less than 10 years will be considered as acceptable Manufacturers.

b) Manufacturers shall show evidence of quality assurance in manufacturing and supplying equipment essential in details to the equipment herein specified.

1.4 WARRANTY

A. Access covers shall carry a lifetime guarantee against defects in material and/or workmanship.

2. PRODUCTS

2.1 ACCESS HATCH

A. Access doors shall be either single or double spring assisted doors as indicated on the drawings.

B. Access doors shall comply with the following specifications:

1. Cover Leaf(s) shall be a minimum 1/4" aluminum diamond plate.

2. Angle Frame shall be a minimum 1/4" aluminum with continuous anchor flange.

3. Frame shall be coated with a bituminous coating where in contact with concrete.

4. Load Rating shall be a minimum of 300 lbs. psf uniform live load with a maximum allowable deflection of 1/150 of the span.

5. Locking System: shall be a Type 316 stainless steel slam lock with removable key.

a) Cover shall be equipped with the following stainless steel features:

b) Spring assists, T-316 tamper proof attaching hardware, automatic T-316 hold

open arm with aluminum latch.

6. Cushion / Gasket: neoprene.

C. Access doors and hatches shall be Halliday Products or Engineer approved equal.

3. EXECUTION

3.1 Access doors and hatches shall be installed in accordance with the Manufacturer's instructions.

END OF SECTION

SECTION 09 9656
CONCRETE EPOXY COATING

1. GENERAL

1.1 SUMMARY

A. Solvent-free epoxy coating to be applied to specified surfaces and conforms to the requirements set forth below.

B. This specification covers all labor, materials, equipment, and services necessary to complete the installation of corrosion protection for concrete and masonry structures as herein specified.

C. Related Sections: Concrete Repair, Environmental, Health and Safety.

1.2 REFERENCES

A. ACI - The published standards of the American Concrete Institute, Farmington Hills, MI.

1. ACI 506.2-77 - Specifications for Materials, Proportioning, and Application of Shotcrete.

B. ASCE - The Published Manuals and Reports on Engineering Practices of the American Society of Civil Engineers, Reston, VA.

1. ASCE Manual No. 92 - Manuals and Reports on Engineering Practice; Manhole Inspection and Rehabilitation (2008 Update).

C. ASTM - The published standards and test methods of the American Society for Testing and Materials, West Conshohocken, PA.

1. ASTM C109 - Compressive Strength Hydraulic Cement Mortars
2. ASTM D543 - Resistance of Plastics to Chemical Reagents
3. ASTM C579 - Compressive Strength of Chemically Setting Silicate and Silica Chemical Resistant Mortars
4. ASTM D638 - Tensile Properties of Plastics
5. ASTM D695 - Compressive Properties of Rigid Plastics
6. ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics
7. ASTM D2584 - Volatile Matter Content
8. ASTM D4258 - Standard Practice for Surface Cleaning Concrete
9. ASTM D4259 - Standard Practice for Abrading Concrete ASTM D4541 - Pull-off Strength of Coatings Using a Portable Adhesion Tester
10. ASTM D4787 Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates.
11. ASTM D7234 - Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.

D. ICRI - The published standards of the International Concrete Repair Institute, Des Plaines, IL.

1. ICRI Technical Guideline No. 03732 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

E. Los Angeles County Sanitation District - Evaluation of Protective Coatings for Concrete (otherwise known as the "Redner Test").

F. NACE - The published standards of National Association of Corrosion Engineers (NACE International), Houston, TX.

1. NACE RPO 188-99 Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

G. SSPC - The published standards of the Society of Protective Coatings, Pittsburgh, PA.

1. SSPC-SP 1 - Solvent Cleaning
2. SSPC-SP 5 - White Metal Blast Cleaning
3. SSPC-SP 10 - Near White Metal Blast Cleaning
4. SSPC-SP 12 Surface Preparation and Cleaning of Metals by Water jetting prior to Recoating.
5. SSPC SP-13/NACE No. 6 - Surface Preparation of Concrete.
6. SSPC-PA 9 - Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages.

H. SSPWC - Standard Specifications for Public Works Construction "Greenbook", 2009.

1. SSPWC 210-2.3.3 & 211-2 - Chemical Resistance Test (Pickle Jar Test).
2. SSPWC 500-2 - Manhole and Structure Rehabilitation.

1.3 SUBMITTALS

A. Technical data sheet on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.

B. Material Safety Data Sheets (MSDS) for each product used.

C. Project specific guidelines and recommendations.

D. Applicator Qualifications:

1. Manufacturer certification that the Applicator has been trained in the handling, mixing and application of the products to be used.
2. Certification that the equipment to be used for applying the products has been approved by the protective coating manufacturer and Applicator personnel have been trained and certified for proper use of the equipment.
3. Written document providing three (3) year’s experience and five (5) recent references of Applicator indicating successful application of a 100% solids high-build solvent-free coating by spray application.
4. Applicator must provide written documentation of having installed a minimum of 50,000 square feet of plural component spray applied epoxy coating the same or similar to that specified within the last two (2) years.
5. Proof of any necessary federal, state or local permits or licenses necessary for the project.
6. Documentation of requirements of Section 1.6 B & C.

1.4 QUALITY ASSURANCE

A. Coating and repair product(s) shall be capable of being installed and curing properly within the specified environment(s); specifically, within environmental conditions of a typical

sanitary sewer. Coating product(s) shall be resistant to all forms of chemical or bacteriological attack found in municipal sanitary sewer systems.

B. Coating and Repair product(s) shall be fully compatible; including ability to bond effectively (as tested for in Section 3.5 C.) to each other and/or the host substrate, forming a composite system.

C. Contractor shall utilize equipment for the application of the coating and repair product(s) which has been approved by the product manufacturer; and Contractor shall have received training on the operation and maintenance of said equipment from the product manufacturer. Written certification of such approval(s) and training shall be submitted by the coating and repair product manufacturer(s).

D. Contractor and contractor personnel shall be certified by, or have their training approved and certified by, the coating and repair product(s) manufacturer(s) for the handling, mixing, application and inspection of the product(s) to be used as specified herein. Written certification of such training shall be submitted by the coating and repair product manufacturer(s) and shall include the individual contractor personnel to be employed on the project.

E. Inspectors shall be trained in the use of testing or inspection instrumentation and knowledgeable of the proper use, preparation and installation of the product(s) to be used as specified herein.

F. Contractor shall initiate and enforce quality control procedures consistent with the coating product(s) manufacturer recommendations and applicable NACE, SSPC, ICRI or other standards as referenced herein.

1.5 DELIVERY, STORAGE AND HANDLING

A. Materials are to be kept dry, protected from weather, and stored under cover.

B. Coating and repair materials are to be stored between 50 °F and 90 °F. Do not store near flame, heat, or strong oxidants.

C. All materials are to be handled according to their material safety data sheets.

1.6 SITE CONDITIONS

A. Contractor shall conform to all local, state, and federal regulations including those set forth by OSHA, RCRA and the EPA and any other applicable authorities.

B. Confined space entry program and other required safety training certifications shall be submitted by Contractor to Owner as necessary to perform the specified work.

C. Flow diversion and/or bypass plans shall be submitted by Contractor to Owner as necessary to perform the specified work.

1.7 WARRANTY

A. Contractor shall warrant all work against defects in materials and workmanship for a period of one (1) year, unless otherwise noted, from the date of final acceptance of the project. Contractor shall, within a reasonable time after receipt of written notice thereof, repair defects in materials or workmanship which may develop during said one (1) year period, and any damage to other work caused by such defects or the repairing of same, at his own expense and without cost to the Owner.

B. Coating and repair product supplier(s) shall warrant all coating materials for a period of one (1) year from the date of final acceptance, unless otherwise noted, to be free of

manufacturing defects; and products will meet current published physical properties when applied and tested in accordance with the manufacturer's standards. If, within said one (1) year period, any product does not meet the physical properties or is defective in manufacture the manufacturer will either replace the defective product or refund the purchase price.

2. PRODUCTS

2.1 EXISTING PRODUCTS

A. Standard Portland concrete or new concrete (for quick setting high strength cement see manufacturer's recommendations) must be well cured prior to application of the protective coating. Generally, 28 days is the minimum cure time for standard Portland concrete or when roughly 80% of its designed concrete strength has been achieved (see Raven 1010.2014 CATB for coating green concrete).

B. Existing coatings shall be removed which may affect the performance and adhesion of the specified coating product(s). Contractor is to maintain strict adherence to the protective coatings manufacturer's recommendations with regard to proper surface preparation and compatibility with existing coatings.

C. Thoroughly clean and prepare existing products/surfaces to effect a seal with and promote the adhesion of the coating product(s).

2.2 COATING PRODUCTS

A. Coating product shall be applied to all interior surfaces to protect the host substrate and repair materials from all forms of chemical or bacteriological attack typically found in municipal sanitary sewer systems and to impart a degree of structural enhancement.

B. Coating product physical properties shall be substantiated through submittal of accredited third party testing results and shall be representative of the actual field applied product and cure mechanism(s) to be employed in the field.

C. 100% Solids, Solvent-Free, Ultra-High Build Epoxy Coating to be spray applied to all interior surfaces of exposed concrete within the wet well.

1. Manufacturer: Raven Lining Systems, Broken Arrow, Oklahoma 800-324-2810 or 918-615-0140 fax.

2. Product: Raven 405 - 100% solids, solvent-free ultra-high-build epoxy system exhibiting the following characteristics:

   a) Product Type: amine cured epoxy

   b) VOC Content (ASTM D2584): 0%

   c) Compressive Strength, (ASTM D695): 18,000 psi

   d) Tensile Strength, (ASTM D638): 7,600 psi

   e) Flexural Modulus, (ASTM D790): 700,000 psi

   f) Adhesion to Concrete, (ASTM D4541/7234): >200 psi with substrate (concrete) failure

   g) Chemical Resistance (ASTM D543/G20) immersion service for:

      i. Municipal sanitary sewer environment

ii. Sulfuric Acid, 30%

iii. Sodium Hydroxide, 10%

iv. Sodium Hypochlorite, 3%

2.3 PRODUCT APPLICATION EQUIPMENT

A. Coating product to be spray applied shall be mixed and applied using manufacturer approved heated plural component spray equipment.

B. Coating product application too hard to reach areas or for touch-up may be performed using hand tools.

3. EXECUTION

3.1 EXAMINATION

A. Appropriate actions shall be taken by Contractor to comply with local, state, and federal regulatory and other applicable agencies with regard to environment, health, and safety during work.

B. New Portland concrete structures shall have a minimum of 28 days' cure since manufacture prior to commencing coating installation. Should earlier coating be required, coating product manufacturer shall recommend specifications including appropriate cure assessment testing or use of specialty primers and sealers such as Raven 155.

C. Any active flows shall be dammed, plugged, or diverted as required to ensure all liquids are maintained below or away from the surfaces to be coated until final applications are cured as recommended by the manufacturer.

D. Temperature of the surface to be coated should be maintained between 40 and 120 °F.

E. Specified surfaces should be shielded to avoid exposure of direct sunlight, other intense heat source or, where cementitious products are employed, excessive ventilation. Where varying surface temperatures do exist, coating installation should be scheduled when the temperature is falling versus rising.

F. Prior to commencing surface preparation, Contractor shall inspect all surfaces specified to receive the coating and notify Owner, in writing, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

3.2 REPAIRS AND SURFACE PREPARATION

A. Excessive debris, sediment, root intrusion or other foreign materials which may impact the effectiveness of the surface preparation process shall be removed prior to the commencement thereof.

B. Offset structural components, lids, covers, frames, etc. shall be repaired, replaced, or reset prior to the commencement of surface preparation.

C. External soil/fill voids shall be remediated and/or stabilized by replacement or injection of stabilizing grout as determined appropriate by the engineer.

D. Oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants which may affect the performance and adhesion of the coating to the substrate shall be removed in accordance with SSPC-SP 1 - Solvent Cleaning.

E. Choice of surface preparation method(s) should be based upon the condition of the structure and concrete or masonry surface, potential contaminants present, access to perform work, and the required cleanliness and profile of the prepared surface to receive the repair and/or coating product(s).

F. Surface preparation method, or combination of methods, that may be used include high-pressure water cleaning, water jetting, abrasive blasting, shot blasting, grinding, scarifying, detergent water cleaning, hot water cleaning and others as referenced in industry accepted standards such as:

1. SSPC SP-13/NACE No. 6 Surface Preparation of Concrete,
2. ASTM D4258 Standard Practice for Surface Cleaning Concrete for Coating and ASTM D4259 Standard Practice for Abrading Concrete,
3. ICRI Technical Guideline No. 03732 Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
4. NACE/SSPC Standards for the surface preparation of steel.

G. Whichever method(s) are used, they shall be performed in a manner that provides a uniform, sound, clean, and neutralized surface suitable for the specified coating product(s).

1. Resulting surface profile of the prepared concrete substrate shall be (as described in ICRI Technical Guideline No. 03732):
   a) For application of coating products: at least a CSP4.
2. Concrete and/or mortar damaged by corrosion, chemical attack or other means of degradation shall be removed so that sound substrate remains,
   a) In conditions where severe chemical/microbiological attack is present the prepared substrate shall exhibit a pH of 8-12. Additional cleaning and/or contaminated substrate removal may be required to achieve the specified pH level.
3. Steel surfaces to be coated shall be abrasive blast cleaned.
   a) Blast air shall be free of oil and water.
   b) Abrasive shall be as required to produce the specified level of cleanliness and profile in an efficient and uniform manner. Abrasive shall not be recycled.
   c) Abrasive blasting shall not be performed when the air or steel temperature is below 40 °F, when the relative humidity exceeds 80%, or when the steel is less than 5 °F warmer than the dew point. The Contractor will provide dehumidification, and/or temperature control as necessary to meet these conditions.
   d) Blast cleaning shall be in accordance with SSPC-SP 5, White Metal Blast Cleaning for immersion service of the coated areas. Blast cleaning for other surfaces shall be in accordance with SSPC-SP 10, Near White Blast Cleaning. Anchor profile shall be 2.5-5.0 mils and relative to the coating thickness specified.
   e) Alternatively, surfaces to be recoated may be cleaned according to SSPC-SP 12/NACE No. 5 Surface Preparation and Cleaning of Metals by Water jetting prior to Recoating.
      i. Preparation shall be to SSPC-SP 12, WJ-1, and Clean to Bare Substrate using a minimum of High-Pressure Water Jetting (10,000 psi-30,000 psi).
      ii. Water jetting does not produce a profile of the magnitude currently

recognized by the coatings industry. Rather, it exposes the original abrasive-blasted surface profile if one exists. An anchor profile of at least 2.5 mils is required to be exposed. If sufficient profile does not exist, abrasive blasting shall be performed as specified in section 3.2 D.

iii. At the time of the recoating, the amount of flash rust shall be no greater than "No Flash Rust" as defined in SSPC-SP 12.

iv. If inhibitors are to be used with the standard jetting water, the coatings manufacturer shall be consulted to ensure the compatibility of inhibitors with the coatings.

H. Prior to the application of the coating product repairs shall be completed to ensure the following:

1. All inflow and infiltration shall be eliminated by use of appropriate repair material(s), such as hydraulic cements and/or chemical grouts as described in Section 2.2.

2. All repairs to joints, pipe seals, steps, mechanical penetrations, benches, inverts, pipes or other appurtenances to be coated shall be completed and repaired surfaces prepared according to this section.

a) Benches or other horizontal surfaces shall have adequate slope (1" rise per lineal foot minimum) to minimize the retention of debris following surcharge.

b) Inverts or flow channels shall be smooth without lips, rough edges or other features which may cause debris to collect; contoured to minimize turbulent flow; and be sloped to promote adequate flow from the inlet(s) to the outlet pipe.

c) All joints, pipe seals, steps or other penetrations shall be sealed against inflow, infiltration and exfiltration and be adequately filled, smoothed and contoured to promote monolithic coating application.

I. Areas where reinforcing steel has been exposed shall be repaired in accordance with the Engineer's recommendations or at the minimum all exposed steel shall be prepared in accordance with Section 3.2 prior to coating with the coating product specified or other approved primer as specified by the coating product manufacturer.

3.3 APPLICATION OF COATING PRODUCT(S)

A. Application procedures shall conform to the recommendations of the coating product(s) manufacturer, including environmental controls, product handling, mixing, application equipment, and methods.

B. Spray equipment shall be specifically designed to accurately ratio and apply the coating product(s) and shall be in proper working order.

C. Contractors qualified in accordance with Section 1.4 of these specifications shall perform all aspects of coating product(s) installation.

D. Prepared surfaces shall be coated via spray application of the coating product(s) described herein unless otherwise recommended by the coating product manufacturer.

E. Coating thickness shall be in relation to the profile of the surface to be coated as recommended by the coating product manufacturer.

F. In all cases the coating product(s) shall be applied to a minimum dry film thickness of 120 mils.

1. See coating manufacture for mil thickness recommendations to ground water head

pressure.

G. Subsequent top coating or additional coats of the coating product(s) shall occur within the products recoat window. Additional surface preparation procedures will be required if this recoat window is exceeded.

H. Coating product(s) shall interface with adjoining construction materials/components throughout the concrete structure to effectively seal and protect substrates from attack by corrosive elements and to ensure the effective elimination of infiltration into the sewer system.

I. Procedures and materials necessary to effect the interface between dissimilar materials and the coating product shall be as recommended by the coating product(s) manufacturer.

J. Sewage flow shall be stopped, bypassed, or diverted as necessary for application of the coating product(s) to the invert and interface with pipe materials.

3.4 TESTING AND INSPECTION

A. Coating system thickness shall be inspected to ensure compliance with the specifications herein.

1. During application a wet film thickness gauge, meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used. Measurements shall be taken, documented, and attested to by Contractor for submission to Owner.

2. After the coating product(s) have cured in accordance with manufacturer recommendations, coating system thickness may be measured according to SSPC-PA 9 - Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages.

B. High voltage holiday detection for coating systems installed in corrosive environments, when it can be safely and effectively employed, shall be performed to ensure monolithic protection of the substrate. After the coating product(s) have cured in accordance with manufacturer recommendations, all surfaces shall be inspected for holidays in accordance with NACE RPO 188-99 Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates or ASTM D4787 Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates. All detected holidays shall be marked and repaired according to the coating product(s) manufacturer's recommendations.

1. Test voltage shall be a minimum of 100 volts per mil of coating system thickness.

2. Detection of a known or induced holiday in the coating product shall be confirmed to ensure proper operation of the test unit.

3. All areas repaired shall be retested following cure of the repair material(s).

4. In instances where high voltage holiday detection is not feasible a close visual inspection shall be conducted and all possible holidays shall be marked and repaired as described above.

5. Documentation of areas tested, equipment employed, results, and repairs made shall be submitted to the Owner/Engineer by Contractor.

C. Adhesion of the coating system to the substrate shall be confirmed a minimum of once every 200 square feet of coated area. After the coating product(s) have cured in accordance with manufacturer recommendations, testing shall be conducted in accordance with ASTM D7234 Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off

Adhesion Testers. Contractor shall select the areas to be tested and submit testing location plan to the Owner for approval prior to testing.

1. A minimum of three 20 mm dollies shall be affixed to the coated surface; one at the top, one at the mid-section and one near the bottom of the structure.
2. The adhesive used to attach the dollies to the coating shall be rapid setting with tensile strengths in excess of at least twice the anticipated failure point (generally 1000 psi) and permitted to cure in accordance with manufacturer recommendations. The coating and dollies shall be adequately cleaned and prepared to receive the adhesive. Failure of the dolly adhesive shall be deemed a non-test and require retesting.
3. Prior to performing the pull test, the coating shall be scored to the substrate, or within 10 mils of the substrate surface, by mechanical means without disturbing the dolly or coating system bond within the test area.
4. Two of the three adhesion pulls in each test area shall exceed 200 psi and shall include substrate adhered to the back of the dolly or no visual signs of the coating product in the test hole. Pulls tests with results between 150 and 200 psi may be acceptable if more than 50 percent of the substrate in the test area is adhered to the dolly.
5. Should a structure, or area, fail to achieve two successful pulls as described above, additional testing shall be performed at the discretion of the Owner or Engineer. Any areas detected to have inadequate bond strength shall be evaluated by the Engineer. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and repairs shall be made by Contractor.
6. All adhesion testing shall be performed by qualified personnel using calibrated equipment as specified by the applicable ASTM standard(s).
7. All adhesion testing shall be documented and submitted in a consistent format detailing location, test values, description of the failure point/mode, scoring method employed, adhesive used, cure time of coating and adhesive and other data as deemed necessary by the owner/engineer.
8. All adhesion test locations shall be repaired by the Contractor at no cost to the Owner.

D. Visual inspection shall be made by the Engineer and/or Owner. Any deficiencies in the finished coating affecting the performance of the coating system or the operational functionality of the structure shall be marked and repaired according to the recommendations of the coating product(s) manufacturer.

END OF SECTION

SECTION 13 3400
PRECAST CONCRETE BUILDING

1. GENERAL

1.1 WORK INCLUDED

A. Contractor shall furnish a precast concrete building to be field assembled by manufacturer on contractor's cast-in-place foundation as indicated on contract plans and in accordance with manufacturer's recommendations. Precast building to be EASI-SPAN® brand Model 2430 as manufactured by Smith-Midland or Engineer approved equal. Building shall be provided by manufacturer with all necessary openings as specified by contractor in conformance with manufacturer's structural requirements.

1.2 REFERENCE STANDARDS

A. ACI-318-11: Building Code Requirements for Structural Concrete and Commentary

B. ASCE/SEI 7-10: Minimum Design Loads for Buildings and Other Structures

C. IBC 2012: International Building Code

D. PCI Design Handbook, 7th Edition

E. Concrete Reinforcing Institute, Manual of Standard Practice

F. UL-752 (Test Method level 5) for bullet resistance certified by a military approved laboratory.

1.3 DESIGN REQUIREMENTS

A. Dimensions shall be as shown on the Drawings.

B. Design Loads:

1. Seismic Design Category 'D', Risk Design Category III
2. Roof Live Load (Snow) – 60 PSF
3. Floor Live Load – 250 PSF (if precast floor is provided)
4. Wind Loading* – 165 MPH

C. Roof: Roof panel shall have a minimum of 6" slope from peak to edge. The roof shall extend 4" beyond the wall panel and have a turndown design which extends ½" minimum below the top edge of the wall panels to prevent water migration into the building along top of wall panels. Roof shall also have an integral architectural ribbed edge.

D. Roof Joint Keyway: Grout in keyways shall be a magnesium phosphate material or equal, prepared and placed per the manufacturer's recommendations. Apply a polysulfide, elastomeric joint sealant to the top of the grouted keyway, installed per manufacture's recommendations.

E. Floor: Contractor supplied cast-in-place slab must have a ½" step-down around the entire perimeter to prevent water migration into the building along the bottom of wall panels.

1.4 SUBMITTALS

A. Layout drawings depicting building, wall openings, dimensions, doors, and accessories.

B. Engineering calculations that are designed and sealed by a professional engineer, licensed in the Commonwealth of Virginia, shall be submitted for approval.

C. Manufacturers' product literature shall be provided for any plumbing, electrical, and miscellaneous installed fixtures demonstrating compliance with these specifications.

1.5 QUALITY ASSURANCE

A. The precast concrete building producer shall be a plant-certified member of either the National Precast Concrete Association (NPCA), The Precast/Prestressed Concrete Institute (PCI), or equal.

B. The precast concrete building producer shall demonstrate product knowledge and must have a minimum of 5 years experience manufacturing and setting precast concrete.

2. PRODUCTS

2.1 MATERIALS

A. Concrete: Steel-reinforced, 5000 PSI minimum 28-day compressive strength, air-entrained (ASTM C260).

B. Reinforcing Steel: ASTM A615, grade 60 unless otherwise specified. Welded Wire Fabric: ASTM 185, Grade 65

C. Post-tensioning Strand: Roof sections shall be post-tensioned in the field after grout keyway is filled and has cured to the required PSI strength. Post-tensioning strand shall be 41K Polystrand CP50, ½" 270 KSI Seven-Wire strand, enclosed within a greased plastic sheath (ASTM A416). There will be a minimum of three transverse post-tensioning cables connecting roof and floor (if provided) sections together to provide a watertight joint. To ensure a watertight design, no alternate methods shall be substituted for the post-tensioning.

D. Caulking: All joints between panels shall be caulked on the exterior and interior surface of the joints. Caulking shall be DOW CORNING 790 silicone sealant or equal. Exterior caulk reveal to be 3/8" x 3/4" deep so that sides of joint are parallel for proper caulk adhesion. Back of the joint to be taped with bond breaking tape to ensure adhesion of caulk to parallel sides of joint and not the back.

E. Panel Connections: All panels shall be securely fastened together with 3/8" thick steel brackets. Steel is to be of structural quality, hot-rolled carbon complying with ASTM A36 and hot dipped galvanized after fabrication. All fasteners to be ½" diameter bolts complying with ASTM A325 for carbon steel bolts. Cast-in anchors used for panel connections to be Dayton-Superior F-63 coil inserts, or equal. All inserts for corner connections must be secured directly to form before casting panels. No floating-in of connection inserts shall be allowed. Wall panels shall be connected to cast-in-place floor slab using expansion anchors providing adequate embedment by manufacturer.

2.2 ACCESSORIES

A. Doors and Frames: Shall comply with Steel Door Institute "Recommended Specifications for Standard Steel Doors and Frames" (SDI-100) and as herein specified. All door and frame galvanizing shall be in accordance with ASTM A924 and A653, A60 minimum coating thickness.

1. The buildings shall be equipped with single and double 3'-0" x 6'-8" x 1-3/4" thick insulated, 18 gauge, metal doors with 16-gauge frames (to meet wall thickness). Doors to have flush top cap. 12 gauge flat astragals shall be applied to the active leaf to protect against the elements or forced opening. Doors and frames shall be factory bonderized and painted with one coat of rust inhibitive primer and one finish coat of enamel paint; color to be BOLT BROWN unless specified otherwise.

2. Doors and frames shall meet SDI standard Level 2, 1¾" heavy duty.

B. Door Hardware

1. Pull Handle: Shall meet requirements of ANSI A156.2. Shall be thru bolt attached and constructed of a minimum ¾" diameter stainless pull handle sized 8" center to center with a stainless backer plate, minimum 0.053" on both sides.

2. Hinges: Shall comply with ANSI A156.1 and be of the ball bearing, non-removable pin type (3 per door minimum). Hinges shall be 4 ½" x 4 ½" US26D (652) brushed chrome finish. Manufacturer shall provide a lifetime limited warranty.

3. Deadbolt: Commercial Grade Deadbolt conforming to ANSI 156.5 furnished with a 2 ¼" face plate and a 1" projecting deadbolt with hardened steel pins. Dead bolts shall be UL and ADA approved. Finish shall be US26D (626) brushed chrome finish. Manufacturer shall provide a lifetime limited warranty.

4. Surface Bolt: 8" Surface bolt UL listed. Finish US26D (626) brushed chrome finish. (2 per inactive leaf)

5. Threshold: Bumper Seal type threshold with a maximum 1" rise to prevent water intrusion. Thresholds shall be approved for UL 10B suitable for use with fire doors rated up to three hours.

6. Overhead Door Holder: Heavy duty surface mounted hold open device with hold open/stop angle of 85 to 110 degrees. Construction shall be stainless steel. Finish US32D (630) satin stainless steel finish.

7. Drip Cap: Aluminum drip cap with minimum projection of 2 ½" shall be furnished.

8. Door Stop: ANSI 156.16 approved wall mounted door stop with keeper constructed of a corrosion resistant cast brass material. Finish US26D (626) brushed chrome finish.

2.3 FINISHES

A. Interior of Building: Smooth steel form finish on all interior panel surfaces.

B. Exterior of Building: Architectural precast concrete brick finish: Finish must be imprinted in top face of panel while in form using an open grid impression tool. Finished brick size shall be 2 3/8" x 7 5/8" with vertical steel float or light broom finish. Joints between each brick must be 3/8" wide x 3/8" deep. Back of joint shall be concave to simulate a hand-tooled joint. Each brick face shall be coated with the following water-based acrylic, water repellent penetrating concrete stain: 1) Canyon Tone stain by United Coatings, 2) Sherwin Williams (H&C concrete stain) or equal. Stain shall be applied per manufacturer's recommendation. Joints shall be kept substantially free of stain to maintain a gray concrete color. Stain color shall be BRICK RED unless specified otherwise.

3. EXECUTION

3.1 SITE PREPARATION

A. Slab on grade to be minimum 6" thick and 4,000 psi steel reinforced concrete. Slab to be level within 1/8" in both directions and capable of supporting loads imposed by the structure. Floor slab must have a ½" step-down around the entire perimeter to prevent water migration into the building along the bottom of wall panels.

B. Provide positive drainage away from slab as required.

3.2 SITE ACCESS

A. Contractor must provide a level, unobstructed area large enough for a crane and a tractor-trailer to park adjacent to the pad. Crane must be able to place outriggers within 5’-0” of edge of pad; truck and crane must be able to get side by side under their own power. No overhead lines may be within 75’ radius of center of pad. Firm roadbed with turns that allow 65’ lowbed tractor-trailer must be provided directly to site. No building shall be placed closer than 2’-0” to an existing structure unless specifically permitted.

END OF SECTION

SECTION 220010
GENERAL PROVISIONS FOR PLUMBING

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 the following:
   1. Definitions
   2. Permits, Fees and Notices
   3. Applicable Publications
   4. Code Compliance
   5. Scope of Work
   6. Record Drawings
   7. Intent of Drawings and Specifications
   8. Quality Assurance
   9. Submittals
   10. Product Requirements, Equals and Substitutions
   11. Manufacturer's Instructions
   12. Delivery, Storage and Handling
   13. Coordination
   14. Cutting, Patching and Demolition
   15. Clean Up/Removal of Debris
   16. Starting of Systems
   17. Guarantee of Work
   18. System Testing

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within above ceiling areas in open and enclosed garages and in unheated shelters.

F. The term "As indicated" means as shown on drawings by notes, graphics or schedules, or written into other portions of Contract Documents. Terms such as "shown", "noted", "scheduled" and "specified" have same meaning as "indicated", and are used to assist the reader in locating particular information.

G. The term "Provide", means furnish and install as part of the work covered in Division 22.

H. The term "Furnish" means furnish only, for installation, as part of this contract, by other Divisions.

I. The term "Install only" means to install under the work of Division 22 equipment furnished by other Divisions, or by the Owner.

J. The term "Owner's Representative" when referenced herein shall be the Architect or the Engineer acting as his designated representative unless otherwise noted.

K. The term "design" as it pertains to the work of this division shall describe the basic intent, component sizing, component relationships and overall architecture of the plumbing system. The design is generally schematic in nature and will require specific detailing after the approved products are determined.

L. The term "detail" as it pertains to the work of this division shall describe the work required by the Contractor to assure a fully coordinated installation of the material and equipment supplied. When requested, the Contractor shall produce detailed shop drawings or sketches indicating the actual placement of the equipment or material supplied; also including how the equipment or material interfaces with work of other sections or divisions within the Contract Documents.

M. The term "workman-like manner" as it pertains to the work of this division shall describe a neat well organized high quality installation system (pipe, control wire or tube, conduit, etc.). Routing shall be well thought out providing adequate service clearance and maximum use of space. Equipment placement shall exhibit proper clearances for service. All lines (pipe, control wire or tube, conduit, etc.) shall be run straight and true, parallel or perpendicular to building structure neatly supported.

N. For additional definitions refer to the General Conditions.

1.4 PERMITS, FEES AND NOTICES

A. Comply with the General Conditions

1.5 APPLICABLE PUBLICATIONS

A. Publications listed in each Section form a part of that Section to the extent referenced.

B. When a standard is specified by reference, comply with requirements of that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.

C. The Publication or Standard is the publication in effect as of the bid date, except when a specific date is listed.

1.6 CODE COMPLIANCE

A. Virginia Uniform Statewide Building Code, 2018 edition, including all adopted Model Codes and Standards:
   1. Virginia Construction Code 2018.
   2. Virginia Mechanical Code 2018.
   3. Virginia Plumbing Code 2018.
   4. NFPA 70, 2017.
   5. Virginia Fuel Gas Code 2018.
   6. Virginia Energy Conservation Code 2018.
   7. Virginia Statewide Fire Prevention Code 2018.

1.7 SCOPE OF WORK

A. The work to be performed under this Division consists of the satisfactory completion of all PLUMBING SYSTEMS as indicated in the Contract Documents.

1.8 RECORD DRAWINGS

A. Comply with the General Conditions.

1.9 INTENT OF DRAWINGS AND SPECIFICATIONS

A. The intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment, and workmanship, and to provide operable plumbing systems complete in every respect.

B. The drawings are diagrammatic, intending to show general arrangement, capacity and location of system components, and are not intended to be rigid in detail. Final placement of equipment, other system components, and coordination of all related trades shall be the Contractor's responsibility.

C. Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets and fittings may not be shown but shall be provided at no additional change in contract cost.

D. In the event of a conflict, the Owner's Representative will render an interpretation in accordance with the General Conditions.

1.10 QUALITY ASSURANCE

A. Material furnished under this Division shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such material and shall be the latest design.

B. Materials shall be the best of their respective kinds. Materials shall be new except where the specifications permit reuse of certain existing materials.

C. Work provided for in these specifications shall be constructed and finished in every part in a workmanlike manner.

D. All items necessary for the completion of the work and the successful operation of a product shall be provided even though not fully specified or indicated on the drawings.

E. All work shall be performed by qualified, experienced personnel specifically trained in their respective field.

F. All work of this division shall be carefully interfaced with the work of other divisions to assure a complete, functioning system or systems.

1.11 SUBMITTALS

A. In addition to all other submittal requirements elsewhere in the Contract Documents, the Contractor shall comply with the following.

B. Submittal for approval is required only for items specifically requested in the applicable specification section.

C. For products and equipment that do not require a submittal for approval, submit a separate letter for each specification section certifying that all products and equipment will be provided in compliance with the Contract Documents.

D. Provide submittal data in accordance with the General Conditions and/or as listed below.

E. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that the submittals will be needed to meet the construction schedule. This schedule shall be submitted prior to or in conjunction with the first submittal. Processing of submittals may be delayed pending the receipt of this schedule at the reviewer's discretion.

F. Submittal data shall be presented in a clear and thorough manner and referenced to the specification section.
   1. Where applicable, data shall be identified by reference to sheet and detail, schedule or room numbers, equipment or unit number as shown on Contract Drawings.

G. Prepare performance and product data as follows:
   1. Clearly mark each copy to identify pertinent products or models, delete non-pertinent data.
   2. Show performance characteristic and capacities.

3. Show dimensions and clearances required.
4. Show wiring or piping diagrams and controls.
5. Clearly list any deviation in the submittals from the requirements of the Contract Documents.
6. Include installation requirements.

H. Manufacturer's standard schematic drawings and diagrams:
1. Modify drawings and diagrams to delete information which is not applicable to the work of this project.
2. Supplement standard information to provide information specifically applicable to the work of this project.

I. Letter of Certification:
1. Where a submittal is not required, provide letter certifying that the work will be completed in strict accordance of the specified requirements. In the event the Contractor wishes to alter the requirements of the specification for whatever reason, this should be clearly explained in this letter noting that this alteration may require additional submittal requirements.

J. Schedules:
1. Where schedules are called for, submit schedule indicating which products will be used and to what extent by system, location, size, etc.

K. Where samples are requested, samples shall be of sufficient size and quantity to clearly illustrate:
1. Functional characteristics of the product, with integral related parts and attachment devices.
2. Full range of color, texture and pattern.
3. Where a mock-up is specified, erect at the Project site, in a location acceptable to the Owner's Representative. Size or area shall be that specified or as agreed upon during pre-construction or other job site meetings.
4. Where mock-up is not a permanent part of the installation, remove mock-ups at conclusion of work or when acceptable to the Owner's Representative.

L. The Contractor shall:
1. Review Shop Drawings, Product Data and Samples prior to submission.
2. Determine and verify:
   a. Field measurements.
   b. Field construction criteria.
   c. Catalog numbers and similar data.
   d. Conformance with specifications.
   e. All submittals have been properly interfaced with the requirements of this and other divisions of work so as to assure a complete, functioning system in accordance with the Contract Documents.
3. Coordinate each submittal with requirements of the work and of the Contract Documents.
4. Clearly identify any deviations in the submittals from requirements of the Contract Documents.

5. Do not release equipment for shipment, begin fabrication or work on any item, which requires submittal for approval until return of submittal with Owner's Representative approval.
6. Make submittals promptly, and in such sequence as to cause no delay in the work or in the work of any other Contractor.

M. Number of Submittals:
1. Comply with the General Conditions.

N. Submittals shall contain:
1. The date of submission and the dates of any previous submissions.
2. The Project title and number.
3. Contract identification.
4. The names and phone numbers including personal contact of:
   a. Contractor.
   b. Supplier.
   c. Manufacturer.
5. Identification of the product, with the specification section number and contract document description clearly indicated.
6. Field dimensions: clearly identified as such.
7. Relation to adjacent or critical features of the work or materials.
8. Applicable standards.
9. Identification of deviations from Contract Documents.
10. Identification of revisions on resubmittals.
11. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
12. Each submittal shall be limited to a single specification section. Submittals shall not be grouped with other sections in common binders or under common control sheets. Each submittal shall have a cover/ control sheet containing the information listed above (a thru k) and have a minimum of 8" x 3" clear space for the general contractors, engineers and architects review stamp.
13. Submittals which do not comply with these requirements may be returned with no action taken at the reviewers' discretion.

O. The Owner's Representative will:
1. Review submittals promptly and where special attention is requested, review in accordance with the schedule required.
2. Review the submittal for general compliance with the Contract Documents. The Contractor is responsible for quantities, dimensions, placement of the product, coordination with all other trades occupying the space, maintain service clearance, function and compliance with the written installation instructions.
3. Determine the appropriate action for the submittal. Action codes will be as follows:

Action	Description
A	No exceptions taken
B	Make corrections to exceptions noted. Resubmittal not required.
C	Make corrections to exceptions noted and resubmit.

D	Not in compliance with Contract Documents. Resubmit.
N	Not required for review. No action taken. Copy retained for reference.

4. Turnaround time will generally be within 14 calendar days on properly prepared submittals.
5. Review comments will generally be on a separate attached sheet.

P. Resubmission requirements for "as specified" products.
1. Make any corrections or changes in the submittals required by the Owner's Representative and resubmit until approved.
2. A submittal shall only be reviewed a maximum of 3 times. If upon the third resubmission an approved action cannot be rendered (A or B action), the Contractor shall supply the basis of design product and bear all costs incurred by the Owner's Representative during the review process until an approved submittal is achieved.

Q. The Contractor shall maintain one copy of all approved submittal data including letters of compliance in a job site file.

1.12 PRODUCT REQUIREMENTS, EQUALS AND SUBSTITUTIONS

A. In addition to all other requirements for submittals, equals and substitutions elsewhere in the Contract Documents, the Contractor shall comply with the following.

B. Product Requirements:

1. The specifications sections under Article 2.1 "MANUFACTURERS", lists suppliers found acceptable for this project. The names listed are manufacturers who meet the minimum acceptable standards that this project dictates. The list is furnished as a guide. Even though a manufacturer is named, he must still provide the type and quality of equipment specified as well as equipment that will fit within the allotted space and within the design weight allowance, etc. Being named does not imply permission for that manufacturer to provide an alternative product or design. Other manufacturers not named will be considered to be equal providing they furnish a product of the type and quality specified and submit detailed product descriptive data including a line-by-line comparison of his product compared to the specified product, at least 14 days prior to bid date so that the product can be reviewed. If found to be acceptable, the name can be added by Addendum.
2. In certain cases, foundations and/or structural supports for equipment specified in this Division are provided under other divisions of the specifications. Where an alternate acceptable manufacturer's product is provided, this Contractor shall coordinate the revised requirements and include an allowance for any cost differential.
3. If the list, under Article 2.1 "MANUFACTURERS" names only one manufacturer followed by "No Substitutions" that product shall be supplied.

C. Substitutions.

1. A substitution is defined as any product which does not meet the requirements as outlined in PART 2 - PRODUCTS. A different design which accomplishes the same result will be considered a substitution. The same design which requires a larger motor, or more space or a structural change to accommodate larger weight, etc., will be considered a substitution. If there is any question on the part of a manufacturer as to whether his product is considered as an equal or as a substitution, submit details to the Owner's Representative 14 days in advance of bid date and a decision will be rendered. If necessary, a clarification will be issued in the form of an Addendum. The Contractor may also request a substitution after award of the contract.
2. Submit a separate request for each product, supported with complete data, with drawings and samples as appropriate, including.

    a. Comparison of the qualities of the proposed substitution with that specified in tabulated format.
    b. Changes required in other elements of the work because of the substitution.
    c. Effect on the construction schedule.
    d. Cost, extra credit or statement of no change in contract price.
    e. Any required license fees or royalties.
    f. Availability of maintenance service, and source of replacement materials.

3. The Owner's Representative shall determine the acceptability of the proposed substitution.
4. A request for a substitution constitutes that the Contractor:

    a. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
    b. Will provide the same warranties for the substitution as for the product specified.
    c. Will coordinate the installation of the substitution into the work, and make such other changes as may be required to make the work complete in all respects.
    d. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.
    e. Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.
    f. Will absorb any cost incurred by the Owner's Representative in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting Contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or miss-sized equipment. In the event of additional engineering costs the billing structure shall be agreed upon prior to review by all involved parties.

D. Owner's Representative will review requests for substitutions with reasonable promptness, and will issue an addendum or notify Contractor, in writing, of the decision to accept or reject the requested substitution.

E. The Owner's Representative will review substitution submittals for compliance a maximum of two times. If the submittal or substituted product does not comply with the Contract Documents on the second submittal, the submittal and product will be rejected and the specified product will be required.

F. The Contractor may request further review of the substitution after the second submittal rejection if the Contractor agrees in writing to accept responsibility for the cost of additional review time and expenses by the Owner's Representative.

G. In the event a substitution is rejected, supply the products which constituted the basis of design at no change in the contract price.

1.13 MANUFACTURER'S INSTRUCTIONS

A. Installation of work shall comply with manufacturer's printed instructions.

B. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Owner's Representative for clarification. Do not proceed with work without clear instructions.

1.14 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions.

B. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.

C. Store products to prevent damage by the elements. Space temperature shall be controlled as required to prevent condensation and metal corrosion or damage to electrical or electronic parts which are the result of condensation.

D. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.

E. Provide protection as necessary to prevent damage after installation.

F. Products which suffer damage due to improper storage shall not be installed and if found in place, shall be removed and replaced at the Contractors expense.

1.15 COORDINATION

A. Arrange for space, chases, slots, and openings in building structure during progress of construction, to allow for integrated automation installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for integrated automation items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.16 CUTTING, PATCHING AND DEMOLITION

A. Comply with the General Conditions.

1.17 CLEAN UP/REMOVAL OF DEBRIS

A. Comply with the General Conditions.

B. Maintain a clean work area. Construction debris shall be immediately removed from all newly erected work.

1.18 STARTING OF SYSTEMS

A. Provide material and labor to perform start-up of each respective item of equipment and system prior to beginning of test, adjust and balance procedures.

B. Provide labor to assist the Owner's Representative in acceptance review.

C. Provide point-by-point system checkout. Submit results in tabulated form by system. Include this data as part of Operation and Maintenance Manuals.

D. Provide information and assistance and cooperate with test, adjust and balance services.

E. Comply strictly with manufacturer's recommended procedures in starting up plumbing systems.

F. Provide such periodic continuing adjustment services as necessary to ensure proper functioning of plumbing systems until acceptance and up to 1 full year after date of Owner acceptance.

1.19 GUARANTEE OF WORK

A. Comply with the General Conditions.

B. Where applicable, furnish manufacturer's written warranty for materials and equipment.

C. Insert warranties in appropriate locations in operating and maintenance manuals.

D. Materials and equipment, which have seasonal operation limitations, shall be guaranteed for one year from date of seasonally appropriate test, and acceptance in writing by the Owner.

1.20 SYSTEM TESTING

A. Provide all necessary labor, materials and equipment to successfully complete all system testing necessary for building occupancy and Owner acceptance.

B. Provide all necessary labor, materials and equipment to assist Contractors of other division to complete system testing necessary for building occupancy and Owner acceptance, wherever an inter-relationship between Division 22 and the work of other divisions exists.

C. Tests shall be repeated as necessary until all occupancy and operation permits are granted and the Owner accepts the project.

PART 2 - PRODUCTS

2.1 NOT USED.

PART 3 - EXECUTION

3.1 NOT USED.

END OF SECTION 220010

SECTION 220500
COMMON WORK RESULTS FOR PLUMBING

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 the following:
   1. Waterproofing and flashing
   2. Fire and smoke stopping
   3. Painting and finishing.
   4. Excavation, trenching and backfilling

1.3 DEFINITIONS

A. Refer to Division 22 Section “General Provisions for Plumbing.”

1.4 SUBMITTALS

A. Welding certificates.
   1. Where welding certificates are required in multiple Division 22 Sections, One complete set of welding certificates, one for each welder, will be acceptable for the entire Division 22 scope of welding work.

B. Shop Drawings:
   1. Submit drawings of fabricated steel supports where proposed supports are not in accord with details on drawings, or where drawings do not detail supports. Submittal for approval is required.

C. Product Data:
   1. Submittal for other than fabricated steel supports is not required. Product data for the following shall be included in the operation and maintenance manuals. Submittal for approval is not required.
      a. Waterproofing and flashing material.
      b. Fire and smoke stopping material.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

1.6 COORDINATION

A. Coordinate requirements for access panels and doors for Plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 – OPENINGS.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

A. Waterproofing and Flashing:

1. Stoneman Engineering and Manufacturing Co.
2. Other suppliers acceptable.

B. Fire and Smoke Stopping Material:

1. Dow Corning Corporation.
2. General Electric Company.
3. Protective Treatments, Inc. (PTI)
4. 3M Ceramic Materials Dept.

2.2 WATERPROOFING AND FLASHING

A. All work is provided under Division 7 - THERMAL AND MOISTURE PROTECTION.

2.3 FIRE AND SMOKE STOPPING

A. All work is provided under Division 7 – THERMAL AND MOISTURE PROTECTION.

2.4 PAINTING AND FINISHING

A. Product specified in Division 9 - FINISHES.

2.5 EXCAVATION, TRENCHING AND BACKFILLING

A. Product description not applicable.

PART 3 - EXECUTION

3.1 WATERPROOFING AND FLASHING

A. All penetrations of roof to be in accordance with requirements of Division 7 - THERMAL AND MOISTURE PROTECTION.

3.2 FIRE AND SMOKE STOPPING

A. All fire and smoke stopping to be in accordance with requirements of Division 7 - THERMAL AND MOISTURE PROTECTION.

3.3 PAINTING AND FINISHING

A. All equipment shall be furnished with a factory-applied galvanized, prime paint, or finish paint finish. Touch-up damaged surfaces of equipment immediately.

B. Paint for galvanized surfaces shall be in accordance with ASTM A780 using zinc rich compound.

C. Paint wooden mounting backboards with two coats of gray enamel prior to making attachments to the board.

D. For quality control refer to DIVISION 9 - FINISHES.

E. Remove all dirt, rust, scale, grease, pipe dope, solder flux, and welding slag from all surfaces to be painted.

F. Paint immediately, under this Division, all damaged galvanized surfaces.

G. Apply rust inhibitive primer to ferrous surfaces of shop fabricated steel supports.

H. Paint immediately under this division all field and shop welded joints in piping or equipment supports with 2 coats of grey metal primer.

3.4 EXCAVATION, TRENCHING AND BACKFILLING

A. Definitions:
1. Satisfactory material includes all materials except those classified "unsatisfactory", "unyielding" or "unstable".
2. Unsatisfactory material includes those materials containing roots, organic matter, trash, debris, frozen materials, stones larger than 3 inches in any dimension, and materials classified by ASTM D 2487 as OL, OH, and PT.
3. Unyielding material consists of rock and gravely soils with stones greater than 3 inches in any dimension, or as defined by the pipe or tank manufacturer, whichever is smaller.
4. Unstable material consists of material too wet to properly support the pipe.

5. Select granular material consists of well-graded sand, gravel, crushed gravel, crushed stone, or crushed gravel, crushed stone, or crushed slag composed of hard, tough, and durable particles, and shall contain not more than 10 percent by weight of material passing a No. 200 mesh sieve, and no less than 95 percent by weight passing the 1-inch sieve. The maximum allowable aggregate size shall be 3 inches, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

B. Excavation, trenching, and backfilling for site utility piping systems are specified in DIVISION 31- EARTHWORK.

C. Excavation, trenching, and backfilling for buried piping systems installed inside the building shall terminate at a point 5 feet outside the building wall, except as specified.

D. Excavation of every description and of whatever substance encountered shall be performed to the lines and grades indicated or required. Excavated material suitable for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the excavation equal to ½ the depth of the excavation, but in no instance closer than 2 feet. Adequate drainage shall be provided for the stockpiles and surrounding areas by means of dikes, ditches, or other approved methods. The stockpiles shall also be protected from contamination with unsatisfactory excavated material or other material that may reduce the quality and fitness of the suitable stockpiled material. Excavated material not required or not satisfactory for backfill shall be disposed of as directed. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained. Unauthorized over-excavation shall be backfilled as specified herein for backfilling.

E. Trench walls below the top of the pipe shall be vertical, and trench walls above the top of the pipe shall be sloped as required to properly complete the work. Trench width below the top of the pipe shall not exceed 24 inches plus pipe outside diameter. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

F. Where unstable material is encountered in the bottom of the trench or excavation, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as specified herein for backfilling.

G. Where unyielding material is encountered in the bottom of the trench, such material shall be removed 4 inches below the required grade and replaced with satisfactory materials as specified herein for backfilling.

H. Where sub-surface water is encountered, the Contractor shall promptly provide suitable means for removing said water and continue draining procedure until installation may be completed.

I. Material stockpiles and open excavation shall be protected from erosion and run-off. Run-off, which covers existing roadways or pedestrian paths, shall be promptly cleaned.

J. Trenches and excavations shall not be backfilled until all specified tests are performed and the installation has been approved for backfilling. Backfilling shall comply with the following:

1. Initial backfill material shall be placed in layers of a maximum of 6 inches loose thickness and compacted with approved tampers to 95 percent maximum density and to a height of at least 1 foot above the pipe. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Backfill material in this portion of the trench shall consist of satisfactory material at a moisture content that will facilitate compaction. Water flooding or jetting methods of compaction for initial backfill will not be permitted.
2. The remainder of the trench shall be backfilled with suitable material deposited in layers of a maximum of 6 inches loose thickness and compacted with approved tampers to the density of the adjacent soil or backfill. Water flooding or jetting methods of compaction for final backfill will be permitted for granular non-cohesive backfill material provided this method produces the specified degree of compaction and does not lessen the degree of compaction specified for the adjacent soil or backfill. Water jetting shall not penetrate the initial backfill.

3. Initial backfill material for oil tank excavation shall be granular well- graded sand deposited in layers of a maximum of 12 inch loose thickness, and compacted with approved tampers to 95 percent maximum density, and to a height equal to the installed tank centerline. The backfill shall be brought up evenly on both ends of the tank, and on both sides of the tank for the entire tank length. Care shall be taken to ensure thorough compaction of the fill under the haunches of the tank. The remainder of the excavation shall be backfilled with suitable material deposited in layers of a maximum of 12 inch loose thickness, and compacted with approved tampers to the specified density of the adjacent soil. Water flooding or jetting methods of compaction for initial and final backfill will be permitted for granular non-cohesive backfill material provided this method produces the specified degree of compaction and does not lessen the specified degree of compaction for adjacent soil or backfill.
4. Backfill material, and placement of backfill for fiberglass fuel tank shall be in strict accord with tank manufacturer's written instructions.

END OF SECTION 220500

SECTION 220529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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 hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Pipe stands. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

1. STEEL PIPE HANGERS AND SUPPORTS

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Grinnell Corp.
c. GS Metals Corp.
d. National Pipe Hanger Corporation.
e. Piping Technology & Products, Inc.

2. METAL FRAMING SYSTEMS

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. ERICO/Michigan Hanger Co.; ERISTRUT Div.
c. GS Metals Corp.
d. Power-Strut Div.; Tyco International, Ltd.
e. Unistrut Corp.; Tyco International, Ltd.

3. THERMAL-HANGER SHIELD INSERTS

a. ERICO/Michigan Hanger Co.
b. PHS Industries, Inc.
c. Pipe Shields, Inc.
d. Rilco Manufacturing Company, Inc.

4. FASTENER SYSTEMS

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. MKT Fastening, LLC.
d. Powers Fasteners.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Base: Plastic.
2. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
3. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Bases: One or more plastic.
2. Vertical Members: Two or more protective-coated-steel channels.
3. Horizontal Member: Protective-coated-steel channel.
4. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, 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 HANGER AND SUPPORT APPLICATIONS

A. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

B. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Use padded hangers for piping that is subject to scratching.

D. 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. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
3. 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.
4. 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.
5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
9. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.

10. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
11. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
13. 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.
14. 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 and with U-bolt to retain pipe.
15. 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.
16. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
17. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
18. 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 not necessary.
19. 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 not necessary.
20. 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.

E. 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 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

F. 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.

G. 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-joist 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.

H. 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.

I. 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 absorb 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 absorb 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 absorb 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.

J. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

K. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

L. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. 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 above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use

operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal 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.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. 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 and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

N. Insulated Piping: Comply with the following:

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 according to ASME B31.1 for power piping and 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. Option: Thermal-hanger shield inserts may be used. 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 shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. 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: 12 inches long and 0.048 inch thick.

b. NPS 4: 12 inches long and 0.06 inch thick.

c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and 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 contours of welded surfaces match adjacent contours.

3.5 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.

3.6 PAINTING

A. Touch Up: 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.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529

SECTION 220553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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. Warning signs and labels.
2. Pipe labels.
3. Valve tags.
4. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Valve numbering scheme.

C. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

PART 2 - PRODUCTS

2.1 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Yellow.

C. Background Color: Black.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances 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.

G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

H. Label Content: Include caution and warning information, plus emergency notification instructions.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded in accordance with ASME (ANSI) 13.1-1996, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.4 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Reinforced grommet and wire or string.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 PIPE LABEL INSTALLATION

A. 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. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

B. Pipe Label Color Schedule:

1. Domestic Cold-Water Piping:

a. Background Color: Green.
b. Letter Color: White.

2. Sanitary Vent:

a. Background Color: Yellow.
b. Letter Color: Black.

3.3 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape: 1-1/2 inches, round.

2. Valve-Tag Color: Natural.
3. Letter Color: Black

3.4 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

SECTION 220700
PLUMBING INSULATION

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. Insulation Materials:

a. Mineral fiber.

2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied fabric-reinforcing mesh.
9. Field-applied cloths.
10. Field-applied jackets.
11. Tapes.
12. Securements.

B. Related Sections:

1. Division 23 Section "HVAC Insulation."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Qualification Data: For qualified Installer.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment 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.

C. Coordinate installation and testing of heat tracing.

1.7 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.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

2.2 MANUFACTURERS

A. Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. Mineral-Fiber (Fiberglas)

    a. CertainTeed Corp.
    b. Johns Manville
    c. Knauf Insulation
    d. Manson Insulation Inc.
    e. Owens Corning

2.3 INSULATING MATERIALS

A. Mineral-Fiber, Preformed Pipe Insulation:

1. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.4 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.5 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. PVC Jacket Adhesive: Compatible with PVC jacket. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II. For indoor applications, use mastics that have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 200 deg F.
3. Solids Content: 63 percent by volume and 73 percent by weight.
4. Color: White.

2.7 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment, and pipe insulation.

3. Service Temperature Range: Minus 50 to plus 180 deg F.
4. Color: White.

2.8 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.9 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 C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.10 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.

B. Woven Glass-Fiber Fabric for Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.

2.11 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.

2.12 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, 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.

4. Factory-fabricated tank heads and tank side panels.

2.13 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

2.14 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2 or 3/4 inch wide with wing or closed seal.
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 or 3/4 inch wide with wing or closed seal.

3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, stainless steel or 0.062-inch soft-annealed, galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade 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 equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and 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, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom 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 application and finishing.

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 at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install 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.
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.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

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 similar 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.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. Install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 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.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be 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 preformed fitting insulation or sectional pipe insulation of same material and thickness as 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 preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two 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 preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two 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 and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
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 fabric-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, vessels, and equipment. 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 shall conform 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 adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two 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.

3.6 MINERAL-FIBER INSULATION INSTALLATION

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 factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but 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 preformed 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 mineral-fiber 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 preformed sections of same material as 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 preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered 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.

3.7 FIELD-APPLIED JACKET INSTALLATION

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, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers 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.

3.8 FINISHES

A. Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

    a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:
   1. 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 shall be 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.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 INSULATION SCHEDULE

A. Refer to the drawings for insulation schedules.

END OF SECTION 220700

SECTION 221316
SANITARY WASTE AND VENT 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. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. LLDPE: Linear, low-density polyethylene plastic.

C. NBR: Acrylonitrile-butadiene rubber.

D. PE: Polyethylene plastic.

E. PVC: Polyvinyl chloride plastic.

F. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:

1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.

C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

1. HEAVY-DUTY, SHIELDED, STAINLESS-STEEL COUPLINGS
   a. ANACO.
   b. Clamp-All Corp.
   c. Ideal Div.; Stant Corp.
   d. Mission Rubber Co.
   e. Tyler Pipe; Soil Pipe Div.

2. GROOVED-JOINT SYSTEMS:
   a. Anvil International.
   b. Star Pipe Products; Star Fittings Div.
   c. Victaulic Company.
   d. Ward Manufacturing, Inc.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
2. Copper is not acceptable for use where the pipe conveys waste from urinals and toilets.

B. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
4. Copper is not acceptable for use where the pipe conveys waste from urinals and toilets.

2.5 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

B. Solvent Cement and Adhesive Primer:

1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty, shielded, stainless-steel couplings; and hubless-coupling joints.

C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty, shielded, stainless-steel couplings; and hubless-coupling joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

3.3 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

D. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and

reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

I. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

K. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

D. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

E. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

    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 supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Install supports for vertical cast-iron soil piping every 15 feet.

E. Install supports for vertical copper tubing every 10 feet.

F. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

SECTION 221319
SANITARY WASTE PIPING SPECIALTIES

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 the following sanitary drainage piping specialties:

1. Cleanouts.
2. Trench drains.
3. Miscellaneous sanitary drainage piping specialties.

B. Related Sections include the following:

1. Division 22 Section "Plumbing Fixtures".

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene plastic.

D. PE: Polyethylene plastic.

E. PP: Polypropylene plastic.

F. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

1. Wiring Diagrams: Power, signal, and control wiring.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.6 COORDINATION

A. Coordinate size and location of floor and roof penetrations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

1. CLEANOUTS

a. Josam Company; Josam Div.
b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
c. Watts Drainage Products Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. TRENCH DRAINS

a. Josam Company; Josam Div.
b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
c. Watts Drainage Products Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.

2.2 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
2. Size: Same as connected drainage piping
3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head, brass plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Closure: Bronze plug with seal.

B. Metal Floor Cleanouts:

1. Standard: ASME A112.36.2M for adjustable housing cleanout.
2. Size: Same as connected branch.
3. Type: Adjustable housing.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Required.
6. Outlet Connection: Threaded.
7. Closure: Bronze plug with tapered threads.
8. Adjustable Housing Material: Cast iron with threads.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
10. Frame and Cover Shape: Round.
11. Top Loading Classification: Light Duty.
12. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.
13. Standard: ASME A112.3.1.
14. Size: Same as connected branch.
15. Housing: Stainless steel.
16. Closure: Stainless steel with seal.
17. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk, bronze plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Wall Access: Square, flat, nickel bronze cover plate with screw.

2.3 TRENCH DRAINS

A. Ductile Iron or Gray Iron Trench Drains TD:

1. Standard: ASME A112.6.3 for trench drains.
2. Material: Ductile or gray iron.
3. Flange: Seepage.
4. Clamping Device: Required.
5. Outlet: End.
6. Grate Material: Ductile iron or gray iron.
7. Grate Finish: Not required.
8. Dimensions of Frame and Grate: Refer to drain schedule on the drawings.
9. Top Loading Classification: Light Duty.
10. Trap Material: Cast iron.
11. Trap Pattern: Standard P-trap.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout connection.

2. Size: Same as connected waste piping.

    a. NPS 2: 4-inch- minimum water seal.
    b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

F. Install deep-seal traps on floor drains and other waste outlets, if indicated.

G. Install trench drain, barrier-type trap seal protection devices.

1. Size: Same as floor drain inlet.

H. Install wood-blocking reinforcement for wall-mounting-type specialties.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 230010
HEATING VENTILATION AND AIR CONDITIONING GENERAL PROVISIONS

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 the following:
1. Definitions
2. Permits, Fees and Notices
3. Applicable Publications
4. Code Compliance
5. Scope of Work
6. Record Drawings
7. Intent of Drawings and Specifications
8. Quality Assurance
9. Submittals
10. Product Requirements, Equals and Substitutions
11. Manufacturer's Instructions
12. Delivery, Storage and Handling
13. Coordination
14. Cutting, Patching and Demolition
15. Clean Up/Removal of Debris
16. Starting of Systems
17. Guarantee of Work
18. System Testing

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The term "As indicated" means as shown on drawings by notes, graphics or schedules, or written into other portions of Contract Documents. Terms such as "shown", "noted", "scheduled" and "specified" have same meaning as "indicated", and are used to assist the reader in locating particular information.

G. The term "Provide", means furnish and install as part of the work covered in Division 23.

H. The term "Furnish" means furnish only, for installation, as part of this contract, by other Divisions.

I. The term "Install only" means to install under the work of Division 23 equipment furnished by other Divisions, or by the Owner.

J. The term "Owner's Representative" when referenced herein shall be the Architect or the Engineer acting as his designated representative unless otherwise noted.

K. The term "design" as it pertains to the work of this division shall describe the basic intent, component sizing, component relationships and overall architecture of the HVAC, plumbing and fire protection system. The design is generally schematic in nature and will require specific detailing after the approved products are determined.

L. The term "detail" as it pertains to the work of this division shall describe the work required by the Contractor to assure a fully coordinated installation of the material and equipment supplied. When requested, the Contractor shall produce detailed shop drawings or sketches indicating the actual placement of the equipment or material supplied; also including how the equipment or material interfaces with work of other sections or divisions within the Contract Documents.

M. The term "workman-like manner" as it pertains to the work of this division shall describe a neat well organized high quality installation system (duct, pipe, control wire or tube, conduit, etc.). Routing shall be well thought out providing adequate service clearance and maximum use of space. Equipment placement shall exhibit proper clearances for service. All lines (duct, pipe, control wire or tube, conduit, etc.) shall be run straight and true, parallel or perpendicular to building structure neatly supported.

N. For additional definitions refer to the General Conditions.

1.4 PERMITS, FEES AND NOTICES

A. Comply with the General Conditions

1.5 APPLICABLE PUBLICATIONS

A. Publications listed in each Section form a part of that Section to the extent referenced.

B. When a standard is specified by reference, comply with requirements of that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.

C. The Publication or Standard is the publication in effect as of the bid date, except when a specific date is listed.

1.6 CODE COMPLIANCE

A. Virginia Uniform Statewide Building Code, 2018 edition, including all adopted Model Codes and Standards:
   1. Virginia Construction Code 2018.
   2. Virginia Mechanical Code 2018.
   3. Virginia Plumbing Code 2018.
   4. NFPA 70, 2017.
   5. Virginia Fuel Gas Code 2018.
   6. Virginia Energy Conservation Code 2018.
   7. Virginia Statewide Fire Prevention Code 2018.

1.7 SCOPE OF WORK

A. The work to be performed under this Division consists of the satisfactory completion of all HEATING VENTILATION AND AIR CONDITIONING SYSTEMS as indicated in the Contract Documents.

1.8 RECORD DRAWINGS

A. Comply with the General Conditions.

1.9 INTENT OF DRAWINGS AND SPECIFICATIONS

A. The intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable mechanical systems complete in every respect.

B. The drawings are diagrammatic, intending to show general arrangement, capacity and location of system components, and are not intended to be rigid in detail. Final placement of equipment, other system components, and coordination of all related trades shall be the Contractor's responsibility.

C. Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets and fittings may not be shown but shall be provided at no additional change in contract cost.

D. In the event of a conflict, the Owner's Representative will render an interpretation in accordance with the General Conditions.

SECTION 230010
HEATING VENTILATION AND AIR CONDITIONING GENERAL PROVISIONS

1.10 QUALITY ASSURANCE

A. Material furnished under this Division shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such material and shall be the latest design.

B. Materials shall be the best of their respective kinds. Materials shall be new except where the specifications permit reuse of certain existing materials.

C. Work provided for in these specifications shall be constructed and finished in every part in a workmanlike manner.

D. All items necessary for the completion of the work and the successful operation of a product shall be provided even though not fully specified or indicated on the drawings.

E. All work shall be performed by qualified, experienced personnel specifically trained in their respective field.

F. All work of this division shall be carefully interfaced with the work of other divisions to assure a complete, functioning system or systems.

1.11 SUBMITTALS

A. In addition to all other submittal requirements elsewhere in the Contract Documents, the Contractor shall comply with the following.

B. Submittal for approval is required only on those items specifically requested in the specification section that applies.

C. For products and equipment that do not require a submittal for approval, submit a separate letter for each specification section certifying that all products and equipment will be provided in compliance with the Contract Documents.

D. Provide submittal data in accordance with the General Conditions and/or as listed below.

E. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that the submittals will be needed in order to meet construction schedule. This schedule shall be submitted prior to or in conjunction with the first submittal. Processing of submittals may be delayed pending the receipt of this schedule at the reviewer's discretion.

F. Submittal data shall be presented in a clear and thorough manner and referenced to the specification section.
   1. Where applicable, data shall be identified by reference to sheet and detail, schedule or room numbers, equipment or unit number as shown on Contract Drawings.

G. Prepare performance and product data as follows:
   1. Clearly mark each copy to identify pertinent products or models, delete non-pertinent data.
   2. Show performance characteristic and capacities.

3. Show dimensions and clearances required.
4. Show wiring or piping diagrams and controls.
5. Clearly list any deviation in the submittals from the requirements of the Contract Documents.
6. Include installation requirements.

H. Manufacturer's standard schematic drawings and diagrams:
1. Modify drawings and diagrams to delete information which is not applicable to the work of this project.
2. Supplement standard information to provide information specifically applicable to the work of this project.

I. Letter of Certification:
1. Where a submittal is not required, provide letter certifying that the work will be completed in strict accordance of the specified requirements. In the event the Contractor wishes to alter the requirements of the specification for whatever reason, this should be clearly explained in this letter noting that this alteration may require additional submittal requirements.

J. Schedules:
1. Where schedules are called for, submit schedule indicating which products will be used and to what extent by system, location, size, etc.

K. Where samples are requested, samples shall be of sufficient size and quantity to clearly illustrate:
1. Functional characteristics of the product, with integral related parts and attachment devices.
2. Full range of color, texture and pattern.
3. Where a mock-up is specified, erect at the Project site, in a location acceptable to the Owner's Representative. Size or area shall be that specified or as agreed upon during pre-construction or other job site meetings.
4. Where mock-up is not a permanent part of the installation, remove mock-ups at conclusion of work or when acceptable to the Owner's Representative.

L. The Contractor shall:
1. Review Shop Drawings, Product Data and Samples prior to submission.
2. Determine and verify:
   a. Field measurements.
   b. Field construction criteria.
   c. Catalog numbers and similar data.
   d. Conformance with specifications.
   e. All submittals have been properly interfaced with the requirements of this and other divisions of work so as to assure a complete, functioning system in accordance with the Contract Documents.
3. Coordinate each submittal with requirements of the work and of the Contract Documents.
4. Clearly identify any deviations in the submittals from requirements of the Contract Documents.
5. Do not release equipment for shipment, begin fabrication or work on any item, which requires submittal for approval until return of submittal with Owner's Representative approval.

6. Make submittals promptly, and in such sequence as to cause no delay in the work or in the work of any other Contractor.

M. Number of Submittals:
1. Comply with the General Conditions.

N. Submittals shall contain:
1. The date of submission and the dates of any previous submissions.
2. The Project title and number.
3. Contract identification.
4. The names and phone numbers including personal contact of:
   a. Contractor.
   b. Supplier.
   c. Manufacturer.
5. Identification of the product, with the specification section number and contract document description clearly indicated.
6. Field dimensions, clearly identified as such.
7. Relation to adjacent or critical features of the work or materials.
8. Applicable standards.
9. Identification of deviations from Contract Documents.
10. Identification of revisions on resubmittals.
11. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
12. Each submittal shall be limited to a single specification section. Submittals shall not be grouped with other sections in common binders or under common control sheets. Each submittal shall have a cover/ control sheet containing the information listed above (a thru k) and have a minimum of 8" x 3" clear space for the general contractors, engineers and architects review stamp.
13. Submittals which do not comply with these requirements may be returned with no action taken at the reviewers' discretion.

O. The Owner's Representative will:
1. Review submittals promptly and where special attention is requested, review in accordance with the schedule required.
2. Review the submittal for general compliance with the Contract Documents. The Contractor is responsible for quantities, dimensions, placement of the product, coordination with all other trades occupying the space, maintain service clearance, function and compliance with the written installation instructions.
3. Determine the appropriate action for the submittal. Action codes will be as follows:

Action	Description
A	No exceptions taken
B	Make corrections to exceptions noted. Resubmittal not required.
C	Make corrections to exceptions noted and resubmit.
D	Not in compliance with Contract Documents. Resubmit.
N	Not required for review. No action taken. Copy retained for reference.

4. Turn around time will generally be within 14 calendar days on properly prepared submittals.
5. Review comments will generally be on a separate attached sheet.

P. Resubmission requirements for "as specified" products.
1. Make any corrections or changes in the submittals required by the Owner's Representative and resubmit until approved.
2. A submittal shall only be reviewed a maximum of 3 times. If upon the third resubmission an approved action cannot be rendered (A or B action), the Contractor shall supply the basis of design product and bear all costs incurred by the Owner's Representative during the review process until an approved submittal is achieved.

Q. The Contractor shall maintain one copy of all approved submittal data including letters of compliance in a job site file.

1.12 PRODUCT REQUIREMENTS, EQUALS AND SUBSTITUTIONS

A. In addition to all other requirements for submittals, equals and substitutions elsewhere in the Contract Documents, the Contractor shall comply with the following.
B. Product Requirements:

1. The specifications sections under Article 2.1 "MANUFACTURERS", lists suppliers found acceptable for this project. The names listed are manufacturers who meet the minimum acceptable standards that this project dictates. The list is furnished as a guide. Even though a manufacturer is named, he must still provide the type and quality of equipment specified as well as equipment that will fit within the allotted space and within the design weight allowance, etc. Being named does not imply permission for that manufacturer to provide an alternative product or design. Other manufacturers not named will be considered to be equal providing they furnish a product of the type and quality specified and submit detailed product descriptive data including a line-by-line comparison of his product compared to the specified product, at least 14 days prior to bid date so that the product can be reviewed. If found to be acceptable, the name can be added by Addendum.
2. In certain cases, foundations and/or structural supports for equipment specified in this Division are provided under other divisions of the specifications. Where an alternate acceptable manufacturer's product is provided, this Contractor shall coordinate the revised requirements and include an allowance for any cost differential.
3. If the list, under Article 2.1 "MANUFACTURERS" names only one manufacturer followed by "No Substitutions" that product shall be supplied.

C. Substitutions.

1. A substitution is defined as any product which does not meet the requirements as outlined in PART 2 - PRODUCTS. A different design which accomplishes the same result will be considered a substitution. The same design which requires a larger motor, or more space or a structural change to accommodate larger weight, etc., will be considered a substitution. If there is any question on the part of a

manufacturer as to whether his product is considered as an equal or as a substitution, submit details to the Owner's Representative 14 days in advance of bid date and a decision will be rendered. If necessary, a clarification will be issued in the form of an Addendum. The Contractor may also request a substitution after award of the contract.

2. Submit a separate request for each product, supported with complete data, with drawings and samples as appropriate, including.

    a. Comparison of the qualities of the proposed substitution with that specified in tabulated format.
    b. Changes required in other elements of the work because of the substitution.
    c. Effect on the construction schedule.
    d. Cost, extra credit or statement of no change in contract price.
    e. Any required license fees or royalties.
    f. Availability of maintenance service, and source of replacement materials.

3. The Owner's Representative shall determine the acceptability of the proposed substitution.
4. A request for a substitution constitutes that the Contractor:

    a. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
    b. Will provide the same warranties for the substitution as for the product specified.
    c. Will coordinate the installation of the substitution into the work, and make such other changes as may be required to make the work complete in all respects.
    d. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.
    e. Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.
    f. Will absorb any cost incurred by the Owner's Representative in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting Contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or miss-sized equipment. In the event of additional engineering costs the billing structure shall be agreed upon prior to review by all involved parties.

D. Owner's Representative will review requests for substitutions with reasonable promptness, and will issue an addendum or notify Contractor, in writing, of the decision to accept or reject the requested substitution.

E. The Owner's Representative will review substitution submittals for compliance a maximum of two times. If the submittal or substituted product does not comply with the Contract Documents on the second submittal, the submittal and product will be rejected and the specified product will be required.

F. The Contractor may request further review of the substitution after the second submittal rejection if the Contractor agrees in writing to accept responsibility for the cost of additional review time and expenses by the Owner's Representative.

G. In the event a substitution is rejected, supply the products which constituted the basis of design at no change in the contract price.

1.13 MANUFACTURER'S INSTRUCTIONS

A. Installation of work shall comply with manufacturer's printed instructions.

B. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Owner's Representative for clarification. Do not proceed with work without clear instructions.

1.14 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions.

B. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.

C. Store products to prevent damage by the elements. Space temperature shall be controlled as required to prevent condensation and metal corrosion or damage to electrical or electronic parts which are the result of condensation.

D. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.

E. Provide protection as necessary to prevent damage after installation.

F. Products which suffer damage due to improper storage shall not be installed and if found in place, shall be removed and replaced at the Contractors expense.

1.15 COORDINATION

A. Arrange for space, chases, slots, and openings in building structure during progress of construction, to allow for integrated automation installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for integrated automation items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.16 CUTTING, PATCHING AND DEMOLITION

A. Comply with the General Conditions.

1.17 CLEAN UP/REMOVAL OF DEBRIS

A. Comply with the General Conditions.

B. Maintain a clean work area. Construction debris shall be immediately removed from all newly erected work.

1.18 STARTING OF SYSTEMS

A. Provide material and labor to perform start-up of each respective item of equipment and system prior to beginning of test, adjust and balance procedures.

B. Provide labor to assist the Owner's Representative in acceptance review.

C. Provide point-by-point system checkout. Submit results in tabulated form by system. Include this data as part of Operation and Maintenance Manuals.

D. Provide information and assistance and cooperate with test, adjust and balance services.

E. Comply strictly with manufacturer's recommended procedures in starting up mechanical systems.

F. Provide such periodic continuing adjustment services as necessary to ensure proper functioning of mechanical systems until acceptance and up to 1 full year after date of Owner acceptance.

1.19 GUARANTEE OF WORK

A. Comply with the General Conditions.

B. Where applicable, furnish manufacturer's written warranty for materials and equipment.

C. Insert warranties in appropriate locations in operating and maintenance manuals.

D. Materials and equipment, which have seasonal operation limitations, shall be guaranteed for one year from date of seasonally appropriate test, and acceptance in writing by the Owner.

1.20 SYSTEM TESTING

A. Provide all necessary labor, materials and equipment to successfully complete all system testing necessary for building occupancy and Owner acceptance.

B. Provide all necessary labor, materials and equipment to assist Contractors of other division to complete system testing necessary for building occupancy and Owner acceptance, wherever an inter-relationship between Division 23 and the work of other divisions exists.

C. Tests shall be repeated as necessary until all occupancy and operation permits are granted and the Owner accepts the project.

PART 2 - PRODUCTS

2.1 NOT USED.

PART 3 - EXECUTION

3.1 NOT USED.

END OF SECTION 230010

SECTION 230500
COMMON WORK RESULTS FOR HVAC

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 the following:
   1. Waterproofing and flashing
   2. Fire and smoke stopping
   3. Sleeves.
   4. Painting and finishing.
   5. Equipment installation requirements common to equipment sections.
   6. Electrical requirements

1.3 DEFINITIONS

A. Refer to Division 23 Section “Heating Ventilation and Air Conditioning General Provisions.”

1.4 SUBMITTALS

A. Welding certificates.
   1. Where welding certificates are required in multiple Division 23 Sections, One complete set of welding certificates, one for each welder, will be acceptable for the entire Division 23 scope of welding work.

B. Shop Drawings:
   1. Submit drawings of fabricated steel supports where proposed supports are not in accord with details on drawings, or where drawings do not detail supports. Submittal for approval is required.

C. Product Data:
   1. Submittal for other than fabricated steel supports is not required. Product data for the following shall be included in the operation and maintenance manuals. Submittal for approval is not required.
      a. Waterproofing and flashing material.
      b. Fire and smoke stopping material.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 COORDINATION

A. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 – OPENINGS.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

A. Waterproofing and Flashing:

1. Stoneman Engineering and Manufacturing Co.
2. Other suppliers acceptable.

B. Fire and Smoke Stopping Material:

1. Dow Corning Corporation.
2. General Electric Company.
3. Protective Treatments, Inc. (PTI)
4. 3M Ceramic Materials Dept.

2.2 WATERPROOFING AND FLASHING

A. All work is provided under Division 7 - THERMAL AND MOISTURE PROTECTION.

2.3 FIRE AND SMOKE STOPPING

A. All work is provided under Division 7 – THERMAL AND MOISTURE PROTECTION.

2.4 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.5 PAINTING AND FINISHING

A. Product specified in Division 9 - FINISHES.

2.6 EQUIPMENT INSTALLATION REQUIREMENTS COMMON TO EQUIPMENT SECTIONS

A. Product description not applicable.

2.7 ELECTRICAL REQUIREMENTS

A. Product description not applicable.

PART 3 - EXECUTION

3.1 WATERPROOFING AND FLASHING

A. All penetrations of roof to be in accordance with requirements of Division 7 - THERMAL AND MOISTURE PROTECTION.

3.2 FIRE AND SMOKE STOPPING

A. Fire and smoke stopping shall be provided as required to meet all code requirements and at a minimum is required in the following locations:

B. Where exposed and concealed horizontal ducts, pipes, tubes, and wires penetrate fire rated walls, shaft walls, and smoke barriers.

C. Where exposed and concealed vertical ducts, pipes, tubes, and wires penetrate rated and non-rated floors.

D. Provide pipe or duct sleeve for all penetrations. Space between pipe or duct and sleeve shall not exceed ½".

E. Fill annular space between pipe and sleeve, or between duct and sleeve, with approved material. Depth of material shall be in accord with laboratory tests for 1, 2, or 3 hour rated assemblies.

F. Damming material may be temporary non-fire approved, or permanent fire- approved. Where permanent fire-approved damming material is used depth of fire and smoke stopping material may be decreased in accord with manufacturer's recommendations. Temporary damming material shall be removed after installation of fire and smoke stopping material.

G. Seal all gaps or voids in cured foam with material to match the fire and smoke stopping material.

H. Trim excess cured foam from around all openings and leave smooth, flush surface.

3.3 PAINTING AND FINISHING

A. All equipment shall be furnished with a factory-applied galvanized, prime paint, or finish paint finish. Touch-up damaged surfaces of equipment immediately.

B. Paint for galvanized surfaces shall be in accordance with ASTM A780 using zinc rich compound.

C. Paint wooden mounting backboards with two coats of gray enamel prior to making attachments to the board.

D. For quality control refer to DIVISION 9 - FINISHES.

E. Remove all dirt, rust, scale, grease, pipe dope, solder flux, and welding slag from all surfaces to be painted.

F. Paint immediately, under this Division, all damaged galvanized surfaces. Paint galvanized metal surfaces behind grilles with two coats of flat black paint.

G. Apply rust inhibitive primer to ferrous surfaces of shop fabricated steel supports.

H. Paint immediately under this division all field and shop welded joints in piping or equipment supports with 2 coats of grey metal primer.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

E. Coordinate setting of equipment with the requirements of other trades so as to avoid conflicts and to insure compatibility. Equipment shall not block access for installation of other equipment.

F. Adjust suspended equipment to final elevation prior to making pipe, duct or electrical connections.

G. Exercise caution during equipment placing operations to insure that structure is not overloaded.

H. Do not move heavy equipment across floor or roof of insufficient load bearing capacity to support such equipment. Provide bracing or shoring as required, or use crane to place equipment directly on permanent and finished support.

3.5 SLEEVES

A. Sleeves shall be provided at every penetration through floor or wall, regardless of fire rating.

B. Deliver sleeve to site in advance of concrete formwork and placing

3.6 ELECTRICAL REQUIREMENTS

A. Electrical apparatus, devices, controls, etc., required but not specified in detail in this Division shall conform to Division 26 - ELECTRICAL.

B. Except as otherwise detailed or specified, all power wiring required to operate electrical devices and equipment furnished in this Division will be provided under Division 26 - ELECTRICAL.

C. Control and interlock wiring required for all electrical devices and equipment furnished in this Division is specified under Division 25 – INTEGRATED AUTOMATION.

D. Motor driven equipment provided under this Division shall be provided with motors as specified in Division 23 Section “Common Motor Requirements for HVAC Equipment.”

E. Starters shall be furnished under Division 23 for installation under Division 26 - ELECTRICAL. Starters shall be as specified in Division 26 Section “Enclosed Motor Controllers.” or Division 23 Section “Adjustable Frequency Motor Controllers.”

F. Starters, except where specified to be furnished with the equipment or for motors having adjustable frequency drives, shall be provided in Motor Control Centers under Division 26 - ELECTRICAL.

END OF SECTION 230500

SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 1400 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Separate winding for each speed.

E. Rotor: Dynamically balanced, die cast aluminum.

F. Windings: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: 115º C at 40º C ambient temperature; Maximum winding temperature 155º C.

I. Insulation: Class F.

J. Vibration limits: Maximum 0.15 inches/second.

K. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

L. Enclosure Material: Cast iron frame, end plates and fan cover for motor frame sizes 254T and larger. Rolled steel frame and fan cover with die cast aluminum endplates for motor frame sizes smaller than 254T.

M. Terminal enclosure: Manufacturer’s standard cast iron, cast aluminum or steel.

N. Shaft Grounding: Grounding brush on the shaft

2.4 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION

A. NOT APPLICABLE

END OF SECTION 230513

SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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 hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 Section "Wet-Pipe Sprinkler Systems" for pipe hangers for fire-protection piping.
3. Division 23 Section “Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
4. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Pipe stands. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

1. STEEL PIPE HANGERS AND SUPPORTS

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Grinnell Corp.
c. GS Metals Corp.
d. National Pipe Hanger Corporation.
e. Piping Technology & Products, Inc.

2. METAL FRAMING SYSTEMS

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. ERICO/Michigan Hanger Co.; ERISTRUT Div.
c. GS Metals Corp.

d. Power-Strut Div.; Tyco International, Ltd.
e. Unistrut Corp.; Tyco International, Ltd.

3. THERMAL-HANGER SHIELD INSERTS

a. ERICO/Michigan Hanger Co.
b. PHS Industries, Inc.
c. Pipe Shields, Inc.
d. Rilco Manufacturing Company, Inc.

4. FASTENER SYSTEMS

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. MKT Fastening, LLC.
d. Powers Fasteners.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, 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 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 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 padded hangers for piping that is subject to scratching.

F. 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.

G. 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 20.

H. 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. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

I. 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-joist 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. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
6. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
7. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
8. 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.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. 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 above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal 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.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. 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 and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

N. Insulated Piping: Comply with the following:

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 according to ASME B31.1 for power piping and 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. Option: Thermal-hanger shield inserts may be used. 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 shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. 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: 12 inches long and 0.048 inch thick.

5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and 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 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. Touch Up: 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.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 230529

SECTION 230548
VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

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 the following:

1. Spring hangers.
2. Spring hangers with vertical-limit stops.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.4 PERFORMANCE REQUIREMENTS

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

A. Delegated-Design Submittal: For vibration isolation details 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. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation required to select vibration isolators and for designing vibration isolation bases.

B. Welding certificates.

C. Qualification Data: For professional engineer and testing agency.

D. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

1. VIBRATION ISOLATORS
   a. Kinetics Noise Control.
   b. Mason Industries.

2.2 VIBRATION ISOLATORS

A. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

B. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation devices to indicate capacity range.

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.

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 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Drilled-in 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 the 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 Anchors: 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 Anchors: 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 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.4 ADJUSTING

A. 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.

B. Adjust active height of spring isolators.

END OF SECTION 230548

SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances 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.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Yellow.

C. Background Color: Black.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances 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.

G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

H. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded in accordance with ASME (ANSI) 13.1-1996, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Reinforced grommet and wire or string.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. 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. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Refrigerant Piping:

a. Background Color: Yellow.
b. Letter Color: Black.

3.4 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

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. Balancing Air Systems:

a. Constant-volume air systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau

C. TAB: Testing, adjusting, and balancing.

D. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. Qualification Data: Within 15 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article."

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.

3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by NEBB or AABC.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by NEBB or AABC.
2. TAB Technician: Employee of the TAB contractor and who is certified by NEBB or AABC as a TAB technician.

B. TAB Conference: Meet with Owner on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Owner.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, flow-control devices, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units; such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine operating safety interlocks and controls on HVAC equipment.

L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
6. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.

d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

   a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Owner for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

   a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 TOLERANCES

A. Set HVAC system's air flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

3.8 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.9 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Terminal units.
4. Balancing stations.

5. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Cooling-coil static-pressure differential in inches wg.
g. Outdoor airflow in cfm.
h. Return airflow in cfm.
i. Outdoor-air damper position.
j. Return-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.

g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig.
j. Refrigerant suction temperature in deg F.

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Air flow rate in cfm.
i. Face area in sq. ft.
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h.
b. Air flow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.

c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.

e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

K. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.10 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
c. Verify that balancing devices are marked with final balance position.
d. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Owner.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Owner.

3. Owner shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.11 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230700
HVAC INSULATION

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. Insulation Materials:

    a. Flexible elastomeric.

2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied fabric-reinforcing mesh.
9. Field-applied cloths.
10. Field-applied jackets.
11. Tapes.
12. Securements.
13. Corner angles.

B. Related Sections:

1. Division 22 Section "Plumbing Insulation."
2. Division 23 Section "Metal Ducts" for duct liners.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Qualification Data: For qualified Installer.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 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.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

2.2 MANUFACTURERS

A. Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. Flexible Elastomeric

a. Aeroflex USA Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

2.3 INSULATING MATERIALS

A. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

2.4 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. PVC Jacket Adhesive: Compatible with PVC jacket. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 MASTICS

A. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
4. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, 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.

2.8 TAPES

A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

2.9 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2 or 3/4 inch wide with wing or closed seal.
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 or 3/4 inch wide with wing or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. 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 equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and 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, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom 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 application and finishing.

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 at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install 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. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. 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 similar to butt joints.

O. 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.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. Install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

3.5 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.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be 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 valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two 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.
4. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

5. 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 fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
6. 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.
7. Label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. 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.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of 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.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed 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.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers 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.

B. 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.

3.8 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.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 INSULATION SCHEDULE

A. Refer to the drawings for insulation schedules.

END OF SECTION 230700

SECTION 230900
INSTRUMENTATION AND CONTROL FOR HVAC

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 control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. Related Sections include the following:

1. Division 23 Section "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

1.3 SEQUENCE OF OPERATION

A. Refer to Division 23 Section “Sequence of Operations for HVAC Controls.”

1.4 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
1. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams showing fans, dampers, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Written description of sequence of operation.
6. Schedule of dampers including size, leakage, and flow characteristics.
7. Controlled Systems:

a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.

b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
c. Written description of sequence of operation including schematic diagram.

C. Qualification Data: For installer and manufacturer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Maintenance instructions and lists of spare parts for each type of control device.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
4. Calibration records and list of set points.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

1.7 COORDINATION

A. Coordinate location of thermostats, and other exposed control devices with plans and room details before installation.

B. Coordinate supply of conditioned electrical branch circuits for controlled devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

1. Alerton Inc.
2. Andover Controls Corporation.
3. Automated Logic Corporation.
4. Honeywell International Inc.
5. Invensys Building Systems.
6. Johnson Controls, Inc.; Controls Group.
7. Trane; Worldwide Applied Systems Group
8. Tridium

B. Control system shall consist of sensors, indicators, actuators, final control elements, other apparatus, and accessories to control mechanical systems.

2.2 THERMOSTATS

A. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
2. Selector Switch: Integral, manual on-off-auto.

2.3 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
1. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

2.4 DAMPERS

A. Dampers: AMCA-rated, opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that power supply is available to control units.

3.2 INSTALLATION

A. Connect and configure equipment to achieve sequence of operation specified.

B. Verify location of thermostats, and other exposed control sensors with Drawings and room details before installation. In general, install devices adjacent to and on the same horizontal centerline as the light switches.

C. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test each system for compliance with sequence of operation.
4. Test hardware interlocks.

3.5 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Calibrate equipment using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.

3. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
4. Provide diagnostic and test instruments for calibration and adjustment of system.
5. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature set points.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 230900

SECTION 230950
SEQUENCES OF OPERATION FOR HVAC

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 control sequences for HVAC systems, subsystems, and equipment.

B. Related Sections include the following:

1. Division 23 Section "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

1.3 DEFINITIONS

A. DDC: Direct digital control.

B. VAV: Variable air volume.

1.4 CONTROL SEQUENCES

A. Refer to the drawings for Sequences of Operation.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

END OF SECTION 230950

SECTION 233113
METAL DUCTS

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. Single-wall rectangular ducts and fittings.
2. Sealants and gaskets.
3. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Sealants and gaskets.

B. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations for selecting hangers and supports.

C. Welding certificates.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Interior Surfaces: The interior surfaces of all ductwork shall be smooth. No sheet metal parts, tabs, angles, screws or anything else may project into the air ducts for any reason unless specified to do so. All seams and joints shall be external.

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) 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."

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," 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."

E. Cross Breaking and Mechanical Beading: The rectangular ductwork shall have cross-breaking or mechanical transverse beading for ductwork sizes 12" and wider. Duct beading used to stiffen ducts shall be at least 1/16" deep at the center of the bead and a maximum of 3/8 inch wide at the base of the bead.

2.2 SHEET METAL MATERIALS

A. General Material Requirements: Unless otherwise indicated or specified all sheet metal ductwork shall be constructed in accordance with the HVAC DUCT CONSTRUCTION STANDARDS, published by the Sheet Metal and Air Conditioning Contractors' National Association, Inc., and herein referenced as the SMACNA Manual. The SMACNA manual edition utilized shall be the SMACNA edition referenced within the codes as adopted by the local code authorities. SMACNA manual includes SMACNA supplements and addenda applicable to the referenced SMACNA edition. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

D. 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.

2.3 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

2.4 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

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 according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts 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. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "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.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "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 feet.

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 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:
   a. Ducts with a Pressure Class of Less than 3-Inch wg: Tested not required except as indicated below.
3. Air distribution system leakage in excess of 5% will not be acceptable. The total leakage for a particular system shall include air leakage at ductwork, equipment connections, plenum interface connections, and other areas in the air distribution system where leakage may occur. Refer to sealing requirements herein. Leakage requirements and limits shall apply to all ductwork pressure/seal classifications.

4. Leaks must be located and sealed regardless of pressure class. All audible leaks, regardless of size, must be sealed.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.7 DUCT SCHEDULE

A. Refer to the drawings for duct schedule.

END OF SECTION 233113

SECTION 233423
HVAC POWER VENTILATORS

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 the following:

1. Propeller fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevations.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Fan speed controllers.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.
2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set for each belt-driven unit.

2. Bearings: One set for each sized used on this project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

1. PROPELLER FANS

    a. Aerovent; a Twin City Fan Company.
    b. Chicago Blower Corporation.
    c. Hartzell Fan, Inc.
    d. Loren Cook Company.
    e. NuTone Inc.
    f. Penn Ventilation.

2.2 PROPELLER FANS

A. Description: Direct- or belt-driven propeller fans consisting of fan blades, hub, housing, orifice ring, motor, drive assembly, and accessories.

B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.

C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.

D. Fan Wheel: Replaceable, cast-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

E. Belt-Driven Drive Assembly: Resiliently mounted to housing, statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.

    1. Service Factor Based on Fan Motor Size: 1.5.
    2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
    3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.

        a. Ball-Bearing Rating Life: ABMA 9, L_{10} of 100,000 hours.

    4. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
    5. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
    6. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
    7. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

F. Accessories:

    1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
    2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
    3. Wall Sleeve: Galvanized steel to match fan and accessory size.
    4. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

5. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

G. Vibration Isolators: Comply with requirements in Division 23 Section "Vibration Controls for HVAC Piping and Equipment."

2.3 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.4 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using vibration-control devices as specified in Division 23 Section "Vibration Controls for HVAC Piping and Equipment."

C. Support suspended units from structure using threaded steel rods and vibration-control devices as specified in Division 23 Section "Vibration Controls for HVAC Piping and Equipment."

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories.

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 233423

SECTION 238126
SPLIT-SYSTEM AIR-CONDITIONERS

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 split-system air-conditioning consisting of separate evaporator-fan and compressor-condenser components.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. 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.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

F. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

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. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.5 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.6 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 years from date of Substantial Completion.
b. For Parts: One year from date of Substantial Completion.
c. For Labor: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems.
2. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.
3. Trane; a business of American Standard companies.
4. YORK; a Johnson Controls company.

2.2 INDOOR UNITS (5 TONS OR LESS)

A. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in manufacturer’s standard color, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
3. Fan: Direct drive, centrifugal.
4. Fan Motors:

a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

5. Condensate Drain Pans:

a. Fabricated with minimum one 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.

1) Length: Extend drain pan downstream from leaving face .
2) Depth: A minimum of 1 inch deep.

b. Single-wall, galvanized or stainless-steel sheet.
c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

1) Minimum Connection Size: NPS 3/4.

6. Air Filtration Section:

a. Disposable Panel Pre-Filters:

1) Comply with the requirements of Division 23 Section Particulate Air Filtration.
2) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in manufacturer’s standard color, 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.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

a. Compressor Type: Scroll.
b. Refrigerant Charge: R-410A.
c. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 210/240.

3. Fan: Aluminum-propeller type, directly connected to motor.
4. Motor: Permanently lubricated, with integral thermal-overload protection.
5. Low Ambient Kit: Permits operation down to 0 deg F.
6. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Thermostat: BACNet or LONWorks, communicating type, low voltage with subbase to control compressor and evaporator fan. Provide communication with the building automation system under the requirements of Division 25 – Integrated Automation.

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. 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.

D. Drain Hose: For condensate.

2.5 CAPACITIES AND CHARACTERISTICS

A. Refer to the drawings:

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

C. 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.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

SECTION 238239.16
PROPELLER UNIT HEATERS

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 propeller unit heaters with electric-resistance heating coils.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. CWP: Cold working pressure.

C. PTFE: Polytetrafluoroethylene plastic.

D. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include location and size of each field connection.
4. Include details of anchorages and attachments to structure and to supported equipment.
5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
6. Indicate location and arrangement of integral controls.
7. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control reports.

D. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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. Engineered Air.
2. McQuay International.
3. Modine
4. Trane Inc.

2.2 DESCRIPTION

A. 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.

2.3 PERFORMANCE REQUIREMENTS

2.4 HOUSINGS

A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

2.5 COILS

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch. Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F at any point during normal operation.

1. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.

2. Wiring Terminations: Stainless-steel or corrosion-resistant material.

2.6 FAN AND MOTOR

A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

B. Motor: Permanently lubricated, multispeed. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.7 ELECTRICAL

A. Provide units heaters with integral disconnect switches. Disconnect switches shall be wired to de-energize the entire unit.

2.8 CONTROLS

A. Control Devices:

1. Unit-mounted, fan-speed switch.
2. Unit-mounted thermostat.

2.9 CAPACITIES AND CHARACTERISTICS

A. Refer to the drawings

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

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 spring hangers. Hanger rods and attachments to structure are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 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.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 238239.16

SECTION 25 0503
BASIC INSTRUMENTATION SYSTEM REQUIREMENTS

1. GENERAL

1.1 DESCRIPTION

A. This specification provides a guide to the Contractor for the supply of a complete instrumentation and control system.

B. Furnish and install the instrumentation system including equipment, equipment installation and final wiring connections to provide a complete, operational system in accordance with the Contract Documents.

C. Provide required interfacing between instrumentation equipment and interrelated items of electronic equipment and devices specified elsewhere.

D. Conduit and wiring required to interconnect various items of instrumentation equipment are specified in Division 16 - Electrical.

1.2 REFERENCE STANDARDS ARE REFFERED TO BY ABBREVIATION AS FOLLOWS:

A. Instrument Society of America ISA

B. National Electric Code (NFPA No. 70) NEC

C. National Fire Protection Association NFPA

D. Underwriters Laboratories, Inc UL

E. Institute of Electrical and Electronic Engineers. IEEE

1.3 QUALITY ASSURANCE

A. Except where otherwise noted, manufacturers named in supporting specifications of Division 13 have been selected as a standard of quality for the purpose of identifying individual items of equipment.

B. Where permitted, other manufacturers will be considered, subject to a detailed offering in accordance with Division I requirements.

C. Products specified herein will be furnished and installed by a systems supplier meeting the qualifications as enumerated below.

1.4 SYSTEM RESPONSIBILITY

A. The Instrumentation System Supplier shall assume complete responsibility for engineering, programming, furnishing, implementing, technically advising on and certifying the correctness of installation, making final corrections to, installing, terminating, calibrating, adjusting, documenting, testing and starting up the complete instrumentation system. In addition, the Instrumentation System Supplier shall coordinate and cooperate with any other Subcontractor, Equipment Vendor, Owner, Engineer and Prime Contractor as required and necessary to ensure the successful and timely startup of this project.

1.5 STANDARDIZATION

A. Furnish each category of equipment by a single manufacturer.

B. Furnish all front panel mounted instruments similar in appearance and in a coordinated color scheme as selected by the Owner from the equipment manufacturer's standard color chart.

C. Control voltage shall not exceed 120 volts.

1.6 REGULATORY REQUIREMENTS

A. Material, equipment and installation shall meet the requirements of applicable federal, state and codes and standards. Where applicable, material and the equipment shall bear the UL label.

1.7 SUBMITTALS

A. Submit shop drawings and product data for all equipment.

B. Job index sheets identifying each item of equipment and related drawings and specification sheets.

C. Specification check sheets identifying each item of equipment and listing all features such as range, standard and optional features incorporated.

D. Specification sheets for each item of equipment furnished.

E. Dimension, wiring and/or piping drawings covering all items of equipment including interconnection diagrams to fully correlate field wiring and equipment termination.

F. System schematic drawings or "loop" diagrams shall be provided showing all components being supplied for each "loop" and their interconnections including a delineation of factory and field wiring and/or piping in accordance with ISA-S5.4 Instrument Loop Diagrams will use a plantwide loop numbering system generated by the contractor and approved by the engineer.

G. Panel drawings including materials, fabrication, instrument layout, nameplate legends, wiring and/or piping schematics.

H. Field training proposal and schedule.

I. Calibration data for all analog devices.

J. Supplementary information deemed necessary by Supplier or Engineer to fully illustrate full compliance with Specifications.

1.8 TEST DOCUMENTS

A. Test Plan: Within 60 days of award of contract, submit a test plan to the Owner for approval. The test plan shall define the scope of test required to ensure that the system meets all applicable specifications.

B. Test Results: Within 15 days of completion of any test, submit test reports to the Owner for approval.

C. Operation and Maintenance Manual: 14 days prior to scheduled equipment testing, submit five (5) copies of the manual bound in loose-leaf binder for review by the Owner and Engineer.

D. The manual's identification shall be inscribed on the cover.

E. The manuals shall include the names, addresses and telephone numbers of each subcontractor installing equipment and systems and of the local representatives for each item of equipment and each system.

F. The manuals shall have a Table of Contents and be assembled to conform to the project manual Table of Contents with the tab sheets placed before instructions covering the subject. Additionally, each manual shall contain a comprehensive index of all manuals submitted in accordance with this paragraph.

G. Manuals and specifications shall be furnished which provide full and complete coverage of the following subjects:

H. Operational Requirements: This document shall describe, in concise terms, all the functional and operational requirements for the system.

1. Maintenance: Documentation of all user-performed maintenance on all system components including inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective units. This shall include calibration, maintenance and repair of all sensors and controls, plus diagnosis and repair or replacement of all system hardware.

I. Deliver maintenance materials, spare parts and test equipment to Owner prior to project closeout.

J. All Development and Run-Time application software used by the controls and instrumentation contractor shall be turned over to the Owner with all software officially registered in the Owner's name. All software shall be the property of the Owner.

1.9 PROTECTION AGAINST LIGHTNING INDUCED VOLTAGES

A. Provide power line protectors on AC power supply to all electronics equipment. Each control panel shall be provided with AC lightning protection.

B. Provide signal line isolators and surge protectors on all items of equipment mounted outside of buildings or structures or connected to signal lines installed between buildings or structures.

C. Surge Protectors shall be selected by use and submitted for approval. All surge protection devices shall be grounded per the NEC and according to the manufacturer’s installation recommendations.

D. Provide isolation relays between instrumentation devices and telephone line protectors. Isolation relays shall be as recommended by Instrumentation Supplier.

1.10 SIGNAL ISOLATION

A. Provide electrical isolation of signal conductors from grounding system.

B. Where signal connections are indicated to equipment not furnished under this Section, provide signal isolation interface.

2. PRODUCTS

2.1 PANELS

A. Instrumentation Panel General

1. Provide totally-enclosed cabinets of the height, width and depth as selected from the manufacturer's standard to contain components of the control system. The enclosures shall conform to NEMA standards as required.

2. Panels shall be made of 14 gauge steel (minimum) for single door enclosures and 12 gauge steel (minimum) for two door enclosures and shall have a strong and rigid construction. All seams shall be continuously welded. A roller lip shall be provided around three sides of the door(s) to increase strength and to keep dirt and liquids from intruding inside the enclosure. Oil-resistant gasketing shall ensure a watertight seal around door openings.

a) Color shall be selected by the Owner from the manufacturer's standard color chart.

b) Body stiffeners and door stiffeners shall be provided in larger enclosures for extra strength and rigidity. External feet shall be provided for mounting if required.

c) All exterior hardware shall be stainless steel. The door clamp shall be quick and easy to operate and shall have no loose parts. A locking handle with keylock shall be provided.

d) Provide engraved, laminated plastic nameplates for each front-panel mounted instrument with embossed, plastic tape labels and all instruments and components visible from the rear of the panel.

3. Wiring shall be in accordance with UL508-A standards.

4. Assign wire numbers to all conductors and identify each end of each conductor by the use of plastic-type sleeves with wire numbers embossed thereon.

5. Wireways

   a) All wiring shall be made in horizontal and vertical runs in PVC wireways neatly harnessed and adequately supported.

6. Terminals

   a) All field wiring will be wired to a field terminal strip including power, control and loops.

7. Receptacles and Lights

   a) Receptacles - Provide a duplex receptacle in each control panel.

   b) Lights - Provide a LED light fixture with door switch assembly in all control panels.

8. Power Supplies

   a) Provide 120VAC to 24VDC power supplies properly sized for each panel's instrumentation and loop power requirements.

9. AC Lightning Protection

   a) Each panel will be provided with AC lightning protection.

10. Provide a grounding bus in each control panel to bond the grounding terminal on each instrumentation device to the external grounding system.

    a) Arrange bus so that individual devices directly connected to the bus by not more than 5' of grounding conductor without the use of "looping" between devices.

    b) Use not less than #12 AWG stranded, copper conductors to bond individual devices to the grounding bus.

    c) Bond all metallic parts of the panel to the grounding bus.

11. Factory-test all panels prior to shipment. Field installation shall consist of settling panel in place, making necessary pneumatic and/or electrical connections and field adjustment of instruments. All PLC Inputs and Outputs shall be fully tested and each PLC program shall be fully tested prior to shipment.

3. EXECUTION

3.1 DEFINITION OF ACCEPTANCE

A. System acceptance shall be defined as that time when the following requirements have been fulfilled:

1. All submittals and documentation have been submitted and reviewed.
2. All spare parts and test equipment have been turned over to the Owner.
3. The complete Instrumentation System has successfully completed all testing requirements cited herein.
4. The training program has been completed.

B. Warranty

C. Provide a one year warranty period that starts upon system acceptance.

D. Warranty services shall include all parts and labor required to maintain the instrumentation system in good working order. Any spare parts used during the warranty period shall be replaced at no additional cost to the Owner.

END OF SECTION

SECTION 25 0503.13
CONTROLS AND INSTRUMENTATION INSTALLATION DRAWINGS

1. GENERAL

1.1 REFERENCES

A. Instrument Society of America (ISA) Publications

1. S5.1 Instrumentation Symbols and Identification
2. S5.4 Instrument Loop Diagrams
3. S51.1 Standard Process Instrumentation Terminology

B. National Fire Protection Association (NFPA)

1. NFPA 79 Electrical Standard for Industrial Machinery

1.2 DESIGN CRITERIA

A. The Contract Documents include instrumentation diagrams, location drawings and specifications, but not detailed installation drawings of the system. Items such as ladder diagrams, cabinet layout and detailed wiring have been left for design by the Contractor.

B. Provide installation drawings to completely document the controls and instrumentation installation.

1.3 DRAWING REQUIREMENTS

A. Drawings shall consist of the following:

1. Floor plans, elevations and sections of equipment and control spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, permanent nameplate identification, wiring, conduit and any other items that must be shown to assure a coordinated installation. Drawings shall indicate required clearance for operation, maintenance and replacement of operating equipment devices.
2. Integrated electric and electronic control diagrams with P & I diagrams detailing the actual equipment being supplied.
3. Electrical control diagrams of the ladder type conforming to NFPA 79, Annex D. The installation drawings shall contain ladder diagrams for each motor and the like showing equipment exactly as it shall be installed. Diagrams shall clearly indicate location of each device. Field wiring shall be shown dotted, panel wiring solid. Each wire shall have a unique identification number. The following system shall be used. Each wire number shall consist of five digits. The first three digits shall be the first three digits of the ladder rung number on which the wire is shown or originates. The last two digits shall be the device terminal number. Number each device terminal with manufacturer's terminal number.
    a) Alternate wire numbering systems shall be submitted to the Engineer for approval. Drawings without a wire numbering system will not be approved. Installations without wire numbers on both ends of all panels and field wiring will not be approved.
4. Develop control logic to meet the requirements shown in the instrumentation and electrical diagrams and the sequence of operation.
5. Panel interior and exterior elevations and sections, conforming to NFPA 79, Annex D.
6. All power distribution including, but not limited to, motor control centers, motor

starters, soft start controllers and variable frequency drives.

7. Programmable Logic Controller (PLC) diagrams shall be of the ladder type. Further annotate logic diagrams by identifying input contacts with their P & ID tag numbers as well as their programmable controller input address number. Also identify outputs by the P & ID tag number of the final element controlled as well as their programmable controller output address number. In addition, provide a narrative of the logic in English-Language text format.

B. Preparation of Drawings

1. Drawings shall be prepared in AutoCad version 14 or newer. System CD's shall become the property of the Owner at project closeout. A copy of the CD's may be retained by the systems house.
2. All available information which will define the scope of the work shall be included on the drawings. A complete legend of abbreviations and symbols and equipment schedules shall also be included on the drawings. Drawings shall be final and complete, with all elements thoroughly checked and coordinated with each other and with the specifications.
3. Equipment tag numbers shall be the same as those indicated on the contract drawings.
4. Drawing format: The drawing format, style and lettering shall be the same as the Contract Drawings. Every effort shall be made to avoid unnecessary detail, poor spacing, careless lettering, weak lines and crowded drawings.
5. Drafting Media: Installation drawings shall be in ink on paper.
6. Sizes of Drawings: The drawings shall be 24 by 36 inches and 11 by 17.
7. Scales: Located directly under the title of each plan, elevation, section, detail, etc., shall be an indication of the scale of the object drawn.
8. Arrangement of Drawings: Drawings shall be arranged in the following order:
    a) Index
    b) Floor plans
    c) P&I diagrams
    d) Ladder Diagrams
    e) Programmable Logic Controller Communication diagrams
    f) Loop diagrams
    g) Panel interior and exterior elevations and sections
    h) Power distribution
9. Lettering: The minimum size lettering, which includes all alphanumeric symbols used on all project drawings, shall be not less than 1/8 inch (24 by 36 format).
10. Checking Drawings: All drawings shall be checked and coordinated before being submitted to eliminate conflicts, errors, or omissions.
11. Certification and Signatures: The complete drawing package shall be signed by a corporate member of the control systems house with the final set of the issued drawings reflecting As-Built conditions.

C. Submittal Requirements

1. Submittal Approval and Review: Submit one set of original size drawings for review by the engineer/Owner. Drawings shall be complete. Review does not constitute approval or acceptance of any variations from the contract documents unless such variations have been specifically pointed out in writing by the contractor and specifically approved in writing by the Owner.
2. Certified for Construction Submittal: After the changes required as a result of the approval review have been made to the original tracings, submit to all parties involved one original size set marked "Certified for Construction."
3. As Built Submittal: Prior to project closeout, update tracings to reflect "As Built" conditions. Mark tracings "As Built." Submit to the Owner. All tracings shall become the property of the Owner.
    a) Work shall not be started until the "Certified for Construction" drawings have been issued by the Contractor.

2. PRODUCTS – NOT USED

3. EXECUTION – NOT USED

END OF SECTION

SECTION 25 0800
CONTROLS AND INSTRUMENTATION INSTALLATION STARTUP

1. GENERAL

1.1 CALIBRATION OF INSTRUMENTATION

A. Calibration of Instrumentation shall be certified within 6 months of the date of use to have an accuracy 50 percent greater than the device being calibrated.

2. PRODUCTS

2.1 NAMEPLATES SHALL HAVE THE FOLLOWING FEATURES:

A. Constructed from black laminated phenolic with a white center core sandwiched between two black strata.

B. Engraved to form white letters 3/8 inch high.

C. Mounting holes at each end to accept screw fastener.

2.2 BRASS TAGS SHALL HAVE THE FOLLOWING FEATURES:

A. Minimum Gage: 16

B. Minimum Dimensions: 0.75 inch by 1.5 inches

C. Stamped to form permanent letters minimum 0.10 inch high.

D. Hole to receive cable tie

2.3 CABLE TIES SHALL HAVE THE FOLLOWING FEATURES:

A. Steel strapping coated with nylon

B. One way detent head

C. Acceptable manufacturer and type: Thomas & Betts, Ty-Wraps

3. EXECUTION

3.1 FACTORY HARDWARE/SOFTWARE VALIDATION TEST REQUIREMENTS

A. Connect the programmable logic controller, if provided, to an I/O mimic panel to verify that the hardware is fully operational and that the programming logic is correct in accordance with the associated Sequence of Operation and its Input/Output ladder diagram. Submit a signed document stating all testing requirements passed.

B. I/O mimic panel shall be equipped with the following I/O devices:

1. SPST switches for each binary input
2. Indicating light for each binary output
3. Current generator for each analog input
4. Milliammeter for each analog output.

3.2 INSTALLATION

A. Coordination for installation of instrumentation and controls

1. Contractor shall coordinate instrumentation and controls work with the mechanical equipment suppliers regarding recommendations for proper installation of sensing devices in piping, ductwork, vessels, and the like. Size and select all sensors and

primary signaling devices such as flowmeters, temperature sensors, pressure sensors, thermo-wells, pressure taps and the like. Provide instructions for the proper installation of equipment, such as maintaining proper upstream and downstream straight-run dimensions on piping to receive flowmeters. Size and select all final control elements such as dampers, valves, and the like.

B. Electrical and Electronic

1. Field wiring requirements shall be determined from the installation drawings. Provide all required field power wiring as required by the equipment and as shown on the power distribution diagram on Sheet E-3.

2. Shielded Cables: Identify each cable at each termination using the wire numbers assigned on the installation drawings. Shielded wire shall not be routed in conduit with power or control wiring. Splices will not be allowed.

3. Nonshielded Wires: Identify each wire on both ends of wire at the point of termination using the wire numbers assigned on the installation drawings. Wiring from each terminal at each field mounted device shall be run from the device back to its associated. Splicing of wire will not be allowed. All termination must be made on terminal strips.

C. Support field devices which are not inherently self-supporting using floor stands, pipe brackets, wall brackets, or other suitable devices of stainless steel, aluminum, or both. Do not support devices from vibrating equipment or equipment operating at temperatures outside the limits of the device.

D. All devices shall be readily accessible.

E. Painting: Touch up or repaint completely equipment on which factory paint has been damaged.

3.3 CALIBRATION

A. Flow Instruments

1. Calibrate flowmeters using the manufacturer's primary element substitution standard with applicable readout device. Calibrate at five points, 0, 25, 50, 75 and 100 percent of span.

B. Level Instruments

1. Calibrate differential pressure type transmitters at 25, 50, 75 and 100 percent of span. The calibration shall compensate for missing hydrostatic head of filled seal leg, if applicable. Verify correct elevation or suppression if required for installation.

2. Verify float switch action by manually stroking the float. Check appendage connected to the float arm for freedom of operation.

3. All level instruments not listed above shall be calibrated using the manufacturer's recommended procedure.

C. Pressure Instruments

1. Calibrate pressure transmitters at 25, 50, 75 and 100 percent span.

2. Calibrate pressure switches for appropriate setting. Set switches with variable differential for minimum differential unless specified otherwise.

D. Receiver Instruments (Indicators, Recorders and Controllers)

1. Connect pens to a calibration source. Check calibration at five points: 10, 25, 50, 75

and 100 percent span.

2. Verify the operability of the Chart Drive(s).

3. Calibrate computational devices at five points. Use the manufacturer's instruction manual as a guide for selecting calibration points.

4. Tune controllers to minimize correction time, overshoot, oscillation, offset, and the like.

E. The contractor shall calibrate or adjust all analog or adjustable control devices shown on the instrumentation drawings or described in the sequence of operation.

3.4 CONTROLS AND INSTRUMENTATION TESTS

A. Furnish calibrated testing equipment and competent, experienced testing engineers who shall conduct operating and performance tests for each system specified.

B. Test instruments shall be calibrated prior to tests.

C. Coordinate tests with requirements of other sections of the specifications.

D. Prior to conducting formal tests, operate systems and equipment for at least 7 days.

E. Conduct formal test in presence of the Owner's representative to demonstrate that all contract requirements are met. These tests shall include performance tests for all equipment and operating tests for systems.

1. Site Acceptance Test (S.A.T.): The objective of this test is to demonstrate that the SCADA system is operating and complying with the specified performance requirements.

2. Perform witnessed, site acceptance tests on the complete system. Demonstrate each function to the satisfaction of the Engineer and the Owner. Each test shall be witnessed and signed off by both the Control System Supplier and the Engineer.

3. Notify the Engineer at least four (4) weeks prior to the date of the S.A.T.

4. Malfunction in any tested system or piece of equipment or component part thereof that occurs before, during, or as a result of tests shall be corrected, repaired, and/or replaced at no additional cost and the tests repeated in the presence of the Owner's representative.

5. Further malfunctions shall be similarly repaired and test shall be repeated in the presence of the Owner's representative.

6. The engineer shall attend one on-site 2-Day SAT test at no cost to the contractor. The contractor shall pay for all expenses incurred by the engineer resulting from additional On-Site SAT Tests as required until the SAT Test is complete, witnessed and signed off by both the Control System Supplier and the engineer. Additional expenses per engineer shall include, but not be limited to, travel per diem @ $75.00 per day, $125.00 per hour port-to-port (8-hour day minimum), Automobile Fuel and Hotel expense at cost plus 10%

3.5 RELIABILITY AND ACCEPTANCE TESTS

A. Reliability Acceptance Test: The objective of this test is to demonstrate that the complete SCADA system is capable of operating in a reliable manner.

B. Upon completion of the S.A.T. operate the complete SCADA system continuously during a Reliability Acceptance Test period of not less than 30 days. There shall not be more than 24 hours of downtime of the SCADA system resulting from failure of field instruments, hardware or software.

C. Downtime of the system is defined as any time when the system is not capable of performing its complete specified functions. Examples of downtime are:

1. Failure of a field instrument, RTU, CRT, printer, disk drive or computer.
2. Failure of the system to provide realtime operations, report generation or any background operations.

D. Examples of occurrences that would not constitute downtime are:

1. Primary power failure.
2. Failure of an individual input module, output module or field instrument provided that the faulty module or field instrument is found and replaced within 24 hours. However, if it is necessary to deactivate a component that performs a signal multiplexing function in order to replace the failure module, i.e. a CPU in the PLC, this time shall be counted as downtime.
3. Failure of units whose operation is successfully transferred to a standby unit.

E. If downtime exceeds 24 hours before the 30 day R.A.T. period is completed, terminate the R.A.T. and start a new R.A.T.

F. Conduct the Reliability Acceptance Test with the station in operation.

G. Formally notify the Engineer one week prior to commencement of the Reliability Acceptance Test and receive his approval.

H. Document the test by maintaining a log during the execution of this test. This log shall become the required documentation for this test. The log shall have entries, signed off by both the Control System Supplier and Engineer for the following minimum information:

1. Test start date and time.
2. Date and time of any failure along with diagnosis, remedial action taken, date and time when system was restored and cumulative downtime since start of test.
3. Test completion date and time.

3.6 NAMEPLATES

A. Install a nameplate on front of the panel, beneath each front of panel mounted device unless device has an integral nameplate. Engraving shall be device name on top line(s) followed by P&ID tag number on last line.

B. Install a nameplate on back of panel front, beneath each front of panel mounted device. Engraving shall be P&ID tag number.

C. Install a nameplate on interior subpanel, beneath each inside of panel mounted device. Engraving shall be P&ID tag number.

D. Fasten nameplates with screws or a nonadhesive type fastener.

3.7 BRASS TAGS

A. Install a brass tag on each field mounted device.

B. Stamping shall be device name on top line(s) followed by P&ID tag number on last line.

C. Attach brass tags to associated devices using cable ties.

END OF SECTION

SECTION 26 0500
GENERAL ELECTRICAL PROVISIONS

1. GENERAL

1.1 RELATED DOCUMENTS

A. The Contract Documents apply to this section.

1.2 SUMMARY

A. Provide necessary items for a complete installation of electrically operated equipment specified in specifications or shown on contract drawings.

B. Arrange equipment substantially as shown on the drawings. Make deviations only where necessary to avoid interference. Check equipment size against available space prior to shipment to avoid interference.

C. Material, equipment, and installation shall meet requirements of applicable codes and standards listed below. Electrical material and equipment shall bear the UL label except where UL does not label such types of material and equipment.

D. Reference to standards are referred to by abbreviation as follows:

1.	Certified Ballasts Mfg	CBM
2.	Electrical Testing Lab	ETL
3.	National Fire Protection Association	NFPA
4.	National Electrical Code (NFPA No. 70)	NEC
5.	Underwriters' Laboratories, Inc	UL
6.	National Electrical Manufacturers' Association	NEMA
7.	Institute of Electrical & Electronics Engineers, Inc	IEEE
8.	Insulated Power Cable Engineers Association	IPCEA
9.	National Electrical Safety Code	NESC
10.	Illuminating Engineering Society	IES
11.	Edison Electric Institute	EEI
12.	Electronic Industries Association	EIA
13.	American Concrete Institute	ACI
14.	American National Standards Institute	ANSI
15.	American Society for Testing and Materials	ASTM
16.	Virginia Statewide Building Code	VAS BC
17.	Association of Edison Illuminating Companies	AEIC

1.3 WARRANTY

A. This contractor will replace, without additional charge, any work or material which develops defects, except from ordinary wear and tear, within one year from date of final acceptance and inspection of the completed system and its' components. Extended warranty periods for specific equipment has been indicated in these specifications as required.

1.4 QUALITY ASSURANCE

A. The term "Electrical Contractor" shall mean the firm or corporation with a Class "A"

License who is to provide, furnish, and install a complete electrical system as shown on the drawings and specified herein.

B. Trade names and catalog numbers used in these specifications shall designate quality and characteristics of the equipment and materials that are acceptable. All electrical equipment entering into the fabrication and erection of the work specified shall be in strict accordance with the specifications. Substitutions shall be considered by the Engineer provided the application for such substitution is made in writing giving complete pertinent data and specifications for the equipment offered in respect to the equipment specified. When substitutions are offered, they shall be submitted with a statement indicating the change in contract price, if any involved if the materials or equipment offered were accepted.

C. Legends, notes, schedules, and dimensioned details shown on the drawings shall be carefully followed. All electrical equipment shall be installed so as not to interfere with the work of other trades. Electrical Contractor shall cooperate with the General Contractor and other subcontractors in advance of the construction to correlate the work and avoid interference with work of other trades. Where electrical work is installed that interferes with the work of other trades without notice to the General Contractor of such interference, the Electrical Contractor shall, at his own expense, reinstall or alter same including damage to the work of other trades, in compliance with the general intent of the drawings and these specifications.

D. Electrical drawings as presented are diagrammatic only and are intended to show the approximate location of the electrical work as related to the structure unless specifically dimensioned. The correct location and relation to the electrical work to the structure when required shall be defined by reference to the working drawings, or to be determined by actual field requirements. Electrical Contractor shall maintain a record of field changes and shall furnish the Engineer with "RECORD" wiring diagrams to show any change from the Engineer's original design. Record drawings shall indicate circuit-numbering system for control and instrumentation wiring.

E. All electrical work, equipment, and materials provided under this contract shall be in strict accordance with the requirements of the applicable regulations of the Virginia Uniform Statewide Building Code, National Electrical Code and the wiring rules and requirements of Virginia Power Company. The Electrical Contractor shall obtain all permits required and pay the fees so levied and file a certificate of inspection by the proper authorities having jurisdiction with the Engineer. The electrical subcontractor shall pay for all temporary power used during the course of construction. All charges for electrical energy passing through the owner's electrical service connection prior to placing the system in operation shall be at the contractor's expense.

F. The Electrical Contractor shall use all new materials unless otherwise noted. Contractor shall comply with accepted industry standards. All fixtures and equipment shall be Underwriters' Laboratories tested, rated, and so labeled. All work shall be executed in a workmanlike manner so as to present a neat appearance. (See NECA manual "Standard of Installation" for approved methods and workmanship.) All equipment shall be left complete and in good operating order. All of the Electrical Systems shall be installed by trained mechanics who are certified in their respective trades under the supervision of an Electrical Contractor licensed to install the work in its entirety as covered by the drawings and these specifications.

2. PRODUCTS

2.1 MATERIALS

A. Nameplates

1. General: Furnish and mount on each panelboard, starter, safety switch, remote control, push-button station, and all similar controls, a nameplate descriptive of the equipment or equipment controlled. Submit complete list of nameplates with wording and location.

2. Constructed from black background phenolic material laminated with a clear main front core to provide for reverse engraving. Reverse engraved letters shall be 3/8-inch high minimum and paint filled white. Mounting holes at each end to accept stainless steel screws and an adhesive type fastener.

B. Supporting Material

1. Complete with hangers, connectors, bolts, clamps, and necessary accessories to make a complete installation. Supporting material shall be galvanized, painted, or otherwise suitably finished for the installed environment.

C. Electrical Cabinetry

1. Furnished with provisions for front access only unless otherwise noted.

3. EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in the manufacturer's packaging or crate.

B. Store materials off ground and under cover to prevent damage, deterioration, or contamination.

C. Promptly remove from the site any materials which show evidence of damage, deterioration, or contamination.

3.2 INSTALLATION

A. Testing and placing in Service:

1. Furnish all necessary instruments and equipment and provide testing to confirm proper operation of electrical systems and equipment. Submit four copies of test results.

2. Test results shall include: service voltage at no load, service voltage at maximum load, voltage drop when largest motor is started, maximum load on each feeder, total service maximum load, ground resistance of main service ground.

3. Instruct Owner's personnel in proper operation and maintenance of equipment.

B. Provide equipment connections complete with motor controls, switches, wiring devices, control devices, protective devices, wiring, and other accessories. All equipment and connections shall be as recommended by the manufacturer or as indicated on drawings and specified in specifications.

C. Equipment connections for equipment furnished by the Owner or under separate contract shall be complete as specified in the above paragraph. Refer to other sections of these

specifications and drawings for definition of extent of electrical switchgear, equipment, materials, and wiring to be provided by the respective sub-contractors.

D. Install control and alarm wiring for all equipment, mechanical and electrical, in accordance with Division 16 specification sections. Before installing control circuits, ensure that controls and wiring diagrams are in accordance with those furnished with the equipment. Make any changes required due to the different equipment, more up-to-date controls, or safety devices, so that the equipment operates as required and specified. Control voltage shall not exceed 132 volts unless indicated otherwise on the drawings.

E. When equipment is supplied with electrical requirements other than those specified or shown on the drawings, associated electrical devices and circuitry of the correct sizes and ratings shall be provided.

3.3 CLEAN UP

A. Remove all labels, shipping documents, wrapping materials, etc., where they are not a part of the finished installation. Nameplates are to be cleaned and left in a legible condition. All finger marks, surplus wire-pulling compound, sealers, and construction debris are to be removed from the surface.

B. Tool marks and scratches will be touched-up by painting. However, excessive amounts of touch-up will warrant painting of the entire surface by a qualified contractor with the cost of painting to be borne by the electrical contract.

END OF SECTION

SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1. GENERAL

1.1 RELATED DOCUMENTS

A. The contract documents apply to this section.

B. Provide grounding in accordance with NEC as a minimum. Additional grounding requirements shall be as specified or indicated on Contract Drawings.

C. Ground rods shall be provided for each building on the site. Ground rods for the various buildings shall be connected to each other, with grounding conductors indicated on the riser diagrams, to form a grounding grid. Where no conductor size is indicated, a #2/0 conductor shall be provided.

1.2 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services and although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a complete installation.

B. Complete grounding system shall be provided for the system conduit work, frames of all electrical equipment, etc., in accordance with Article 250 of the National Electrical Code.

1.3 SUBMITTALS

A. The Contractor shall submit all submittal data in a timely manner in accordance with the approved submittals schedule.

B. Manufacturer’s Data

1. Submit data on each type of device to be installed.

2. Submittals for each manufactured item shall be Manufacturer's descriptive literature (equipment specification), equipment drawings, diagrams, performance and characteristic curves and catalog cuts. The submittal shall include the Manufacturer's name, trade name, catalog model or number, nameplate data, dimensions, physical layout, capacity, specification reference and all other information necessary to establish contract compliance.

1.4 WARRANTY

A. Each type of device covered under this section to be used for this project shall be installed according to the manufacturer’s installation instructions and recommendations in order to maintain the manufacturer’s complete warranty.

2. PRODUCTS

2.1 MATERIALS

A. Ground rods shall be copper clad steel, 10' in length and ¾" in diameter.

B. Contractor may, at his option, propose grounding electrodes other than ground rods but such electrodes shall be subject to review and approval by the engineer.

C. Proposed plate electrodes shall include a minimum of two plates on 16 foot centers encased in Harger “Ultrafill” or Erico “GEM” (Grounded Enhancement Material). Proposed ground rings shall include a minimum of 100 feet of #2/0 bare copper conductor encased in “Ultrafill” or “GEM” and all points shall be exothermically welded as specified for ground connections.

D. Grounding electrode conductors shall be bare copper sized in accordance with NEC Table 250-94, as a minimum. Larger size conductors indicated on the Contract Drawings shall be used.

E. Equipment grounding conductors in raceways shall be copper with green insulation, sized in accordance with NEC 250-95 as a minimum. Larger size conductors indicated on the Contract Drawings shall be used where shown. Bare copper grounding conductors will be acceptable in underground outside raceways.

F. Ground connections shall be exothermic type weld at point of connection to grounding electrode, when direct buried and/or for service equipment. Weld shall be Harger "Ultraweld" or Erico "Cadweld." Personnel performing the welding operation shall be certified by the welding material manufacturer and shall give the Owner's representative twenty-four (24) hours notice prior to welding activity.

G. Unless specifically noted otherwise, use No. 4/0 AWG bare copper (minimum) for ground grid and for connecting ground rodsComplete with hangers, connectors, bolts, clamps, and necessary accessories to make a complete installation. Supporting material shall be galvanized, painted, or otherwise suitably finished for the installed environment.

3. EXECUTION

3.1 INSTALLATION

A. Install equipment grounding conductors in all raceways containing conductors having 100 volts or more to ground.

B. Grounding electrodes shall have a resistance to ground of 10 ohms or less when measured with a Biddle "Ground Megger" or an AEMC "3 Point Ground Resistance Tester", and using the "Fall of Potential" method of testing. Test shall be conducted prior to connection of service equipment. Results of ground resistance tests shall be submitted to the Engineer for approval prior to final acceptance of the facility.

C. Grounding electrode conductors shall be installed from system ground bus to ground rods with no slack, coiled or uncoiled.

D. If earth resistance of the service grounding electrode is more than required, install up to a maximum of five additional ground rods a minimum of 16' from each other to obtain a value as close to 10 ohms as practical. Ground rods shall be bonded to each other with a #4/0 copper conductor minimum.

E. Install a green grounding conductor between main telephone cabinet and grounding system, sized as required by the telephone company.

F. Ground each outside lighting standard with one ground rod.

G. Ground all equipment racks and electrical enclosures.

H. Ground oil tank and associated metal parts with one ground rod.

I. Grounding Fence Enclosures:

1. Ground fence enclosures at diagonally opposite corners and at 500 ft. maximum intervals.

2. Where an electric utility line rated 65 KV or greater passes over the fence, fence shall be grounded 50 ft., measured horizontally, beyond the outside conductors of the line.

3. Where an electric utility line rated 65 KV or greater runs parallel to and within 40 ft. of the fence, measured horizontally, fence shall be grounded at 50 ft. maximum intervals along the parallel section of fence.
4. Fence post grounding shall consist of three ¼″ diameter, cadmium plated, plus gold chromated steel U-bolts and nuts installed at the top, middle and bottom of the post. A cast bronze clamp on each U-bolt shall permit connection of the grounding conductor.
5. Fence grounding shall consist of conductors secured to the fence with compression connectors.
6. Ground rods shall be 10′ x ¾″ with a 6″ projection. Provide ground rod at each grounding point located on post side of fence as close as possible to post and fence. Ground rods shall have a resistance to ground of 25 ohms or less.
7. Grounding conductors shall be #4 AWG copper and shall be cad welded to the ground rod.
8. Provide flexible copper bonding jumper between fixed fencing and moveable elements such as gates.

J. Connect instrumentation panels to equipment grounding system.

K. Install ground grid conductors and ground rod tops a minimum of 30" below finished grade.

END OF SECTION

SECTION 26 0543
UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

1. GENERAL – NOT USED

2. PRODUCTS

2.1 Underground ducts shall be rigid steel or PVC conduit as specified in Section 26 27 26.

2.2 Concrete shall be at least 3000 psi at 28 days.

3. EXECUTION

3.1 The arrangement and encasement of the ducts shall be as indicated on the Contract Drawings.

3.2 Duct lines shall be laid to a minimum grade of 4" per 100'. Grade may be from one manhole to the next or both ways from a high point between manholes, depending on the contour of the finished grade.

3.3 Top of concrete encasement of duct lines shall not be less than 18" below grade.

3.4 Top of un-encased duct lines shall be not less than 30" below finished grade.

3.5 Changes in direction of runs exceeding a total of 10°, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25', except that manufactured bends may be used at the ends of the run.

3.6 Conduit shall be thoroughly cleaned before using or laying. During construction and after the duct line is completed, the ends of the conduits shall be plugged. Care shall be taken to keep conduits clean of concrete, dirt, and any other substance.

3.7 Conduit joints in concrete encasement may be placed side by side horizontally but shall be staggered at least 6" vertically.

3.8 Joints shall be made in accordance with manufacturer's recommendations for the conduits. Joints shall be made watertight.

3.9 Base and intermediate spacers and tie downs shall be used in sufficient numbers to maintain conduit spacing.

END OF SECTION

SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

1. GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install identification for electrical apparatus and electrical Work.

B. Related Sections:

1.2 QUALITY ASSURANCE

A. Regulatory Requirements:

1. NEC Article 110, Requirements for Electrical Installation.
2. NEC Article 210, Branch Circuits.
3. NEC Article 215, Feeders.
4. NEC Article 504, Intrinsically Safe Systems.
5. NEC Article 700, Emergency Systems.
6. NEC Article 701, Legally Required Standby Systems.
7. NEC Article 702, Optional Standby Systems.
8. 40 CFR 1910.145 (OSHA) – Specification for Accident Prevention Signs and Tags.
9. NFPA 70E, Electrical Safety in the Workplace.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings: Submit the following:

a) Complete description and listing of proposed electrical identification and electrical identification devices for associated equipment or systems.

b) Conduit and wire identification numbering system and equipment signage.

2. Product Data:

a) Manufacturer’s literature, cut sheets, specifications, dimensions and technical data for all products proposed under this Section.

2. PRODUCTS

2.1 Manufactured Units

A. Engraved Identification Devices (Nameplates and Legend Plates):

1. Nameplates:

a) Laminated thermoset plastic, 1/16-inch thick, engraved condensed block black lettering on white background, square corners, and beveled front edges, or match existing.

b) Size: As required.

c) Letter Size: Minimum 3/16-inch.

d) Nameplates one-inch or less in height shall have one mounting hole at each end. Nameplates greater than one-inch in height shall have mounting holes in the four corners.

2. Legend Plates:

a) Legend plates for pushbuttons, pilot lights, selector switches, and other panel-mounted devices shall be large size with dimensions of approximately 2-7/16 inches wide by 2-13/32 inches tall (Allen Bradley large automotive size), plastic, custom engraved with black letters on white background.

i. Provide standard-size legend plates where devices are mounted on motor control centers and spacing of devices precludes using automotive-size legend plates.

ii. Lettering size and line weight shall be the same for all legend plates on the same panel or enclosure. Maximum size shall be 1/4-inch and minimum size shall be 1/8-inch.

B. Safety Signs and Voltage Markers:

1. Provide high voltage signs for equipment operating over 600 volts.

2. Unless otherwise shown or indicated, high voltage safety signs shall be a minimum of 10 inches high by 14 inches wide, of fiberglass reinforced plastic, and conform to 40 CFR 1910.145. Signs shall resist fading from exposure to temperature extremes, ultraviolet light, abrasive, and corrosive environments, and shall read, "DANGER – HIGH VOLTAGE – KEEP OUT".

a) Mounting hardware shall be Type 316 stainless steel.

b) Products and Manufacturers: Provide one of the following:

i. B-120-45471 by Brady.

ii. Or equal.

3. High voltage safety signs for installation on indoor equipment shall be either pressure-sensitive acrylic or vinyl, and shall be at least 10 inches high by 14 inches wide, conform 40 CFR 1910.145, and shall read, "DANGER – HIGH VOLTAGE – KEEP OUT".

a) Products and Manufacturers: Provide one of the following:

i. B-302-84084 by Brady.

ii. Or equal.

4. Cable tray safety signs shall be pressure-sensitive vinyl conforming to 40 CFR 1910.145, 5 inches by 3.5 inches in size, and shall read, "DANGER – HIGH VOLTAGE".

a) Products and Manufacturers: Provide one of the following:

i. B-302-86139 by Brady.

ii. Or equal.

5. Low voltage safety signs shall be pressure-sensitive vinyl conforming to 40 CFR 1910.145, five inches by 3.5 inches in size, and shall read, "DANGER – 480

VOLTS".

a) Products and Manufacturers: Provide one of the following:

i. B-302-86060 by Brady.

ii. Or equal.

6. Low voltage markers shall be either pressure-sensitive vinyl or vinyl cloth with black lettering on orange background and shall read, "120 VOLTS", "208 VOLTS", "120/208 VOLTS", or "240 VOLTS" as required.

a) Products and Manufacturers: Provide one of the following:

i. CV442xx by Brady.

ii. Or equal.

C. Arc-flash Safety Signs:

1. Warning signs shall be adhesive-backed polyester.

2. Warning signs shall read, "Warning – Arc Flash and Shock Hazard. Appropriate PPE Required. Arc flash warning signs shall also include the additional information in accordance with NFPA-70E.

3. Products and Manufacturers: Provide one of the following.

a) 94914 by Brady.

b) Or equal.

D. Voltage System Identification Directories:

1. General:

a) Directories shall be laminated thermoset plastic, 1/16-inch thick, engraved block black letters on white background, square corners, and beveled front edges.

b) Directories shall identify all voltage systems within building or structure.

c) Directories shall list the colors that identify ungrounded and grounded conductors of each system.

d) Colors shall be in accordance with Section 16122, 600 Volt Cable, and Section 16123, Medium Voltage Cable.

e) Example Directory Text:

Voltage System Identification		
System	A, B, C	Neutral
277/480	Brown, Orange, Yellow	Gray
120/208	Black, Blue, Red	White

2. Large directories for rooms shall have a minimum text height of 1/2-inch.

3. Small directories for equipment shall have a minimum text height of 1/4-inch.

E. Conduit Labels:

1. Products and Manufacturers: Provide one of the following:

a) B-915-xxxxx by Brady.

b) Or equal.

2. Shall be pre-tensioned acrylic/vinyl construction coiled to completely encircle conduit for conduit up through five-inch diameter, or pre-molded to conform to circumference of conduit six-inch diameter and larger.

3. Attach strap-on style for six-inch diameter conduit with stainless steel springs.

4. Shall be blank for use with custom printed labels.

5. Custom Labels:

a) Shall have black lettering on yellow background.

b) Shall not contain abbreviations in legend.

c) Shall be custom printed on continuous tape with permanent adhesive using thermal printer specified below.

F. Wire Identification:

1. Heat Shrinkable Wire and Cable Labeling System:

a) White heat-shrinkable irradiated polyolefin shrink-on sleeves. Labels shall be thermal printed. Labels shall be at least two inches wide.

b) Products and Manufacturers: Provide one of the following:

i. B-341 PS-xxx-2W by Brady.

ii. Or equal.

2. Wrap-Around Wire and Cable Labeling System:

a) Self-laminating white/transparent self extinguishing vinyl strips. Length shall be sufficient to provide at least 2.5 wraps. Labels shall be thermally printed and at least two inches wide.

b) Products and Manufacturers: Provide one of the following:

i. THT-XX-427 by Brady.

ii. Or equal.

G. Detectable Underground Warning Tape:

1. Material: Polyethylene or polyester with detectable metal core and polyester underlaminate.

2. Width: Two inches.

3. Color and Labeling: Yellow or red with permanently imprinted black letters: “CAUTION – Buried Electric Line”, repeated continuously over full length of tape.

4. Products and Manufacturers: Provide one of the following:

a) Indentoline by Brady.

b) Or equal.

H. Thermal Printing System:

1. Utilize thermal transfer process to provide non-smearing labels and markers.

2. Wire and Cable Markers:
    a) Portable, Products and Manufacturers: Provide one of the following:
        i. TLS2200 by Brady.
        ii. Or equal.
    b) Desktop, Products and Manufacturers: Provide one of the following:
        i. 200M by Brady.
        ii. Or equal
3. Cable Markers:
    a) Portable, Products and Manufacturers: Provide one of the following:
        i. Handimark by Brady.
        ii. Or equal.
    b) Desktop, Products and Manufacturers: Provide one of the following:
        i. Labelizer PLUS by Brady.
        ii. Or equal.

I. Stand-by-Pump Station Warning Signs:
1. Warning signs shall be labeled in accordance with NEC Article 700, NEC Article 701, or NEC Article 702.
2. Material, Colors, Letters: Plastic with white letters on a red background. Letters shall be minimum height of 3/8 inch.
3. Attachment: Use stainless steel self-tapping screws.

2.2 FABRICATION

A. Engraved Identification Devices (Nameplates and Legend Plates):
1. Nameplate and legend plate text is preliminary and subject to change pending final review and approval of nomenclature by ENGINEER after start-up and testing.

3. EXECUTION

3.1 INSTALLATION

A. Provide electrical identification in accordance with manufacturer recommendations and as required for proper identification of equipment and materials.

B. Engraved Identification Devices (Nameplates and Legend Plates):
1. Unless otherwise specified, attach permanent nameplates with permanent adhesive and with 3/16-inch diameter, round head, stainless steel machine screws into drilled and tapped holes.
2. Provide nameplate with 1.5-inch letters to identify each console, cabinet, panel, or enclosure as shown or indicated.
3. Provide nameplates for field-mounted motor starters, disconnect switches, manual starter switches, pushbutton stations, and similar equipment operating components,

which shall describe motor or equipment function and circuit number.

4. Provide nameplates with 1/2-inch letters to identify each junction and terminal box shown or indicated.
5. On switchgear, provide nameplates for each main and feeder circuit including control fuses, and for each indicating light and instrument.
    a) Provide nameplate with 1.5-inch letters giving switchgear designation, voltage rating, ampere rating, short circuit rating, manufacturer's name, general order number, and item number.
    b) Identify individual door for each compartment with nameplate giving item designation and circuit number.
6. Motor Control Centers:
    a) Provide nameplate with 1.5-inch letters with motor control center designation.
    b) Identify individual door for each unit compartment with nameplate identifying controlled equipment.
7. Except conduit, all electrical appurtenances including lighting panels, convenience outlets, fixtures, and lighting switches, shall be provided with nameplates indicating appropriate circuit breaker number(s).
8. Push Buttons:
    a) Provide legend plates for identification of functions.
    b) Provide nameplates for identification of controlled equipment.
    c) Provide red buttons for stop function.
    d) Provide black buttons for other functions.
9. Pilot Lights:
    a) Provide legend plates for identification of functions.
    b) Provide nameplates for identification of controlled equipment.
    c) Shall have lens colors as shown or indicated. Where no color is indicated, provide the following lens colors:

Color	Legend
Green	Running, Open
Red	Stopped, Closed
Amber	Alarm
Blue	Power
White	Status

10. Selector Switches:
    a) Provide legend plates for identification of functions.
    b) Provide nameplates for identification of controlled equipment.
11. Panel Mounted Instruments:

a) Provide nameplates for identification of function.

12. Interiors of Cabinets, Consoles, Panels, Terminal Boxes, and Other Enclosures:

a) Provide nameplates for identification.

b) Provide each item inside cabinet, console, panel, terminal box, or enclosure with laminated plastic nameplate as shown on approved Shop Drawings and submittals. Install nameplates with adhesive.

c) Interior items requiring nameplates include.

i. Terminal blocks and strips.

ii. Bus bars.

iii. Relays.

iv. Rear of face-mounted items.

v. Rear of door-mounted items.

vi. Interior mounted items that require identification when mounted externally.

d) Circuit Breaker Directory:

i. Provide engraved laminated plastic directory listing function and load controlled for each circuit breaker within panel used for power distribution.

13. Re-label existing equipment whose designation have changed.

C. Safety Signs and Voltage Markers:

1. Provide safety signs and voltage markers on and around electrical equipment as shown or indicated.

a) Install rigid safety signs using stainless steel fasteners.

b) Clean surfaces before applying pressure-sensitive signs and markers.

2. Install high voltage safety signs on all equipment doors providing access to uninsulated conductors, including terminal devices, greater than 600 volts.

3. Provide cable tray safety signs on both sides of cable trays at maximum intervals of 20 feet. Install signs on side rails of tray as acceptable to ENGINEER.

a) Label cable trays that contain conductors greater than 600 volts with cable tray safety signs.

b) Cable trays that contain conductors greater than 208 volts and less than 600 volts shall be labeled with low voltage safety signs.

c) Cable trays that contain conductors of 120/208 volts shall be labeled with low voltage markers.

d) Do not label cable trays that contain only instrument signal cables.

e) Label cable trays that contain intrinsically safe wiring or cables in accordance with NEC Article 504.

4. Install low voltage safety signs on equipment doors that provide access to uninsulated 480-volt conductors, including terminal devices.

5. Install low voltage markers on each terminal box, safety disconnect switch, and

panelboard installed, modified, or relocated as part of the Work and containing 120/208 volt conductors.

D. Voltage System Identification Directories

1. Provide voltage system identification directories as required by NEC Article 210 and NEC Article 215.
2. Provide in each electrical room voltage system identification directory mounted on wall or door at each entrance to room.
3. For panelboards, switchboards, motor control centers, and other branch circuit or feeder distribution equipment that are not located in electrical rooms, provide voltage system identification directory mounted on equipment.
    a) Directories shall be affixed using epoxy glue. Screws or bolts shall not penetrate equipment enclosures.
    b) Directories shall be readily visible and not obscure labels and other markings on equipment.

E. Arc-flash Safety Signs:

1. Provide arc-flash safety signs as required by NEC Article 110.
2. Provide signs for switchboards, panelboards, motor control centers, and industrial control panels. Provide signs for control panels that contain 480 volt equipment.

F. Conduit Labels:

1. Provide conduits with conduit labels unless otherwise shown or indicated.
2. Do not label flexible conduit.
3. Do not label exposed single conduit runs of less than 25 feet between local disconnect switches and their associated equipment.
4. Conduit labels shall indicate the following information:
    a) Contract Number: Alphanumeric, three or four digits, as applicable.
    b) Conduit Number: Alphanumeric as shown on the Drawings, as assigned by CONTRACTOR for unlabeled conduits, and in accordance with approved submittals.
5. Conduits that contain intrinsically safe wiring shall have an additional pipe marker provided that has blue letters on white background and reads, “INTRINSICALLY SAFE WIRING”.
    a) Install intrinsically safe pipe markers in accordance with NEC Article 504 along entire installation. Spacing between labels shall not exceed 25 feet.
6. Provide conduit labels at the following locations:
    a) Where each conduit enters and exits walls, ceilings, floors, or slabs.
    b) Where conduit enters or exits boxes, cabinets, consoles, panels, or enclosures, except pull boxes and conduit bodies used for pull boxes.
    c) At maximum intervals of 50 feet along length of conduit.
7. Orient conduit labels to be readable.

G. Wire and Cable Identifications:

1. Color-coding of insulated conductors shall comply with Section 16122, 600 Volt Cable, and Section 16123, Medium Voltage Cable.
2. Use heat-shrinkable wire labels where wire or cable is terminated. Use wrap-around labels where wire or cable is to be labeled but is not terminated.
3. Do not provide labels for the following:
    a) Bare (uninsulated) conductors, unless otherwise shown or indicated as labeled.
4. Provide wire and cable labels for the following:
    a) New, rerouted, or revised wire or cable.
    b) Insulated conductors.
    c) Wire and cable terminations:
        i. Wire labels shall be applied between 1/2-inch and one inch of completed termination
        ii. Apply cable labels between 1/2-inch and one inch of cable breakout into individual conductors.
            a. Label individual conductors in a cable after breakout as specified for wires.
    d) Wire or cable existing cabinets, consoles, panels, terminal boxes, and enclosures.
        i. Label wires or cables within two inches of entrance to conduit.
    e) Wire or cable in junction boxes and pull boxes.
        i. Label wires or cables within two inches of entrance to conduit.
    f) Wire and cable installed in cable tray.
        i. Wire and cable shall have labels at maximum intervals of 20 feet.
    g) Wire and cable installed without termination in electrical manholes.
        i. Wire and cable shall have wrap-around labels applied within one foot of exiting manhole.
5. Wire and Cable Identification Systems:
    a) Wire and cable labels shall be imprinted with an identifying designator.
        i. Wire and cable extending between two devices or items and that does not undergo a change of function shall be identified by a single unique designator as specified below.
    b) Field Wiring:
        i. Wire of cable designator shall consist of:
            a. Three left-most characters shall consist of the Contract number under which wiring or cable was installed.
            b. Fourth character from the left shall be an asterisk (*), a plus sign (+) or a hyphen (-). Do not use other punctuation symbols in a wire designator.
            c. Remaining characters shall be alphanumeric and make wire designator

unique.

d. Numbering shall reflect actual designations used in the Work and shall be documented in record documents.

c) Cabinet, Console, Panel, and Enclosure Wiring, Internal:

i. New Cabinets, Consoles, Panels, and Enclosures:

a. Wire and cable inside cabinets, consoles, panels, and enclosures shall have designators as specified in Section 13401, Plant Monitoring and Control System General Requirements.

6. Modified Cabinets, Consoles, Panels, and Enclosures:

a) New or rerouted wire or cable in existing cabinets, consoles, panels, and enclosures shall be labeled as shown on the Drawings or be assigned a ten-character designator equivalent to field wire designator.

H. Terminal Strip Labeling:

1. Label panel side of terminal to match panel wire number.

2. Label field side of terminal to match field wire number. Terminal number shall not include the Contract number.

END OF SECTION

SECTION 262726
BASIC MATERIALS AND METHODS

1. GENERAL

1.1 Wire and Cable

A. Conductor sizes are based on copper unless otherwise indicated on Contract Drawings.

B. Two or three single phase circuits may be installed in one conduit using conductors of different phases and a common neutral, except where ground fault breakers are applied for circuit protection.

C. Conductor coding

1. Color code insulated grounding conductors in accordance with NEC 210-5.

2. Color code current carrying conductors, except control and instrumentation conductors.
   a) Conductors No. 10 and smaller shall have continuous insulation color.
   b) Color code conductors larger than No. 10 which do not have continuous insulation color by application of at least two laps of colored tape on each conductor at all points of access.

3. Number code all wiring, provided under this Contract, at all points of access.

1.2 Motors will be furnished as part of the equipment which they drive.

1.3 Panelboards shall be handled, stored and installed in accordance with manufacturers' instructions and with NEMA Pub PB2.1-1991.

2. PRODUCTS

2.1 Raceways

A. Rigid Steel Conduit: Low carbon, hot-dipped galvanized inside, outside, and threaded ends. Conduit shall conform to ANSI Standard C80.1 and UL Standard #6 and shall be 3/4" minimum size. Couplings, elbows and nipples shall be of the same classification as conduit. Conduit and accessories shall be Wheatland or approved equal. Use galvanized rigid steel conduit in all exposed and outdoor locations. Use PVC coated rigid steel conduit in all hazardous and/or corrosive locations and below grade unless otherwise indicated. PVC coated rigid steel conduit, elbows and riser sections shall be used to transition from underground raceways to a point 12" above grade or to the inside face of a structure, where the structure is below grade.

B. PVC Coated Rigid Steel Conduit: Rigid steel conduit, specified hereinbefore, shall have an exterior PVC coating with a nominal thickness of 40 mils and an interior coating of 2 part blue urethane chemically cured with a nominal thickness of 2 mils. Coatings shall also be applied to associated fittings. Coated conduit shall conform to NEMA Standard No. RN-1-1989. Installation of coated conduit shall conform to Ocal Installation Manual. PVC coated elbows and riser sections shall be used to transition from underground raceways to a point 12" above grade or to the inside face of a structure, where the structure is below grade.

C. Intermediate Metal Conduit: Low carbon, hot dipped galvanized inside and outside, with threaded ends, minimum size 3/4". May be used above grade in non-hazardous or corrosive locations. Threaded fittings: Cast iron or alloy steel, galvanized.

D. Flexible Metal Conduit: Galvanized, single strip.

E. Liquid-tight Flexible Metal Conduit: UL rated Alflex type UL or Sealtite type U.A. by Anaconda. Fittings shall be OZ/Gedney Type 4QLT or T & B equivalent.

F. Electrical Surface Metal Raceways: Wiremold or walker duct painted steel, totally enclosed, snap cover systems. Include all fittings, elbows, connectors, covers, grounding devices, boxes, and extensions. Use surface metal raceways only where specifically indicated on Contract Drawings.

G. Polyvinyl Chloride Conduit: Schedule 80, Carlon Plus 80, 90°C, UL rated or approved equal. Minimum size conduit shall be ¾ inch. Material shall comply to NEMA Specification TC-2 (Conduit), TC-3 (Schedule 40 Fittings-UL-514), and UL-651 (Standard for rigid nonmetallic conduit). Conduit shall be made from polyvinyl chloride C-300 compound which includes inert modifiers to improve weatherability and heat distortion. Clean rework material, generated by the manufacturer's own conduit production, may be used by the same manufacturer, provided the end products meet the requirements of this specification. Conduit fittings and cement shall be produced by the same manufacturer to assure system integrity. Conduit and fittings shall be tested in accordance with the testing requirements defined in NEMA TC-3, UL-651 and UL-514 (fittings). The acceptance criteria shall be as given in the same standards. All conduit and fittings shall be solvent cemented in applications in accordance with instructions from the manufacturer. PVC conduit may be used for underground feeder and underground branch circuits (this does not include instrumentation and annunciator wiring). PVC coated rigid steel conduit elbows and riser sections shall be used to transition from underground raceways to a point 12" above grade or to the inside face of a structure where the structure is below grade.

H. Expansion Joint Fittings: OZ/Gedney Type AX or Appleton type XJB, watertight, permitting two-way movement up to 4", equipped with bonding jumpers around or through each fitting.

I. Expansion/Deflection Fittings: Crouse-Hinds type XD or OZ/Gedney Type DX watertight fittings with integral bonding jumper for rigid metal conduit permitting movement up to 3/4" in any direction and angular deflection up to 30° from normal in all directions.

J. Sealing Fittings or Bushings: OZ/Gedney Series EY, EZS, EYD, Crouse-Hinds series EYS, EYD or EZS or equal by Appleton.

K. Thruwall Sealing Fittings: OZ Type WSK (Type CSM for existing structures) and/or Type CSBI/SEG shall be provided for all raceway and conductor systems entering or leaving a building below grade.

L. Fire-Seal Fittings: Type CFSI by O.Z. Gedney Company.

M. Insulated Bushings: Type BLG or SBT, as applicable, by O-Z or Series B1900 or Series TC700, as applicable, by Steel City.

N. Wireway: Provide 14 gage minimum steel wiring troughs with 16 gage minimum covers, rectangular in shape, totally enclosed with hinged cover, or cover fastened with screws. Indoors, wireway shall be NEMA 1 and outdoors NEMA 3R unless indicated otherwise on Drawings. The wireway shall include all necessary accessories and fittings to make a complete installation. Wireway and accessories shall be as manufactured by the Square D Company or Hoffman Engineering Company.

1. Finish shall be baked enamel of manufacturer's standard color unless specifically noted otherwise.

O. Pulling in Wire: Provide No. 14 galvanized iron or 5/32" polyethylene rope with 3' of slack at each end, in all empty conduits.

P. Thread lubricant/sealant shall be applied to all screw thread joints in raceway and outlet box systems and shall be Crouse-Hinds type HTL.

2.2 Wire and Cable

A. Power and Control Conductors by Southwire/Senator or Aetna Insulated Wire, of the types as follows:

1. Underground and/or outdoor conductors shall be type XHHW or "USE" insulated and rated for 600 volts unless otherwise indicated. Direct burial cable shall be jacketed. Insulation shall comply with UL 44 for Type XHHW-2, ICEA S-66-524 and NEMA WC-7.

2. Overhead service cable shall be self-supporting, polyethylene insulated, stranded aluminum, rated for 600 volts unless otherwise indicated on Contract Drawings.

3. Conductors inside buildings shall have moisture resistant, flame retarding, thermoplastic insulation with nylon jacket, type THHN/THWN, rated for 600 volts unless otherwise indicated. Insulation shall comply with UL 83.

4. Conductors for variable frequency drives, where noted, shall be Armor-X type MC-HL multi conductor cable and shall consist of:
   a) 600V XHHW phase conductors
   b) Three bare grounding conductors
   c) Continuous corrugated aluminum sheathed armor
   d) Overall polymeric jacket
   e) MC-HL cables shall be manufactured and tested in accordance with the latest revisions of ICEA S-66-524/NEMA WC7, ICEA S-58-679, UL 1569 Type MC and UL 2225 Type MC-HL.

5. Conductors shall be soft annealed copper unless specifically indicated otherwise. Conductors shall meet requirements of ASTM B-3 and ASTM B-8 or B-496.

6. Conductors No. 6 and larger may be soft annealed copper or aluminum alloy compact stranded AA-8000 series alloy as recognized by NEC 310-14. Insulation shall be type THHN/THWN or cross-linked polyethylene Type XHHW. Connectors and terminations installed with aluminum-alloy conductors shall be UL listed Standard 486-B and marked "AL7CU" for 75° C rated circuits and "AL9CU" for 90° C circuits.

7. Provide No. 12 conductors, minimum unless otherwise indicated on Contract Drawings.
   a) Control conductors shall be No. 14 minimum for NEC Class I and No. 16 for NEC Class II unless otherwise indicated on Contract Drawings.

8. Conductors No. 8 AWG and larger shall be stranded.

9. Conductor size noted on homerun symbol (on drawings) shall continue throughout length of circuit.

10. Flexible cable shall be heavy duty cord type "SO" with equipment ground

conductor in addition to current carrying conductors. Cable shall comply with UL 62, ICEA S-19-81 and NEMA WC-3 standards.

B. Instrumentation, signal and/or annunciator cables shall be equal to Belden "Instrumentation Cable – 600V Tray Cable" rated 90°C of the types as follows:

1. Single pair cable
   a) Conductors shall be No. 16 AWG minimum 7 strand soft annealed copper.
   b) Conductor insulation shall be 600 volt PVC/Nylon.
   c) Conductors shall be twisted in pairs.
   d) Pairs shall be individually shielded with aluminum foil – polyester tape that provides 100% coverage. Each shield shall include an 18awg drain wire.
   e) Pairs shall have flame-retardant PVC moisture resistant, sunlight resistant jacket rated 90°C.
2. Cables shall be approved for direct burial applications. Cables shall meet requirements of ICEA S-73-532 and UL1277.
3. Multiple-pair cable shall have single pair cables as above with outer shield and jacket as above.
4. Triad cable
   a) Conductors shall be No. 16 AWG minimum 7 strand soft annealed copper.
   b) Conductor insulation shall be 600 volt PVC/Nylon.
   c) Conductors shall be twisted in triads.
   d) Triads shall be individually shielded with aluminum foil – polyester tape that provides 100% coverage. Each shield shall include an 18 ga. drain wire.
   e) Triads shall have flame-retardant PVC moisture resistant, sunlight resistant jacket rated 90°C.
   f) Cables shall be approved for direct burial applications. Cables shall meet requirements of ICEA S-66-524, NEMA WC-7 and UL1277.
5. Multiple triad cables shall have single triad cables as above with overall jacket as above.
6. Multiple conductor cables
   a) Conductors shall be No. 16 AWG minimum 7 strand soft annealed copper.
   b) Conductor insulation shall be 600 volt PVC/Nylon.
   c) Cables shall be overall shielded with aluminum foil – polyester tape that provides 100% coverage. Each shield shall include an 18 ga. drain wire.
   d) Cables shall have flame-retardant PVC moisture resistant, sunlight resistant jacket rated 90°C.
   e) Cables shall be approved for direct burial applications. Cables shall meet requirements of ICEA S-66-524, NEMA WC-7 and UL1277.

C. Fiber Optic Cables for data communications for the plant SBR SCADA system shall be provided as specified under another Division of this Contract and shall be installed in raceway systems provided under this Division of the Contract.

D. Wire Identification

1. Wires shall be numbered and tagged at each end of termination.
2. Tags shall be legible with machine-printed markings and numbers.
3. Tags shall be on heat-shrinkable irradiated polyolefin that will not smudge or

fade when printed. Adhesive or taped on tags are not acceptable.

2.3 Pull and Junction Boxes

A. Provide steel boxes and removable covers of code gage, hot rolled sheet steel, hot dipped galvanized inside and outside, for above ground work. Furnish weatherproof boxes when installed above ground outside.

B. Provide cast iron boxes, hot dipped galvanized inside and outside, where shown on the Contract Drawings and where required. Furnish removable covers with gaskets and stainless steel, brass, or bronze screws. Boxes shall be by OZ/Gedney or Crouse-Hinds.

C. Provide concrete boxes for underground work unless otherwise indicated on the Contract Drawings. Furnish stainless steel frames and covers with cover attached to frame with hexagon head, brass or bronze cap screws, 3/8" in diameter. Provide rubber gasket for sealing between cover and frame. Paint cover with two coats of heavy asphaltum.

2.4 Outlet Boxes

A. Use sheet steel boxes, zinc coated or cadmium plated, for concealed interior work, or exposed interior work at least 8' above finished floor levels.

B. Use cast boxes, zinc-cadmium finish malleable iron, for exposed interior work within 8' above finished floor levels, and for exposed or concealed work in wet, damp or exterior locations. Cast boxes shall be series FD by OZ/Gedney, Crouse-Hinds or Appleton.

C. Wall box sizes (minimum) shall be 4" wide, 4" long and 2⅛" deep where wall construction permits. Where wall construction dictates width may be reduced to 2⅛″ or depth to 1½".

D. Fixture outlets in ceilings (minimum) 4" octagonal (4-11/16" x 2½" deep where required to accommodate larger conduit or larger number of wires).

E. Gang boxes shall be one piece (minimum) 2⅛" deep.

F. Provide lighting fixture outlet boxes, with suitable studs and supports for carrying the weight of the fixture, where fixtures are to be mounted on the box. Increase box depth, as required, for additional wires and conduits.

G. Provide cast iron adjustable floor boxes set level with finish floor. Furnish Hubbell B2500 series or Walkerduct 80 CI series boxes equipped with leveling screws, flush type covers, and openings to serve outlets used. Provide flush caps for closing off box when

H. not in use.

I. Provide Hubbell "Lo-Con" or Walker "500 Series" telephone and back to back receptacle service fittings of cast aluminum for use with floor boxes, for outlets shown on the Contract Drawings. Provide fittings with all accessories to make a complete and secure installation.

J. Provide cover or device plates for outlet boxes as follows unless otherwise noted.

1. Finished areas - flush type stainless steel, Type 302/304, non magnetic, .040" thick, satin finish, fastened with stainless steel recessed machine screws.

2. Unfinished areas - zinc coated sheet metal, aluminum or cast metal as appropriate for type of box.

3. Exterior areas - copper free aluminum with gray, powder epoxy finish, gasketed, weatherproof, Crouse-Hinds WLRD for duplex receptacles and WLRS for single receptacles.

4. Furnish telephone and signal outlet plates with single hole provided with a non-metallic bushing or rolled edge.

K. Provide covers and gaskets with conduit bodies, of a design suitable for the application. Provide watertight conduit bodies in damp and wet locations. Conduit bodies shall be cast ferrous alloy, galvanized, as manufactured by OZ/GEDNEY, Crouse-Hinds, or Appleton.

2.5 Wiring Devices

A. A.C. general-use snap switches

1. Provide totally enclosed, 20 ampere, 120/277 volt, side and back wired, quiet A.C. toggle switches.

2. Switches shall be single pole, double pole, three-way, four-way, locking, or with pilot light as indicated on the Contract Drawings.

3. Switches shall be Specification grade. Leviton 1221-2 series, Hubbell HBL 1221 series, P&S 20AC1 series.

4. Explosion-proof switches shall be those specified above, in cast Crouse-Hinds explosion-proof enclosure with external operator.

5. In corrosive areas provide corrosion proof devices as required. Switches shall be equal to Hubbell No. HBL 1221 with No. HBL 1795 plate and No. HBL 6080 box.

B. Duplex Convenience Receptacles

1. Provide NEMA configuration 5-20R duplex, 125 volt, grounding type, side and back wired receptacles rated for 20 amperes unless otherwise indicated on the Contract Drawings.

2. Receptacles shall be Hospital Grade Hubbell HBL 8300 Series, Leviton 8300 Series, or P&S 9300-HG Series.

C. Other Receptacles

1. Receptacles requiring current, voltage or configuration different from duplex convenience receptacles shall be as indicated on Contract Drawings.

2. Provide other receptacles with quality, material and workmanship at least equal to that specified for duplex convenience receptacles.

3. Explosion-proof receptacles shall be 20 ampere, 125-250 vac, two pole, three wire unless otherwise indicated on Contract Drawings.
   a) Explosion-proof receptacles shall be type ENR with type ENP plug for each as manufactured by Crouse-Hinds or Appleton Electrical Products.

4. In corrosive areas provide corrosion resistant devices as required. These devices shall be equal to Hubbell #HBL 53 CM62 with box #HBL 6080 or Leviton #53CM62 with Box #6080 and with Hubbell #HBL 52 CM21 yellow thermo-plastic cover. Devices shall be mounted vertically.

5. Receptacles installed in outdoor or toilet areas shall be the ground fault circuit interrupter type equal to Hubbell HGF83001 or Leviton #6899-HG.
6. All outdoor receptacles shall be supplied with weather-proof covers.

D. Wiring device color shall be ivory except where otherwise indicated.

2.6 Motor Starters

A. Magnetic motor starters shall be of the electro-mechanical type and shall be FVNR, RVNR, or reversing type as scheduled on the Contract Drawings. Where not scheduled, starters shall be (FVNR) (Solid State, reduced voltage type).

B. Motor starters shall conform to the latest applicable NEMA standards for type, size, and duty as specifically applied. Magnetic controllers shall provide thermal overload protection in each ungrounded phase leg not to exceed 125% of full load current for motors marked to have a temperature rise of not over 40°C, and at not more than 115% for all other types of motors and shall be provided with a manual reset type push button on the outside of the housing. Manual motor starters shall provide thermal overload protection not to exceed the above listed values, plus the actual current drawn by auxiliary controls. Thermal overload protection shall be trip-free and of the hand reset type.

C. Magnetic motor starter shall be equipped with a 120 volt fused secondary control transformer and 115 volt contactor coils.

D. Magnetic motor starters shall provide under voltage protection or under voltage release as appropriate.

E. Motor starters shall have provision for padlocking in the "off" position.

F. Unless otherwise indicated, motor starters for interior general service shall be housed in general purpose enclosures, NEMA 1.

1. Motor starters in hazardous areas shall be housed in appropriate enclosures.
2. Motor starters in exterior locations shall be housed in NEMA 4X enclosures with thermostatically controlled space heaters.

G. Motor starters shall have auxiliary contacts, switches, devices and pilot lights to permit control as indicated. Manual motor starters shall have pilot lights.

1. Provide time delay relays (TCIO) adjustable from 1 to 60 seconds, wired in control circuit of motors 10 H.P. and larger to permit staggered starting of motors following a power interruption.
2. Push buttons shall be heavy-duty type with momentary contacts unless otherwise indicated.
3. Pilot and indicating lights shall be LED type.
4. Remote push button stations shall have pilot lights for each motor speed.

H. Manufacturer shall be Square D, Siemens or Cutler Hammer.

2.7 Panel-boards

A. Panel-boards shall be enclosed dead-front safety type with features and ratings as scheduled on the Contract Drawings.

1. Panels known as "load centers" are unacceptable.

B. Molded case circuit breakers, or switches and fuses shall be as scheduled on the Contract Drawings and specified in this Division.

C. Bus bars shall be rectangular solid copper.

D. Cabinets shall have steel hinged doors, trim, combination latches and locks with four master keys to fit all panels, plastic covered directory holders and cards.

1. Boxes shall be galvanized steel. Door and trim shall be finished with baked enamel of the manufacturer's standard color.

E. Space where shown in panel schedules designates space for future protective devices and shall include bus and support components.

F. Panel-boards shall be as manufactured by Square D, Siemens or Cutler-Hammer.

2.8 Safety Switches

A. Switches and/or disconnect switches shall be safety switches conforming to the latest applicable NEMA standards for Type HD safety switches with arc suppressors, quick-make, quick-break mechanism and with external padlockable operating handle.

B. Safety switches shall be rated for 240 or 600 volts as applicable. They shall be horsepower rated when used in motor circuits.

C. Safety switches shall be fusible or non-fusible 2, 3 or 4 pole as indicated or as required for application indicated.

D. Safety switches shall be single throw unless otherwise indicated.

E. Enclosures shall be NEMA-12 indoors and NEMA-4X outdoors unless otherwise indicated.

F. Where fusible switches are required they shall be equipped with dual element "Low Peak" fuses.

G. Manufacturer shall be Square D, Siemens or Cutler Hammer.

2.9 Cartridge Fuses

A. Fuses shall be Class RK-1 dual element type of the appropriate voltage rating and rated to safely interrupt 300,000 amperes unless indicated otherwise.

2.10 Molded Case Circuit Breakers (MCCB)

A. Ratings and special features shall be as scheduled.

B. Trips shall be thermal magnetic with inverse time delay and instantaneous time-current characteristics.

C. 400 ampere frame and larger MCCB shall have interchangeable trips and adjustable magnetic feature.

D. Industrial grade MCCB shall be provided. (Cutler-Hammer quick-lag, Square "D" "Q-line" or G.E. "Q-line" breakers will not be permitted).

E. Ambient compensating MCCB shall be provided for outdoor applications or where

indicated on Contract Drawings.

F. MCCB shall not be used for switching lights unless they are specifically rated for switching duty.

2.11 Insulated Case Circuit Breakers (ICCB)

A. Ratings shall be as scheduled.

B. Trips shall be solid state, field adjustable having characteristics as scheduled.

C. Cases shall be high impact, glass reinforced insulating material.

D. Operating mechanism shall be manually charged, stored energy, quick-make. Indication shall be provided for contact and operating mechanism states.

E. Enclosures for individually enclosed units shall be NEMA 1 indoors, NEMA 3R outdoors, unless indicated otherwise on Contract Drawings.

2.12 Door switches for toxic gas (chlorine and sulphur) systems shall be lever arm, heavy duty, oiltight type, Square D Class 9007, Type T or approved equal

2.13 Remote "Emergency Off/Lockout" stations shall be red, 2.25 inch, mushroom head, push for "Off", pull for "On" type with D.P.D.T. contact block and Nema 4X stainless steel enclosure.

2.14 Cable Reel

A. Provide cable reel suitable for pick up operation in Class I, Group D, Division 1 location. Assembly shall be rated 25 amperes at 600 volts and shall be complete with 25' of 10-4 S0 cable and mounting accessories. Cable reel shall be Appleton #RL204LE-104-25 or approved equal.

2.15 Plastic Nameplates: Provide laminated phenolic nameplates with black face and white core. Letters shall be approximately 3/16" high (minimum). Nameplate shall contain name of equipment or descriptive name of control device. Submit a complete listing of all nameplates with legend and location.

2.16 Supporting Materials: Supporting materials shall be galvanized, painted or otherwise suitably finished. Materials shall be complete with hangers, connectors, bolts, clamps and necessary accessories to make a complete installation. Products shall be similar to B-Line, Steel City, RACO or Unistrut.

2.17 Hardware

A. All hardware including bolts, screws, nuts, clamps and hangers shall be galvanized cast iron, hot dipped galvanized steel, brass, stainless steel or chromed brass or bronze. Stainless steel spacers, washers and hardware shall be provided to prevent dissimilar metals from being in intimate contact with aluminum.

2.18 Marking Tape for Underground Conduits

A. Provide plastic marking tape consisting of one layer of aluminum foil laminated between two layers of inert plastic film. Tape shall be resistant to alkalis, acids and other destructive agents commonly found in the soil. The lamination bond shall be

strong enough that the layers cannot be separated by hand.

B. Tape shall be a minimum of 4.5 mils thick with a minimum tensile strength of 60 lbs. in the machine direction and 58 lbs. in the transverse direction per 3" wide strip. Tape shall be red and shall be imprinted with a continuous warning message "Caution - Electric Line Buried Below", normally repeated every 16 to 36". Tape shall be inductively locatable and conductively traceable using a standard pipe and cable locating device. The tape shall be 3" wide and shall be Terra Tape "Sentry Line Detectable 620."

2.19 Switchboard Matting

A. Provide corrugated matting consisting of 36" wide non-conductive material with 1/16" deep grooves, and with a dielectric strength of 30,000 volts suitable for insulating against 20,000 volts A.C

B. Matting shall be tested to ASTM standards and shall conform to ANSI/ASTM D-178-77 Type 2 Class II with certification branded on back. Matting shall be as manufactured by Tennessee Mat Co. or Biltrite Corp. Product Code #700161.

2.20 Unless specifically noted otherwise, Surge Protective Devices (SPD) shall be parallel design, UL 1449 listed, bi-directional systems. Each protective element shall be individually fused. Each system shall feature LED's to indicate the on-line status of each phase and a diagnostic test port to allow the system to be tested to determine the actual surge current protection levels for each mode.

A. For panels rated for 800 amps and over, the SPD units shall offer 150,000 amps per mode of protection (L-G, L-N & N-G in a wye mode and L-L & L-G in a delta mode). The unit shall be capable of withstanding a minimum of 11,000 ANSI/IEEE C62.41, category C.3 impulses per phase, without failure. For panels rated for less than 800 amps, the units shall offer 60,000 amps per mode of protection (L-G, L-N & N-G in a wye mode and L-L & L-G in a delta mode). The unit shall be capable of withstanding a minimum of 7,000 ANSI/IEEE C62.41, category C.3 impulses per phase, without failure. The clamping voltage @ 120/208 volts shall be no higher than 625 volts or 875 volts @ 277/480 volts when subjected to an ANSI/IEEE C62.41, category "C.3" impulse.

B. The SPD shall provide as a minimum the following noise filtering levels; 47dB @ 100 KHz, 33dB @ 1MHZ, 38 dB @ 10MHz & 53 dB @ 100MHz. All MOVs within the SPD shall be individually fused. Printed circuit board tracings shall not be used to conduct high energy transient current. The connection lugs on the SPD shall accept up to a #2 AWG wire.

C. The SPD shall be mounted in a NEMA 12 enclosure (indoors) or a NEMA 4X enclosure (outdoors).

D. The SPD shall be covered by a seven year, "on-site" warranty. The warranty shall cover manufacturing defects and damage or failure caused by lightning or momentary over voltage conditions that may occur after the unit has been installed. The SPD shall be designed such that the protective elements can be replaced in the field without replacing the entire unit. The manufacturer shall have a local representative to provide service support and training to the end user.

E. Submittals shall include the following; complete product information, UL file

information, noise filtering test data, a copy of an ANSI/IEEE test report verifying clamping voltage and the number of impulses the SPD will successfully withstand, and an independent test report showing that the unit will withstand, without failure, a surge current at the published level. The submittals shall include a letter signed by an officer of the manufacturer certifying that the independent test was conducted on the entire unit including the fusing. Furthermore, a letter signed by an officer of the fuse manufacturer shall state that the fuses supplied on the TVSS manufacturers equipment are designed and will withstand an impulse equal to or greater than the surge current rating of the MOV's they are protecting.

F. The SPD shall be provided with an integral disconnect switch if the panelboard schedule does not indicate a circuit breaker to serve the SPD. The switch shall interlock with the front cover. The switch shall be non-fused and rated for a minimum of 200 amps.

G. The SPD shall be provided with a monitoring system that features an audible alarm, surge counter and remote alarm contacts. The surge counter and audible alarm shall have battery back-up or alternate power supply.

H. SPD shall be installed to have the shortest leads possible and shall be as manufactured by Current Technology, Atlantic Scientific or Joslyn.

3. EXECUTION

3.1 Raceways

A. Install conduit concealed where indicated on the Contract Drawings. Maintain minimum distance of 6" from parallel runs of flues, steam or hot water pipes.

B. Use liquid-tight flexible metal conduit for connections to motors and other equipment subject to vibration, and for connections to recessed or semi-recessed lighting fixtures. Limit the length to 4FT where possible.

C. Space groups of conduits uniformly. For bends and offsets, use an approved hickey or bending machine.

D. Cut all conduits with hacksaw or approved cutting machine and ream after threading to remove all burrs.

E. Fasten conduit securely to outlets, junctions and pull-boxes to ensure firm electrical contact. Join conduit with approved couplings. No running threads will be allowed.

F. Provide insulated bushings and double locknuts on conduits entering or leaving sheet metal outlet, junction, or pull boxes, and cabinets.

G. Avoid condensation pockets in installations. Keep conduit, fittings and boxes free from foreign matter, before, during and after installation.

H. Use electrical surface metal raceway for extensions of circuits only where specifically indicated.

I. Make joints in plastic jacketed conduit with plastic jacketed nipples or fittings, or wrap each joint with three ½" lapped layers of 2" wide polyvinyl chloride tape extending 3" each side of the coupling. Repair any breaks or nicks in the plastic jacket on the fittings and conduits with a material of the same composition as the jacket on the conduit.

J. Not more than one exposed conduit shall be run down to an exposed wall switch or outlet box.

K. Use expansion fittings where conduits pass through building expansion joints.

L. Use expansion/deflection fittings where rigid metal conduits pass from existing building structures to additions on new foundations and where otherwise indicated on Contract Drawings.

M. Use sealing fittings where conduits pass from hazardous areas to areas of normal atmosphere.

N. Use Thruwall sealing fittings where conduits enter buildings or vaults below finished grade.

O. Conduits less than 1" may be installed in concrete floors, but shall not cross each other. Installation of larger conduits in concrete floors must be approved by the Engineer.

P. Use watertight joints with buried and concrete encased conduit. All buried conduits outside of buildings shall have a minimum of 30" of cover. Metal conduits buried in earth or encased in concrete, shall be rigid steel conduit.

Q. Support runs of metallic conduit at least every 8'.

R. Support runs of non-metallic conduit at least as required by NEC Table 347-8.

S. Install exposed runs of conduit and conduit above lay-in ceilings parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings. Provide right angle turns consisting of fittings or symmetrical bends. Support conduits within 1' of all changes in direction.

T. Supports shall include wall brackets, trapeze hangers, strap hangers, or pipe straps secured to hollow masonry with toggle bolts, to brick and concrete with expansion bolts, to metal surfaces with machine screws; and to wood with wood screws.

U. Explosive drive equipment may be used to make connections subject to compliance with safety regulations.

V. Wooden plugs inserted in masonry, and the use of nails as fastening media, are prohibited.

W. Support conduit risers exposed in wire shafts at each floor level with approved U-clamp hangers.

X. Install empty conduit for future use as indicated on the Contract Drawings. Conduit shall be complete with pull wire or rope, junction and outlet boxes.

Y. Conduit shall not be supported from metal roof deck.

Z. Conduit shall not penetrate concrete bases designed for vibration isolation.

AA. Thread lubricant/sealant is required on outdoor and underground threaded metal joints.

BB. Use PVC conduit only where indicated.

CC. Install fire-seal fittings where conduits penetrate concrete floor slabs or masonry walls required to be fire rated. Provide seals on each side of opening where recommended by equipment manufacturer.

DD. Install instrumentation wiring in rigid steel conduit separate from conduit used for power and control wiring. Conduits for instrumentation:

1. Shall be galvanized rigid steel for interior work.
2. Shall be galvanized rigid steel conduit with waterproof joints for buried/concrete encased work.

EE. Except as noted in the following, install rigid steel conduit, galvanized as required by location.

1. Non-Hazardous Locations
   a) Install liquidtight (jacketed) flexible metal conduit for connections to motors and other equipment subject to vibration. The maximum allowable length is 4-Feet. Rigid Steel Conduit, galvanized by location, shall be installed and secured within 3-Feet of the vibrating equipment. Liquidtight flexible metal conduit shall only be used for the extension from the secured conduit to the vibrating equipment.
   b) Install galvanized Rigid Steel conduit where conduit is exposed, subject to damage or above grade.
   c) Install Schedule-80 PVC rigid conduit or galvanized rigid steel conduit where conduit is buried or under vehicle drive paths and parking lots. Direct buried PVC conduit shall be encased with red-dye colored concrete with support chairs, tie-downs and rebar anchors.
2. Hazardous Locations
   a) Install explosion proof liquidtight (jacketed) flexible metal conduit for connections to motors and other equipment subject to vibration. The maximum allowable length is 4-Feet. PVC coated Rigid Steel Conduit shall be installed and secured within 3-Feet of the vibrating equipment. Explosion proof liquidtight flexible metal conduit shall only be used for the extension from the secured conduit to the vibrating equipment.
   b) Install PVC coated rigid steel conduit for all equipment not subject to vibration.
   c) Install gas seal-offs sealing fittings and fill with sealing material where conduits pass from hazardous areas to areas of normal atmosphere and at other locations as required by Articles 500 and 501 of the National Electric code.

FF. Provide separate conduits for AC and DC wiring, for signal wiring 50 volts or less and for signal wiring over 50 volts, per NEC.

GG. Provide cast iron straps with clamp boxes for exposed conduit runs. The clamp backs shall hold the conduit off the surface.

HH. Exposed threads, including those on conduits to be encased in concrete or masonry, shall be painted with a heavy coat of gray marine enamel, neatly brushed on.

II. All conduits installed below grade and outside of building walls shall be concrete encased.

3.2 Wire and Cable

A. Install wiring in conduit unless otherwise shown.

B. Install splice-free conductors within ducts, conduits or earth.

C. Connect No. 6 and smaller wires with solderless pressure connectors filled with

silicone grease to form a waterproof and corrosion-proof joint. Connectors shall be sized according to manufacturers recommendations, shall be UL and C.S.A. listed and shall be as manufactured by King Technology.

D. Connect No. 4 and larger wires with compression connectors or splices as manufactured by Burndy, T&B, or ILSCO.

E. Install connectors for aluminum to aluminum or aluminum to copper specifically designed for that purpose. The aluminum conductor in contact with the connector shall be wire brushed and coated with oxide inhibiting compound such as Penetrox A. Wipe away excess compound adjacent to the connector.

1. Use compression equipment adapters, Hyplug by Burndy, for connecting aluminum wire to equipment having set screw connectors.

F. Insulate splicing connectors to at least 200 pct. of wire insulation. Use pre-stretched tubing connector insulators, 3/M PST, or equivalent by Plymouth, for No. 2 and larger conductors.

G. Use terminal strips to interconnect and splice control, and communication cables.

H. Pull conductors using recognized methods and equipment leaving ample lengths of wire at junctions for connections.

1. Use Ideal "Yellow 190" wire pulling lubricant as required to facilitate pulling.

2. Complete and clean-out conduit system before pulling wire.

I. Use split wedge type cable supports which clamp each conductor individually in vertical feeders where required.

J. Form and tie all wiring in panel-boards, switchboards, switchgear and control panels.

K. A maximum of 24 current carrying conductors will be permitted in a single raceway unless specifically indicated otherwise on the Contract Drawings. Derate in accordance with NEC.

L. Install identification labels in all junction boxes and terminal points so as to be clearly visible.

M. Install all instrumentation and annunciator wiring (using signal cables) in accordance with the requirements of Section 13320 and the equipment supplier.

1. The instrumentation equipment supplier will provide wire sizing for signal conductors; see Section 13320 - Instrumentation.

2. Make cable runs continuous without intermediate splicing whenever possible.
   a) Use terminal strips in above-grade exterior or in all interior locations to interconnect and splice instrumentation cables. Terminal strips to be rated 10A, 300 V minimum.
   b) In all below-grade, exterior locations provide a mechanically-strong, low-loss connection using a crimping type connector. Make all below-grade splices watertight and capable of complete submergence.
   c) Install insulated, spade-type wire lugs on all conductors at all screw-type terminal connectors.

3. Make final connections to instrumentation equipment.

4. Install instrumentation grounding system in accordance with NEC, Article 250

and requirements as set forth herein.

a) All instrumentation devices shall be connected to an earth ground by means of stranded, copper conductors and presenting a maximum resistance to ground of not more than eight ohms as measured from any point of the grounding system.
b) A minimum of #12 AWG conductors shall be installed from each device to the grounding conductor. Individual device grounding conductors shall be limited to a maximum length of 5'. Each device shall be separately bonded to the grounding conductor and no "looping" will be allowed.
c) Not less than a #12 grounding conductor shall be provided for a single device. Not less than a #10 conductor shall be provided for 2-4 devices. Not less than a #8 conductor shall be provided for 5-15 devices. Not less than a #6 conductor shall be provided for 16 or more devices.
    1) The above sizes are based on a maximum of 75' of grounding conductor employed.
    2) Use one size larger conductor for runs in excess of 75'.
    3) Grounding conductor sizing requirements shall be subject to review and modification by the instrumentation equipment supplier, with the concurrence of the Engineer.
    4) Shielding shall be continuous through all splices and connections. Provide grounding at secondary device only and at no other point on the loop.

3.3 Pull and Junction Boxes

A. Install pull and junction boxes where shown on the Contract Drawings, and where required for changes in direction, at junction points, and to facilitate wire pulling. Furnish box sizes in accordance with NEC unless larger boxes are indicated.

B. Provide steel boxes and removable covers of code gage, hot-rolled sheet steel, hot-dipped galvanized inside and outside, for above ground work above the level of the pump room floor. Furnish weatherproof boxes when installed above ground outside.

C. Provide cast aluminum alloy boxes (Millark or Crouse-Hinds) or hot-dipped galvanized inside and outside for wet well, dry well, and wet locations. Furnish removable covers with gaskets and stainless steel, brass, or bronze screws.

D. Provide concrete boxes for underground work unless otherwise indicated in the drawings. Furnish stainless steel frames and cover with cover attached to frame with hexagon head, brass or bronze cap screws, 3/8 inches in diameter. Provide rubber gasket for sealing between cover and frame. Paint cover with two coats of heavy asphaltum as required.

E. Locate underground boxes as shown on Contract Drawings. Minor adjustments as necessary to avoid other utilities, grading, and other restrictions shall be made.

F. Conduit bodies may be used on exposed work in lieu of boxes, except where wiring devices are to be installed.

G. Install above ground boxes with angle iron or other suitable fittings when required to ensure a rigid and secure mounting.

3.4 Outlet Boxes

A. Provide boxes, complete with cover or device plate for switches, receptacles, or other similar devices, or where required for pulling or joining branch circuit wiring.

B. Conduit bodies may be used on exposed conduit work instead of outlet boxes, except where wiring devices are to be installed.

C. Flush mount boxes in finished walls. Install plaster rings in plastered walls and raised covers as required in walls with other finishes so that cover plates fit against boxes or rings. 3/16" maximum gaps allowed for noncombustible walls.

D. Adjust location of outlets in masonry or tile construction to occur in the nearest joint to the height specified.

E. Support all boxes to maintain alignment and rigidity.

F. Clean boxes of all foreign matter prior to installation of wiring or devices.

3.5 Wiring Devices

A. Install A.C. toggle switches for switching lighting or other branch circuit loads as indicated on the Contract Drawings. Where adjacent to doors coordinate with contract drawings to insure switches are installed on strike side of door.

1. Locate approximately 4' 6" above finished floor elevation unless otherwise indicated.
2. Long dimension of switches shall be vertical unless otherwise indicated or required.

B. Install receptacles as indicated on the Contract Drawings.

1. Locate approximately 1' 6" above finished floor elevation unless otherwise indicated.
2. Long dimension of receptacles shall be vertical unless otherwise indicated or required.
3. Locate clock receptacles approximately 8' above finished floor level unless otherwise indicated.

3.6 Panel-boards

A. Bolt all connections to bus bars through highly conductive metal.

B. Install cabinets so that center of top breaker or switch does not exceed 6' 6" above finished floor.

C. Circuits shall be arranged and numbered as indicated in Contract Drawing schedules.

D. Entries on directory cards shall be typed, complete and accurate.

3.7 Safety Switches

A. Provide safety switch where any motor is out of sight of its controller and any controller is out of sight of its branch circuit breaker in accordance with Article 430 of NEC.

B. Mount safety switches securely between 3′ and 6′ above floor unless otherwise indicated on the Contract Drawings.

C. Furnish dual element fuses for fusible switches of the size indicated on the Contract Drawings. Furnish one set of spare fuses for each fusible switch.

3.8 Plastic Nameplates

A. Install plastic nameplates on all items of electrical equipment and associated control devices. Fasten nameplates to equipment and devices with screws or other non-adhesive fastenings.

3.9 Marking Tape for Underground Conduits

A. Install marking tape in all trenches containing underground conduit runs. Tape shall be installed in trenches with a minimum cover of 12" and a minimum clearance over conduits of 18". Tape shall be carried through all junction boxes, pull boxes and manholes. Tape shall be made electrically conductive throughout the entire system through the use of splices of a type as recommended by the manufacturer.

3.10 Switchboard Matting

A. Install switchboard mats in the aisles in front of, and behind, all switchboards and motor control centers. Mats shall be continuous - no splices or breaks - and shall be installed in accordance with manufacturers recommendations.

END OF SECTION

SECTION 263213
STANDBY POWER SYSTEM

1. GENERAL

1.1 STANDARDS

A. NEMA MG1

1.2 SCOPE

A. A complete emergency standby power system shall be provided including a diesel engine driven generator set, automatic transfer switch, and all auxiliary systems required for automatic operation.

1.3 OPERATIONS AND MAINTANCE MANUALS

A. Operations and Maintenance Manuals shall be provided as required in Division 1.

1.4 TRAINING

A. Training shall be provided in accordance with Division 1.

1.5 MANUFACTURER REQUIREMENTS

A. Renewal parts and major maintenance shall be readily available through authorized manufacturers dealers located within 50 miles of job site.

B. A single manufacturer's dealer shall supply and warrant all equipment for the emergency standby power system. Warranty: 5 year, 2500 hour warranty to cover parts, labor and travel for the full five years. This includes all parts as shipped from the factory but does not include normal maintenance items such as filters, oil and belts, etc..

C. The generator set provided under these specifications shall be completely factory assembled and shall be listed and labeled per UL2200.

D. The equipment supplied and installed shall meet the requirements of the NEC and all applicable local codes and regulations. All equipment shall be of new and current production by a MANUFACTURER who has 25 years of experience building this type of equipment. Manufacturer shall be ISO9001 certified. Generators, Equipment and Testing in this section must meet NFPA 110 Requirements.

E. The units shall be the product of a firm regularly engaged in the manufacture of engines and generator sets and shall meet the requirements set forth herein. It shall be a standard model in regular production at the manufacturer’s place of business.

F. The engine generator set provided under these specifications shall comply with applicable EPA emissions requirements. Generator Sets shall be certified EPA Emergency Stationary Emergency (Tier 2 or Tier 3). It shall be the responsibility of the engine generator supplier to comply with all applicable requirements of the Commonwealth of Virginia and the Authority Having Jurisdiction (AHJ) where the generator set will be installed.

2. PRODUCTS

2.1 GENERAL

A. Generator set shall be: CAT Model D250GC-C9-ACERT T3/Permanent Magnet

B. Provide a 250kW (480Y/277Vac/3-Phase/60Hz/) Generator Set mounted outside in a sound attenuated weatherproof enclosure rated 74dBA@23FT and with an integral diesel fuel tank sized for a runtime of 48-hour@75%-Load. Reference the electrical drawings for the plant loads and the specifications startup sequence.

2.2 GENERATOR REQUIREMENTS

A. Cooling System (Radiator) designed to operate in 122oF ambient temperatures with an air flow restriction of 0.5 inches of water.

B. Certified copy of generator set standard factory tests shall be provided for the engineers and owners records.

C. Voltage regulation shall be +/- 1.0 percent of rated voltage for any constant load between no load and rated load.

D. The generator set shall be capable of starting the equipment in the facility in multiple steps (not to exceed four). Voltage dip shall not be greater than 15% at any point in the operating cycle. Factory approved voltage dip calculations based on data obtained shall be submitted for review and approval.

E. The generator set shall be rated to step loads per the following Startup Sequence:

1. Starting Step 1 shall include 480Vac powered Unit Heaters and loads powered by Panelboard PB.
2. Step-2 Wet Well Lead Pump 75HP VFD
3. Step-3 Wet Well Lag Pump 75HP VFD
4. The Stand-by Pump, user selectable shall be electrically interlocked so that only two pumps will run simultaneously.

F. Readily accessible voltage droop, voltage level and voltage gain controls shall be provided. Voltage level adjustment shall be a minimum of plus or minus 5 percent.

G. Generator insulation shall be Class H. Temperature rise shall not exceed 105°C over 40°C ambient for continuous operation at the standby rating.

H. Frequency regulation from no load to full load shall be in accordance with governor specification. For any addition of load up to 90 percent of rated load, the frequency shall recover to steady state frequency band within five seconds.

I. Equipment supplier shall furnish printed copy of equipment starting steps to Instrumentation/Controls equipment supplier to insure that the starting steps are included in the control systems.

J. Provide PMG Excitation and Integrated/Automatic Voltage Regulator (IVR) capable of 2:1 Slope (0.5V/Hz to 3V/Hz in steps of 0.1V/Hz).

K. Gensets shall come with Phase Sensing.

2.3 DIESEL ENGINE

A. Diesel engine shall be four cycle, 1800 RPM.

B. All engine ratings shall be shown in manufacturer's literature published at least six months prior to bid opening and engine shall be of a design that has been successfully used for at least three years.

C. Generator shall be driven by a single engine without the use of gearing.

D. Provide a generator mounted engine controller that provide Auto/Start/Stop, Engine Cooldown Timer, Emergency Stop, Engine Cycle Crank, and Programmable cycle timer. Controller indications shall include: Generator 3 phase voltage +/- 1% accuracy, RPM, Battery Voltage, Generator AC Current, Generator Frequency, Power metering (kW, kVA, kVAr, pf), Hour Meter (kW-Hours, kVAr-Hours), Engine oil pressure, Engine oil Temperature, Engine Coolant Temperature.

E. Engine Lubrication

1. Engine lubrication shall include a forced feed lubricating oil system with wet sump.

2. Provide water cooled lube oil cooler.

3. Provide full flow replaceable oil filters with spring loaded bypass valve to insure oil flow if filter clogs.

F. Engine combustion air cleaner shall be dry replaceable element type cleaner.

G. Engine fuel system shall be fuel injection type capable of performance on commercial Grade No. 2 fuel oil. Provide primary and secondary fuel filters of replaceable cartridge type. A positive displacement engine mounted fuel pump capable of 12' minimum suction (Priming Lift) shall be provided. All fuel lines shall have flexible connections and a check valve shall be provided ahead of the fuel pump.

H. Engine exhaust system shall include a minimum 18" long flexible steel exhaust connection for each exhaust outlet to muffler. For outdoor units with mufflers bolted to engine or engine housing, flex connection may be omitted.

1. Provide internal critical silencer and exhaust scoop to direct silencer and radiator air up.

2. Mufflers mounted on top of the weatherproof enclosure shall be shielded with formed expanded metal guards for protection of operating personnel.

3. Provide a threaded drain hole.

4. Diesel exhaust system piping shall be extra heavy black steel (schedule 80). Fitting shall be standard weight forged steel with beveled ends.

I. Engine governor shall be speed droop type which shall control the frequency within 3 pct of rated frequency from no load to full load. The frequency at any constant load shall remain within a steady state band width of plus or minus 0.33 pct of rated frequency.

2.4 GENERATOR COMPONENTS

A. Provide a thermostatically controlled jacket water heater to maintain proper generator starting conditions at ambient temperatures as low as -20oF. Heater voltage shall be suitable for circuit voltage shown on Contract Drawings.

B. Radiator shall be engine mounted and cooled by blower fan. Fan belts shall have tension adjustment. The radiator shall be capable of cooling the engine at its standby load ratings and 110°F ambient air temperature. The radiator shall be filled with ethylene glycol and water solution to protect to -20°F and shall include a cooling system rust inhibitor. All cooling system gaskets shall be suitable for use with ethylene glycol.

C. Provide engine driven centrifugal type water circulating pump and thermostatic valve to maintain engine at recommended temperature level.

D. Provide a thermostatically controlled heater in the generator to prevent condensation. Heater shall be suitable for circuit voltage shown on Contract Drawings.

E. Engine-generator set shall be provided with factory pad type vibration isolator between the frame and the generator components.

F. Engine starting shall be electrically powered from heavy-duty lead-acid storage batteries, having voltage rating and ampere hour minimum capacity ratings recommended by the manufacturer to provide 120 seconds of cranking at an ambient temperature of 40°F. Provide batteries, battery rack and cables within the generator enclosure. Provide a U/L listed 10Amp NFPA compliant automatic battery charger with automatic two rate charging that will provide recharge from 0 volts to full charge in 8 hours. Charger shall have 120 volt single phase input, ammeter, voltmeter and suitable enclosure. Charger shall be stand-alone, installed inside the Genset enclosure and shall have visual Voltage and Amperage meters. In addition to the battery charger, an engine driven battery charging alternator shall be factory installed with required guards. Alternator shall be rated minimum of 24 volts and 45 amperes.

G. Finish paint coat of engine generator set, accessories and auxiliary equipment shall be standard factory color.

2.5 GENERAL CONTROLS

A. The Generator Control Panel, Low Voltage Power Distribution Panel (if installed) and the Generator Main Output Circuit breaker shall be mounted in the generator housing.

B. The controls shall include the following meters and relays:

1. A.C. voltmeter (L-L, L-N)
2. A.C. ammeter (Phase)
3. Average Volt, Amp, Frequency
4. kW, KVAR, KVA (Average, Phase, %)
5. Power Factor (Average, Phase)
6. kW-hr, kVAr-hr (total)
7. Desired Voltage, Excitation Command, Operating Mode
8. Kw Load histogram

C. The controls shall include the following alarms which shall light an individual indicating lamp for each alarm condition and shall stop and lockout the unit. Lockout shall require manual reset.

1. Over-crank
2. Low oil pressure
3. High water temperature
4. Low Coolant Water Level (Alarm and Shutdown)
5. Over-speed

6. "Not In Automatic" alarm light
7. Provide Generator Run Relay.
8. Auxiliary digital I/O and Analog connections to indicate alarm condition (for use with plant enunciator system).
9. Indicator/Display lamp test switch to permit checking indicator and display lamps.

D. Starting and stopping controls shall be activated by contacts located in the transfer switch.

E. Generator Main Output Circuit Breaker:

1. Installed inside of the weatherproof housing.
2. The Main Output Circuit Breaker shall be 400AF/400AT, 3-Pole, 100% Rated with Auxiliary Contacts, 24v Shunt Trip and LSI Electronic Adjustable Trip Unit.
3. Provide a current limiting 10 AMP two-rate battery charger, NFPA 110 Registered, UL Certified, independently mounted, (not in Control Panel or ATS) on generator support pad, to automatically recharge batteries. Provide connections between battery charger and batteries as required by Genset manufacturer. Provide overload protection, silicon diode, full wave rectifiers, voltage surge suppressors, DC voltmeter, DC ammeter, and fused AC input. AC input voltage shall be 120 VAC, 1 phase. Provide contacts for annunciation of battery low DC voltage alarm. Ampere output shall not be less than 10 amperes. Provide connections between battery charger and batteries as required by the Genset manufacturer.

F. Not Used

G. Emergency Stops - The generator shall come equipped with an Emergency Stop installed. E-Stops shall be red, 2.5 inch mushroom head push for “Off” and pull for “On” type with D.P.D.T. contact block.

2.6 SUB-BASE DIESEL FUEL TANK

A. Provide a double-walled, UL 142 listed, fuel tank, mounted under the base of the generator set sized as noted section 2.01.A of this specification. Bolt tank to the generator set base. Tank to be shipped to the jobsite connected to the generator as one piece.

B. Fuel fill cap and level indicator accessible from outside of generator.

C. Provide a 2-Gallon Over-Spill Kit on fuel fill inlet – external to generator.

D. Provide Low, High and Leak detection alarms and sensors.

E. Equip the tank with conduit space beneath the circuit breakers for cable runs.

2.7 AUTOMATIC TRANSFER SWITCH (ATS)

A. The ATS shall be ASCO 300 Series (or approved equal) in a NEMA-3R enclosure.

B. Automatic Transfer Switch (ATS) shall be the delayed transition type.

C. ATS Ratings:

1. The ATS shall be 400Amp/3-Pole at 480-277VAC/3-Phase/4-Wire/60Hz.

D. The transfer function shall be accomplished as follows:

1. The transfer of load shall be initiated by a drop of any phase of normal supply voltage below 70 pct. of rated voltage.
2. Provide adjustable time delay in order to over-ride momentary power outages or fluctuations. Set delay at 20 seconds.
3. Load transfer to the generator shall occur only after the generator has attained at least 90 pct. of rated voltage and 95 pct. of rated frequency.
4. The total elapsed time between the loss of normal supply voltage and the transfer of load to the generator shall not exceed 30 seconds.
5. The load shall be transferred back to the normal supply when the voltage of each phase of the normal supply has continuously remained above 90 pct. of rated voltage for 15-600 seconds, adjustable.
6. The engine shall be stopped after a cool-down run following load transfer to the normal source, length of cool-down run shall be determined by engine manufacturer.

E. The switch shall be equipped with spare auxiliary relay contacts, 1 n.o., 1 n.c. that transfer when the normal source is energized or de-energized.

F. Switch shall be equipped with an auxiliary relay having S.P.D.T. contacts to indicate "Emergency Power Available."

G. Switch shall be equipped with an auxiliary relay having S.P.D.T. contacts to indicate "Normal Power Available."

H. The switch shall be equipped with two (2) auxiliary contacts; the contacts to open when the switch is in the emergency position.

I. Provide a time clock to automatically initiate exercising the engine as recommended by the engine manufacturer.

J. Ampere rating shall be continuous with the switch installed in an unventilated enclosure. The thermal capacity of the main contacts shall be not less than 20 times the continuous rating, for a minimum of 3 cycles.

K. WCR Ratings:

1. When coordinated with molded case circuit breakers, the minimum withstand and closing rating (WCR) shall be as follows, for a minimum of 3 electrical cycles. WCR rating of the By-Pass Isolation switch shall be equal to the ATS.
   a) Amperage 3 Cycle Rating (UL1008)
      1. 0-100A 22,000 Symmetrical
      2. 101-399A 30,000
      3. 400-599A 35,000
      4. 600-1599A 50,000
      5. 1600-3000A 100,000
2. ATS shall also be rated for 200,000 WCR when coordinated with current limiting fuses, regardless of ampere rating.

L. Transfer switch and all accessories shall be front accessible.

M. Switch shall be complete with:

1. Ammeter, voltmeter and selector switches to monitor all three phases of the load side of the switch.
2. Pilot lights to indicate switch position (normal or emergency).
3. A pause-in-neutral feature shall be provided with an adjustable time period (15-600sec) and shall be effective during switch operation in either direction.
4. ATS Enclosure Anti-Condensation Heater

N. ATS Warranty – Standard Asco ATS Warranty or equal.

2.8 FACTORY TESTING

A. Generator set shall be tested at the factory with a 0.8 Power Factor Test and provide testing reports to engineer. On Site: Provide resistive load bank test per NFPA-110. Load banks and Load Bank cables shall be furnished, setup and broken down by the generator set supplier. After Load Bank Testing, provide site load tests to pump station capacity.

B. Site Tests: An installation check, start up, a load bank test and a station load test shall be performed by the manufacturer's local representative in the presence of the owner and the engineer. The engineer, regular operators, and the maintenance staff shall be notified one week in advance of the time and date of the site test. The contractor is responsible for providing all fuel required for testing and filling the tank upon acceptance by the owner.

C. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations under the environmental conditions present and expected.

D. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. This shall include: engine heaters, battery charger, generator strip heaters, remote enunciator, etc.

E. Start up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line to line voltage and phase rotation.

F. Automatic start up by means of simulated power outage to test remote automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper systems coordination. Engine temperature, oil pressure and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test.

G. During each test, data shall be tabulated at 30-Minute intervals for the following:

1. Voltage - each phase
2. Amperage - each phase
3. Frequency
4. Power factor
5. Cooling water temperature
6. Exhaust gas temperature

7. Oil pressure
8. Ambient temperature

H. Results of all tests shall be submitted to the Engineer for approval prior to final acceptance of the equipment and installation.

I. All fuel and other consumables required for this test when performed on site shall be provided by the Contractor. Fuel tank shall be filled to capacity prior to acceptance of installation by Owner.

3. EXECUTION

3.1 The generator, fuel tank and all associated equipment shall be installed and tested according to current installation instructions provided by each manufacturer.

3.2 The equipment shall be installed where shown on the plans and in accordance with the manufacturer's recommendations and all applicable codes.

3.3 Manufacturer’s Services

A. Supply the services of a field representative or engineer for one (1) eight (8) hour day minimum at each generator site to inspect the complete installation and to aid in start-up, and one additional eight (8) hour day at each generator site for on-site training. Notify the Project Engineer of the time of the visit one week in advance. Three loose leaf training manuals summarizing instructions shall be provided to the Owner one week prior to the on site meeting.

B. Submit written certification to the Engineer within five (5) days that the installation was satisfactorily completed and that the equipment is ready for normal operation.

C. Should the equipment not be satisfactorily installed or is not ready for normal operation, submit a list of corrective actions required.

D. Submit lubrication log to the Owner, including date of lubrication, points lubricated and name of lubricant used.

3.4 FACTORY and FIELD TESTING

A. Provide the manufacturer's standard certified Reactive .08 PF testing at the factory. Test Report is required to be turned in to engineer/customer.

B. Prior to acceptance of the installation, field test the equipment to demonstrate it will start automatically, and subject it to a full Resistive load-bank load test, per NFPA 110, shut down and reset as indicated herein. Coordinate with transfer switch manufacturer’s representative to test adjust and test transfer switch at the same time of generator the testing.

C. Correct, prior to acceptance, any defect which becomes evident during this test. Perform the test in accordance with the following requirements and include any other tests that may be recommended by the manufacturer for the purpose of evaluation.

D. Load Bank Testing shall be per NFPA 110 Standards.

E. Fuel for Testing is the responsibility of the Contractor. Re-fuel the generator tank after testing.

F. Submit a full written certified test report indicating BHP developed, KW output, voltage, current and frequency variations to the Engineer for evaluation and disposition. Perform all tests in the presence of the Owner's authorized representatives and the manufacturer's representative, who both shall validate the report.

G. On completion of the installation, provide the initial start-up by a factory- trained representative of the engine supplier. At the time of start-up, explain operating instructions and maintenance procedures to the Owner's operating personnel. The factory-trained representative shall provide a minimum of (1) 4-hour session of operating and maintenance instructions to the Owner's operating personnel, which shall include the generator and auxiliary components.

END OF SECTION 263213

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

1. GENERAL

1.1 WORK INCLUDED

A. Galvanized steel chain link fence and gates.

B. Polyvinyl Chloride (PVC) clad chain link fence and gates.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's technical data, and installation instruction for fencing, fabric, gates, and accessories.

B. Shop Drawings: Submit shop drawings indicating location of fence (with dimensions), height, post locations, details of post installation, gate swing, hardware and accessories.

C. Samples: None required

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage 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.

B. Source Limitations for Chain-Link Fences and Gates: Obtain each color, grade, finish, type, and variety of component for chain-link fences and gates from one source with re- sources to provide chain-link fences and gates of consistent quality in appearance and physical properties.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates indicated in relation to property survey and existing structures. Verify dimensions by field measurements.

2. PRODUCTS

2.1 GENERAL

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Galvanized Steel Fencing and Fabric:
   a) Allied Tube and Conduit Corp.
   b) American Chain Link Fence Company
   c) American Tube Company
   d) Anchor Fence, Inc.
   e) Century Tube Corp.
   f) Cyclone Fence Div. /USX Corp.

2. PVC Coated Steel Fencing and Fabric:
   a) Colorguard Fence Products, Inc.
   b) American Chain Link Fence Company
   c) Semmerling Fence & Supply, Inc.
   d) Anchor Fence, Inc.

2.2 FABRIC:

A. Steel Fabric: Comply with Chain Link Fence Manufacturers Institute (CLMFI) Product Manual. Provide one-piece fabric widths. Wire size includes zinc coating.

B. Size: 1-3/4 inch diamond mesh, 9-gauge (0.148-inch diameter) interwoven wire.

C. Galvanized Steel Finish: ASTM A 392, Class I, with not less than 1.2 oz. zinc per sq. ft. of uncoated wire surface.

D. PVC Coating: ASTM F668, Class 2B (fused) PVC coating, black color.

E. Selvage shall be twisted at the top and knuckled at the bottom.

2.3 FRAMING:

A. Strength requirements for posts and rails shall conform to ASTM F 669.

B. Pipe shall be straight, true to section, material, and sizes specified.

C. Steel Framework, General: Posts, rails, braces and gate frames.

1. Type II Pipe: Manufactured from steel conforming to ASTM A 569 or A 446, grade D, cold formed, electric welded with minimum yield strength of 50,000 p.s.i. and triple coated with minimum 0.9 oz. Zinc per square foot after welding, a chromatic conversion coating and a clear polymer overcoat. Corrosion protection on inside sur- faces shall protect the metal from corrosion when subjected to the salt spray test of ASTM B 117 for 300 hours with the end point of 5% Red Rust.

D. End, Corner and Pull Posts:

1. For fabric height up to 6' - 2.375" OD Type II steel pipe.

2. For fabric height over 6' - 2.875" OD Type II steel pipe.

E. Line Posts:

1. For fabric height up to 6' - 1.90" OD Type II steel pipe.

2. For fabric height over 6' - 2.375" OD Type II steel pipe.

F. Gate Posts:

1. Provide posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as indicated on plans.

G. Top & Bottom Rail:

1. Manufacturer's longest lengths, with expansion-type couplings, approximately 6" long, for each joint. Provide means for attaching rail securely to each gate corner, pull, & end post.
   a) Galvanized Steel: 1-1/2" NPS (1.66" OD) Type II steel pipe.

2.4 FITTINGS AND ACCESSORIES:

A. Material: Comply with ASTM F 626. Mill finished galvanized steel, to suit manufacturer's standards.

1. Zinc Coating: Unless specified otherwise, galvanize steel fence fittings and accessories in accordance with ASTM A 153, with zinc weights indicated.

2. Supplemental Color Coating: In addition to above metallic coatings, provide a 10- mil minimum polyvinyl chloride (PVC) plastic resin finish applied to exterior surfaces and, except inside cap shapes, to exposed interior surfaces. Color to match chain link fabric.

B. Tension Wire: 0.177"-diameter metallic coated steel marcelled tension wire conforming to ASTM A 824 with finish to match fabric.

1. Type II Zinc Coated, Class 2, with a minimum coating weight of 1.2 oz. Per sq. ft. of uncoated wire.

C. Tie Wires: 12-gauge (0.106") diameter galvanized steel with a minimum of 0.80 oz. per sq. ft. of zinc coating of surface area in accordance with ASTM A 641.

D. Post Brace Assembly:

1. Manufacturer's standard adjustable brace at end of gateposts and at both sides of corner and pull posts, with horizontal brace located at mid height of fabric. Provide same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener. Manufacturer's standard galvanized steel cap required for each end.

E. Intermediate and/or Center Rail: Same material as top rail. Manufacturer's standard galvanized steel cap required for each end.

F. Post and Line Caps: Weathertight closure cap required for each post. Use line post caps with loop to receive tension wire or top rail.

G. Tension or Stretcher Bars: Hot-dip galvanized steel with minimum length 2" less than full height of fabric, minimum cross section of 3/16" by ¾" and minimum 1.2 oz. zinc coating per sq. ft. of surface area. One bar is required for each gate and end post and two for each corner and pulls post, except where fabric is integrally woven into post.

H. Tension and Brace Bands: Minimum ¾" wide hot-dip galvanized steel with minimum:

1. 1.2 oz. zinc coating per sq. ft. of surface area.

2. Tension bands: Minimum 14 gauge (0.074") thick.

3. Tension and Brace bands: Minimum 12 gauge (0.105") thick.

I. Concrete: Comply with the requirements for VDOT Std. Class A3 concrete.

J. Barbed wire: Where required, shall meet requirements of ASTM A 121. Each strand shall consist of two 12 gage twisted copper bearing, 0.20 percent copper, steel line wires, zinc coated, Class 2, having 14 gage 4 point barbs spaced 3 inches apart.

K. PVC Privacy Slats: Where required, privacy slats shall be hollow durable solid PVC material, incorporating a vertical locking system to prevent shifting of individual slats. Slats shall provide approximately 75% coverage of fence open area. Color shall be selected by Owner.

2.5 GATES:

A. Fabrication:

1. Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories. Space frame members maximum of 8' apart unless otherwise indicated.Provide same fabric as for fence. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretcher hooks to gate frame at not more than 15" o.c.

2. Install diagonal cross bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.

B. Swing Gates: Comply with ASTM F 900.

1. Fabricate perimeter frames of minimum 1.90" OD Type II steel pipe.

C. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:

1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 degrees gate opening. Provide 1-1/2 pair of hinges for each leaf over 6' nominal height.
2. Latch: Forked type to permit operation from either side of gate, with padlock eye as integral part of latch.
3. Keeper: Provide keeper that automatically engages gate leaf and holds it in open position until manually released.
4. Double Gates: Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar. Include locking device and padlock eyes as integral part of latch, per- mitting both gate leaves to be locked with single padlock.

3. EXECUTION

2.6 INSTALLATION

A. General: Install fence in compliance with ASTM F 567 and manufacturer's recommendations. Do not begin installation and erection before final grading is completed, unless otherwise permitted. Apply fabric to outside of framework, unless otherwise indicated.

B. Excavation:

1. Drill or hand excavate (using post hole digger) holes for posts to diameters and spacing indicated, in firm, undisturbed or compacted soil.
2. Excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than 4 times largest cross-section of post.
3. Excavate hole depths approximately 6" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.

C. Setting Posts:

1. Space 10' o.c. maximum, unless otherwise indicated.
2. Center and align posts in hole, 6" above bottom of excavation.
3. Protect portions of concrete posts above ground from concrete splatter. Place concrete around post and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
4. Extend concrete above grade and slope all around (dome) to allow for drainage away from post.
5. Top Rails: Run rail continuously through line post caps, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.

D. Center Rails:

1. Install in one place between posts and flush with post on fabric side, using rail ends and special offset fittings where necessary.

E. Bottom Rails:

1. Install in one piece between posts and flush with post on fabric side, using rail ends and

special offset fittings when necessary.

F. Brace Assemblies:

1. Install braces so posts are plumb when diagonal rod is under proper tension.

G. Top and Bottom Tension Wire:

1. Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than same gauge and type of wire. Pull wire taut, without sags. Fasten fabric to tension wire, using 11 - gauge galvanized steel hog rings spaced maximum 24" o.c.

H. Fabric:

1. Leave approximately 2" between finish grade and bottom selvage. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, un- less otherwise indicated, and anchor to framework so that fabric remains in tension after pulling force is released.

I. Stretcher Bars:

1. Thread through fabric 4" o.c., and secure to end, corner, pull, and gateposts with tension bands spaced maximum 15" o.c.

J. Tie Wires:

1. Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe, and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.

2. Tie fabric to line posts with wire ties spaced 12" o.c. and to rails and braces with wire ties spaced 24" o.c. Tie fabric to tension wires, with hog rings spaced 24"o.c.

K. Fasteners:

1. Install nuts for tension bands and hardware bolts on site of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

L. Gates:

1. Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

END OF SECTION

SECTION 33 3213
SUCTION LIFT PUMP STATION

1. GENERAL

1.1 Work under this section includes, but is not limited to, furnishing and installing a factory built triplex pump station as indicated on the project drawings, herein specified, as necessary for proper and complete performance.

1.2 REFERENCES

A. Publications listed below form part of this specification to extent referenced in the text by basic designation only. Consult latest edition of publication unless otherwise noted.

1. American National Std. Institute (ANSI) / American Water Works Assoc. (AWWA)
   a) ANSI B16.1 Cast iron pipe flanges and flanged fittings.
   b) ANSI/AWWA C115/A21.51 Cast/ductile iron pipe with threaded flanges.
   c) ANSI 253.1 Safety Color Code for Marking Physical Hazards.
   d) ANSI B40.1 Gages, Pressure and Vacuum.
   e) AWWA C508 Single Swing Check Valves.

2. American Society for Testing and Materials (ASTM)
   f) ASTM A48 Gray Iron Castings.
   g) ASTM A126 Valves, Flanges, and Pipe Fittings.
   h) ASTM A307 Carbon Steel Bolts and Studs.
   i) ASTM A36 Structural Steel.

3. Institute of Electrical and Electronics Engineers (IEEE)
   j) ANSI/IEEE Std 100 Standard Dictionary of Electrical Terms.
   k) ANSI/IEEE Std 112 Test Procedure for Polyphase Induction Motors.
   l) IEEE Std 242 Protection of Industrial and Control Power Systems.
   m) National Electric Code (NEC) / National Electrical Manufacturers Assoc. (NEMA)
   n) NEC National Electric Code.
   o) NEC 701 National Electric Code article 701.
   p) NEMA Std MG1 Motors and Generators.

4. Miscellaneous References
   q) Ten-State Standards Recommended Standards for Sewage Works.
   r) Hydraulic Institute Std for Centrifugal, Rotary and Reciprocating Pumps.
   s) NMTBA and JIC Std. National Machine Tool Builders Association and Joint Industrial Council Standards
   t) ISO 9001International Organization for Standardization.

1.3 SYSTEM DESCRIPTION

A. Contractor shall furnish and install one factory built, automatic pump station. The station shall be complete with all equipment specified herein, factory assembled on a steel baseplate.

B. The principal items of equipment shall include three self-priming, horizontal, centrifugal, v-belt motor driven sewage pumps, valves, and piping. A pump motor control panel with variable frequency drives, thermal-magnetic circuit breakers, magnetic motor starters, float controls, and internal wiring.

C. Factory built pump station design, including materials of construction, pump features, valves and piping, and motor controls shall be in accordance with requirements listed under PART 2 - PRODUCTS of this section.

1.4 PERFORMANCE CRITERIA

A. Pumps must be designed to handle raw, unscreened, domestic sanitary sewage. Pumps shall have 8" suction connection, and 6" discharge connection. Each pump shall be selected to perform under following operating conditions:

1.	Capacity (GPM)	875
2.	Total Dynamic Head (FT)	144
3.	Total Dynamic Suction Lift(FT)	20.0
4.	Maximum Repriming Lift (FT)	14.0
5.	Maximum Static Suction Lift(FT)	19.5
6.	Total Discharge Static Head (FT)	110
7.	Minimum Submergence Depth (FT)	2.94

B. Station Power Requirements

1. Site power furnished to the pump station shall be 480Y/277Vac, 3-Phase, 4-Wire, 60Hz and shall be maintained within industry standards. Each 480Vac/3-Phase VFD Control Panel shall be rated for an available fault current of 65kA rms symmetrical. The 120Vac Single Phase Pump Station Control Panel (PSCP) shall be rated for an available fault current of 22kA rms symmetrical. Voltage tolerance shall be plus or minus 10 percent. Phase-to-phase unbalance shall not exceed 1% average voltage as set forth in NEMA Standard MG-1. Control voltage shall not exceed 132 volts.

1.5 SUBMITTALS

A. Product Data

1. Prior to fabrication, pump station manufacturer shall submit digital copy of submittal data for review and approval.

2. Submittal shall include shop drawings, electrical ladder logic drawings, and support data as follows: Catalog cut sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor and v-belt drive data, pump characteristic curves showing the design duty point capacity (GPM), head (FT), net positive suction head required (NPSHr), and hydraulic brake horsepower (BHP). Electrical components used in the motor branch and liquid level control shall be fully described.

B. Shop drawings shall provide layout of mechanical equipment and anchor bolt locations for equipment baseplate. The electrical ladder logic drawings shall illustrate motor branch and liquid level control circuits to extent necessary to validate function and integration of circuits to form a complete working system.

C. Operations Maintenance Manuals

1. Installation shall be in accordance with written instructions provided by the pump station manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience on exact equipment supplied.

2. Documentation shall be specific to the pump station supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the station manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design,

shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:

a) Functional description of each major component, complete with operating instructions.
b) Instructions for operating pumps, motors, and pump controls in all modes of operation.
c) Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.
d) Support data for commercially available components not produced by the station manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.
e) Electrical schematic diagram of the pump station circuits shall be in accordance with NFPA70. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the station operator, need not be included. Details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.

3. Mechanical layout drawing of the pump station and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves and piping.

D. Operation and maintenance instructions which rely on vendor cut sheets and literature which include general configurations, or require operating personnel to selectively read portions of the manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications.

1.6 QUALITY ASSURANCE

A. The pumps and pump station manufacturer must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

B. The pumps and pump station manufacturer must be registered to the ISO 14001 Environmental Management System standard and as such is committed to minimizing the impact of its activities on the environment and promoting environmental sustainability by the use of best management practices, technological advances, promoting environmental awareness and continual improvement.

C. Upon request from the engineer, the pump station manufacturer shall prove financial stability and ability to produce the station within the specified delivery schedules. Evidence of facilities, equipment and expertise shall demonstrate the manufacturer's commitment to long term customer service and product support.

D. Manufacturer must show proof of original product design and testing. Products violating intellectual property regulations shall not be allowed, as they may violate international law and expose the user or engineer to unintended liabilities. “Reverse-engineered” products fabricated to substantially duplicate the design of original product shall not be allowed, as they may contain substantial differences in tolerances and material applications addressed in the original design, which may contribute to product failure.

E. The term “pump manufacturer” or “pump station manufacturer” shall be defined as the entity which designs, machines, assembles, hydraulically tests and warranties the final product. Any entity that does not meet this definition will not be considered a “pump

manufacturer" or "pump station manufacturer" and is not an acceptable supplier. For quality control reasons and future pump and parts availability, all major castings of the pump shall be sourced and machined in North America.

F. Pump Performance Certifications

1. All internal passages, impeller vanes, and recirculation ports shall pass a 3" spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with priming and pump performance shall not be permitted. Upon request from the engineer, manufacturer's certified drawings showing size and location of the recirculation port(s) shall be submitted for approval.

2. Reprime Performance
   a) Consideration shall be given to the sanitary sewage service anticipated, in which debris is expected to lodge between the suction check valve and its seat, resulting in the loss of the pump suction leg, and siphoning of liquid from the pump casing to the approximate center line of the impeller. Such occurrence shall be considered normal, and the pump must be capable of automatic, unattended operation with an air release line installed.
   b) During unattended operation, the pump shall retain adequate liquid in the casing to insure automatic repriming while operating at its rated speed in a completely open system. The need for a suction check valve or external priming device shall not be required.
   c) Pump must be capable of providing the Maximum Repriming Lift stated above at the specified speed and impeller diameter. Reprime lift is defined as the static height of the pump suction above the liquid, while operating with only one-half of the liquid remaining in the pump casing. The pump must reprime and deliver full capacity within five minutes after the pump is energized in the reprime condition. Reprime performance must be confirmed with the following test set-up:

      1) A check valve to be installed down stream from the pump discharge flange. The check valve size shall be equal (or greater than) the pump discharge diameter.

      2) A length of air release pipe shall be installed between pump and the discharge check valve. This line shall be open to atmosphere at all times duplicating the air displacement rate anticipated at a typical pump station fitted with an air release valve.

      3) The pump suction check valve shall be removed. No restrictions in the pump or suction piping will prevent the siphon drop of the suction leg. Suction pipe configuration for reprime test shall incorporate a 2 feet minimum horizontal run, a 90o elbow and vertical run at the specified lift. Pipe size shall be equal to the pump suction diameter.

      4) Impeller clearances shall be set as recommended in the pump service manual.

      5) Repeatability of performance shall be demonstrated by testing five consecutive reprime cycles. Full pump capacity (flow) shall be achieved within five minutes during each cycle.

      6) Liquid to be used for reprime test shall be water.
   d) Upon request from the engineer, certified reprime performance test results, prepared by the manufacturer, and certified by a registered professional engineer, shall be submitted for approval prior to shipment.

G. Certified Pump Performance Test

1. Tests shall be conducted in accordance with Hydraulic Institute Standards 14.6.3.4 Acceptance Grade 2B at the specified head, capacity, rated speed and horsepower. The performance tests will validate the correct performance of the equipment at the design head, capacity and speed.
2. For pumps utilizing up to (13 HP) motors; but larger than (1.3 HP), tests shall be conducted in accordance with Hydraulic Institute Standards 14.6.3.4.1, as the specified head, capacity, rated speed and horsepower.

H. Factory System Test

1. All components including the pumps, motors, valves, piping and controls will be tested as a complete working system at the manufacturer's facility. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head, capacity, rated speed and horsepower. Factory operational test shall duplicate actual performance anticipated for the complete station.
2. Upon request from the engineer, the operational test may be witnessed by the engineer, and/or representatives of his choice, at the manufacturer's facility.

I. The manufacturer’s technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment as described in Part 3 of this section.

1.7 MANUFACTURER'S WARRANTY

A. The pump station manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below.

1. All equipment, apparatus, and parts furnished shall be warranted for sixty (60) months, excepting only those items that are normally consumed in service, such as light bulbs, oils, grease, packing, gaskets, O-rings, etc. The pump station manufacturer shall be solely responsible for warranty of the station and all components.

B. Components failing to perform as specified by the engineer, or as represented by the manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer.

2. PRODUCT

2.1 Unitary Responsibility

A. The pump station system integrator must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

B. In order to unify responsibility for proper operation of the complete pumping station, it is the intent of these Specifications that all system components, associated electrical panels, the three VFD Control Panels and the Pump Station Control Panel be furnished by a single supplier (unitary source). The pumping station must be of standard catalog design, totally warranted by the manufacturer. Under no circumstances will a system consisting of parts compiled and assembled by a manufacturer's representative or distributor be accepted.

2.2 Manufacturer

A. The specifications and project drawings depict equipment and materials manufactured by The Gorman-Rupp Company which are deemed most suitable for the service anticipated.

2.3 Unit Base

A. The unit base shall be comprised of structural steel with a perimeter flange and reinforcements. Perimeter flange and reinforcements shall be designed to prevent flexing or warping under operating conditions. Perimeter flange shall be drilled for hardware used to secure unit base to concrete pad as shown on the contract drawings. Unit base shall contain provisions for lifting the complete pump unit during shipping and installation.

2.4 Pump Design

A. Pump shall be horizontal, self-priming centrifugal type, designed specifically for handling raw unscreened domestic sanitary sewage or industrial waste. Pump solids handling capability and performance criteria shall be in accordance with requirements listed under PART 1 - GENERAL of this section.

B. The pump manufacturer must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

C. Materials and Construction Features

1. Pump casing shall be cast iron Class 30 with integral volute scroll. Casing shall incorporate following features:
   a) Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.
   b) Fill port coverplate, 3 1/2" diameter, shall be opened after loosening a positive lock clamp bar assembly. In consideration for safety, capscrew threads must provide slow release of pressure, and the clamp bar shall be retained by detente lugs. A non-metallic gasket shall prevent adhesion of the fill port cover to the casing while assuring a reliable seal.
   c) Casing drain plug shall be at least 1 1/4" NPT to insure complete and rapid draining.
   d) Liquid volume and recirculation port design shall be consistent with performance criteria listed under PART 1 - GENERAL of this section.

2. Coverplate shall be cast iron Class 30. Design must incorporate the following maintenance features:
   a) Retained by hand nuts for complete access to pump interior. Coverplate removal must provide ample clearance for removal of stoppages, and allow service to the impeller, seal, wearplate or check valve without removing suction or discharge piping.
   b) A replaceable wearplate secured to the coverplate by weld studs and nuts shall be AISI 1015 HRS. Wearplate shall be self-cleaning design ensuring that debris is cleared away and does not collect on the impeller vanes.
   c) In consideration for safety, a pressure relief valve shall be supplied in the coverplate. Relief valve shall open at 75-200 PSI.
   d) Two O-rings of Buna-N material shall seal coverplate to pump casing.
   e) Pusher bolt capability to assist in removal of coverplate. Pusher bolt threaded holes shall be sized to accept same retaining capscrews as used in rotating assembly.
   f) Easy-grip handle shall be mounted to face of coverplate.

3. Rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, seal plate and bearing housing, must be removable as a single unit without disturbing the pump casing or piping. Design shall incorporate the following features:
   a) Seal plate and bearing housing shall be cast iron Class 30. Anti-rotation ribs shall be cast into the sealplate to reduce internal wear and maximize component life. Separate oil filled cavities, vented to atmosphere, shall be provided for shaft seal

and bearings. Cavities must be cooled by the liquid pumped. Three lip seals will prevent leakage of oil.

1) The bearing cavity shall have an oil level sight gauge and fill plug check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil without removal of the fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.

2) The seal cavity shall have an oil level sight gauge and fill/vent plug. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the fill/vent plug.

3) Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.

b) Impeller shall be ductile iron, two vane, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall be statically or dynamically balanced. Impeller shall thread onto the pump shaft and be secured with a lockscrew and conical washer.

c) Shaft shall be AISI 4140 alloy steel unless otherwise specified by the engineer, in which case AISI 17-4 pH stainless steel shall be supplied.

d) Bearings shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil lubricated from a dedicated reservoir. Pump designs which use the same oil to lubricate the bearings and shaft seal shall not be acceptable.

e) Shaft seal shall be oil lubricated mechanical type. The stationary and rotating seal faces shall be silicon carbide alloy. Each mating surface shall be lapped to within three light bands flatness (35 millionths of an inch), as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating by virtue of a dual O-ring design. An external O-ring secures the stationary seat to the sealplate, and an internal O-ring holds the faces in alignment during periods of mechanical or hydraulic shock (loads which cause shaft deflection, vibration, and axial/radial movement). Elastomers shall be viton; cage and spring to be stainless steel. Seal shall be oil lubricated from a dedicated reservoir. The same oil shall not lubricate both shaft seal and shaft bearings. Seal shall be warranted in accordance with requirements listed under PART 1 - GENERAL of this section.

f) Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same capscrews as used for retaining rotating assembly.

4. Adjustment of the impeller face clearance (distance between impeller and wearplate) shall be accomplished by external means.

a) Clearances shall be maintained by a four point external shimless coverplate adjustment system, utilizing a four collar and four adjusting screw design allowing for incremental adjustment of clearances by hand as required. Each of the four points shall be lockable to prevent inadvertent clearance increases or decreases due to equipment vibration or accidental operator contact. The four point system also allows for equal clearance gaps at all points between the impeller and wear plate. Requirement of realignment of belts, couplings, etc., shall not be acceptable. Coverplate shall be capable of being removed without disturbing clearance settings. Clearance adjustment systems that utilize less than four points will not be considered.

b) There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the coverplate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above
c) Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

5. An externally removable suction check valve shall be molded Neoprene with integral steel and nylon reinforcement. A blow-out center shall protect pump casing from hydraulic shock or excessive pressure. Removal or installation of the check valve must be accomplished from the top of pump without disturbing the suction piping or completely draining the casing. Sole function of check valve shall be to save energy by eliminating need to reprime after each pumping cycle. Pumps requiring a suction check valve to assist reprime will not be acceptable.

6. Pump shall include flange kit consisting of two female 125# NPT cast iron class 30 flanges suitable for attachment to suction and discharge ports.

7. Pump shall include flange kit consisting of two ASA spool flanges that shall be one piece cast iron class 30 suitable for attachment to suction and discharge ports. Each spool shall have one 1-1/4" NPT and one 1/4" NPT tapped hole with pipe plugs for mounting gauges or other equipment.

D. Serviceability

1. The pump manufacturer shall demonstrate to the engineer's satisfaction that consideration has been given to reducing maintenance costs.

2. No special tools shall be required for replacement of any components within the pump.

E. Pump drain kit

1. The pump drain kit shall consist of a 10' length of plastic hose with a quick connect female Kamlock fitting on one end of hose and two sets of fittings for pump drains. Each set of fittings for pump drain includes a stainless steel pipe nipple, stainless steel bushing, stainless steel ball valve and an aluminum quick connect male Kamlock fitting.

F. Spare parts kit

1. There shall be furnished with the pump station the following minimum spare parts:
a) One spare pump mechanical seal (complete), and with it all gaskets, seals, sleeves, O-rings, and packing required to be replaced during replacement of the seal.
b) One set of impeller clearance adjustment shims.
c) One set cover plate O-ring.
d) One rotating assembly O-ring.

2.5 Valves and Piping

A. Each pump shall be equipped with a full flow type check valve capable of passing a 3" spherical solid. Valve shall be constructed with flanged ends and fitted with an external lever and torsional spring. Valve seat shall be constructed of stainless steel, secured to the body to ensure concentricity, sealed by an O-ring, and shall be replaceable. The valve body shall be cast iron incorporating a clean-out port large enough to allow removal and/or replacement of the valve clapper without removing valve or piping from the line. Valve clapper shall have a molded neoprene seating surface incorporating low pressure sealing rings. Valve hinge pin and internal hinge arm shall be stainless steel supported on each end in brass bushings. Shaft nut shall have double O-rings which shall be easily replaceable

without requiring access to interior of valve body. All internal hardware shall be stainless steel. Valve shall be rated at 175 PSI water working pressure, 350 PSI hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 3" spherical solid shall not be acceptable.

B. The discharge header shall include plug valves to permit each pump to be isolated from the common discharge header. Valves shall have ports designed to pass spherical solids equal to the pumps capability. The plug valve shall be non-lubricated, tapered type. Valve body shall be semi-steel with flanged end connections drilled to 125 pound standard. Valve shall be furnished with a drip-tight shutoff plug mounted in stainless steel bearings, and shall have a resilient facing bonded to the sealing surface. Valve shall be operated with a single lever actuator providing lift, turn, and reseat action. The lever shall be equipped with a locking device to hold the plug in the desired position.

C. Automatic air release valves:

1. An automatic air release valve shall be furnished for each pump designed to permit the escape of air to the atmosphere during initial priming or unattended repriming cycles. Upon completion of the priming cycle or repriming cycle, the valve shall close to prevent recirculation. Valves shall provide visual indication of valve closure, and shall operate solely on discharge pressure. Valves which require connection to the suction line shall not be acceptable.
2. All valve parts exposed to sewage shall be constructed of cast iron, stainless steel, or similar corrosion resistant materials. Diaphragms, if used, shall be of fabric-reinforced neoprene or similar inert material.
3. A cleanout port, three inches in diameter, shall be provided for ease of inspection, cleanout, and service.
4. Valves shall be field adjustable for varying discharge heads.
5. Connection of the air release valves to the station piping shall include stainless steel fittings.

D. Gauge kit

1. Each pump shall be equipped with a glycerin-filled compound gauge to monitor suction pressures, and a glycerin-filled pressure gauge to monitor discharge pressures. Gauges shall be a minimum of 4 inches in diameter, and shall be graduated in feet water column. Rated accuracy shall be 1 percent of full scale reading. Compound gauges shall be graduated -34 feet to +34 feet water column minimum. Pressure gauges shall be graduated 0 to 231 feet water column minimum.
2. Gauges shall be mounted on a resilient panel and frame assembly which shall be firmly secured to pumps or piping. Gauge installations shall be complete with all hoses and stainless steel fittings, and shall include a shutoff valve installed in each gauge inlet at the point of connection to suction and discharge pipes.

E. Piping

1. Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI/AWWA A21.51/C115 and class 53 thickness.
2. Flanges shall be cast iron class 125 and Comply with ANSI B16.1.
3. Pipe and flanges shall be threaded and suitable thread sealant applied before assembling flange to pipe.

4. Bolt holes shall be in angular alignment within 1/2^{o} between flanges. Flanges shall be faced with a gasket finish.

F. Contractor must insure all pipes connected to the pump station are supported to prevent piping loads from being transmitted to pumps or station piping. Pump station discharge force main piping shall be anchored with thrust blocks where shown on the contract drawings.

2.6 Drive Unit

A. Motors

1. Pump motors shall be 75 HP, 3 phase, 60 hertz, 460 VAC, horizontal ODP, 1345 RPM, NEMA design B with cast iron frame with copper windings, induction type, with class F insulation and 1.15 SF for normal starting torque and low starting current characteristics, suitable for continuous service. The motors shall not overload at the design condition or at any head in the operating range as specified.

2. Motors shall be tested in accordance with provisions of ANSI/IEEE Std 112.

B. Drive Transmission

1. Power to pumps transmitted V-belt drive assemblies. The sheave/belt combination shall provide the speed ratio needed to achieve the specified pump operating conditions.

2. Each drive assembly shall utilize at least two V-belts providing minimum a combined safety factor of 1.5. Single belt drives or systems with a safety factor of less than 1.5 are not acceptable. Computation of safety factors shall be based on performance data published by the drive manufacturer.

3. Belt guards
   a) Pump drive transmissions shall be enclosed on all sides in a guard constructed of any one or combination of materials consisting of expanded, perforated, or solid sheet metal, except that maximum perforated or expanded openings shall not exceed 1/2 inch.
   b) Guards shall be manufactured to permit complete removal from the pump unit without interference with any unit component, and shall be securely fastened to the unit base.
   c) All metal shall be free of burrs and sharp edges. Structural joints shall be continuously welded. Panels may be riveted to frames with not more than five inch spacing. Tack welds shall not exceed four-inch spacing.
   d) The guard shall be finished with one coat of gray W.R. non lift primer and one coat of orange acrylic alkyd W.R. enamel in accordance with section 3, Color Definitions of ANSI 253.1; Safety Color Code for Marking Physical Hazards.

2.7 Finish

A. Pumps, piping, and exposed steel framework shall be cleaned prior to coating using an approved solvent wipe or phosphatizing cleaner. The part must thoroughly dry before paint application. Open joints shall be caulked with an approved polyurethane sealant. Exposed surfaces shall be applied with one coat of Tnemec Series 69 Polymide Epoxy Primer and one finish coat of Series 73 Aliphatic Acrylic Polyurethane for a total dry film thickness of 4-6 mils. Finish coat shall be semi-gloss white for optimum illumination and enhancement. The coating shall be corrosion, moisture, oil, and solvent resistant when completely dry. The factory finish shall allow for over-coating and touch-up for 6 months after coating. Thereafter, it will generally require sanding to accept a topcoat or touch-up coating. See Product Data Sheet for additional information.

2.8 Pump Station Control Panel (PSCP) shall include but not be limited to the following:

A. The pump station control panel (PSCP) will be tested as an integral unit by the pump station manufacturer. The control panel shall also be tested with the pump station as a complete working system at the pump station manufacturer's facility.

B. The electrical control components shall be provided by the pump station supplier and shall be provided with the following features.

C. Panel PSCP enclosure

1. Enclosure shall be constructed in conformance with applicable section of National Electrical Manufacturers Association (NEMA) standards for Type 12 electrical enclosures. Enclosure shall be fabricated of steel having a minimum thickness of not less than 0.075 Inch (14 gauge). All seams shall be continuously welded, and shall be free of burrs and voids. Interior and exterior surfaces shall be coated with a paint finish suitable for the NEMA classification of the enclosure. There shall be no holes through the external walls of the enclosure for mounting the enclosure or any components contained within the enclosure. Panel enclosure up to 60" x 48" x 12" shall be mounted on 12” floor stands where shown in the electrical room.

2. Enclosure shall be equipped with a door mounted on a continuous steel hinge, and sealed around its perimeter. Door shall be held closed with door handles that are quick and easy to operate. The door shall accommodate the mounting of switches and indicators.

3. Enclosure shall be furnished with a removable back panel, fabricated of steel having a thickness of not less than 0.106 Inch (12 gauge), which shall be secured to the enclosure with collar studs. Such panel shall be of adequate size to accommodate all basic components with 25% spare capacity.

4. All control components shall be securely fastened to a removable back panel with screws and lock washers. Switches, indicators and instruments shall be mounted through the control panel door. All control devices and instruments shall be secured to the sub-plate with machine screws and lockwashers. Mounting holes shall be drilled and tapped; Self-tapping screws shall not be used to mount any components. All connections from the back panel to door mounted or remote devices shall be made through terminal blocks. All control devices shall be clearly labeled to indicate function.

D. UL Label Requirement:

1. Pump station controls shall conform to third party safety certification. The panel shall bear a serialized UL label listed for "Enclosed Industrial Control Panels". The enclosure, and all components mounted on the sub-panel or control cover shall conform to UL descriptions and procedures.

E. PSCP Power:

1. The Pump Station Control Panel shall be powered with a 120Vac single phase 20-Amp Circuit Breaker in the pump station Panelboard PB for the control and auxiliary equipment. An operating mechanism shall penetrate the control panel door. and a padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until the operator handle is in the "OFF" position. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.

F. PSCP Control Functions:

1. Reference the Typical VFD Control Panel Schematic on Sheet E-2, the Liquid Level Control System (Section 2.10) and the PLC Control System (Section 2.11) for additional requirements and functions.
2. Provide Triplex Alternating control of all three pumps if the HOA switches of all three pumps are in Auto.
3. Provide Duplex Alternating control for two pumps if the HOA switches of only two pumps are in Auto.
4. Provide control for a single pump if only one of the pumps HOA switches are in Auto.
5. Alternation shall occur after each On then Off Cycle of the designated Lead Pump as controlled by the Lead ON Float and the Pumps OFF Float.
6. Alarms shall be locally displayed on Panel PSCP and repeated to the City Scada Panel (CSP). An additional circuit shall be included to lockout a pump from being called to run until a manual reset pushbutton has been pressed by an operator and the motor has sufficiently cooled down after a Pump High-Temperature condition has occurred.
7. An Alarm silence pushbutton

a. Provide an audible alarm buzzer with an alarm silence pushbutton.

8. Indicating lights shall be LED and rated for the enclosure where they are installed. Lamps shall be replaceable from the front without opening the control panel door and without the use of tools. Indicating lights will be provided for the following functions:
   a) High wet well level
   b) Alarm silenced
   c) Pump #1 Called to Run
   d) Pump #2 Called to Run
   e) Pump #3 Called to Run
   f) Pump #1 Running
   g) Pump #2 Running
   h) Pump #3 Running
   i) Pump #1 Fault
   j) Pump #2 Fault
   k) Pump #3 Fault
   l) Pump #1 VFD Fault
   m) Pump #2 VFD Fault
   n) Pump #3 VFD Fault
   o) Pump #1 high pump temperature shutdown
   p) Pump #2 high pump temperature shutdown
   q) Pump #3 high pump temperature shutdown
   r) Provide a status light for each float
   s) 115 volt power available

2.9 Pump VFD Control Panels:

A. Provide an individual Variable Frequency Drive (VFD) Control Panel for each pump with the following:

1. Reference the Typical VFD Control Panel Schematic on Sheet E-2, the Liquid Level Control System (Section 2.10) and the PLC Control System (Section 2.11) for additional requirements and functions.

2. Coordinate the selection of the VFD with the pump supplier to ensure compatibility and all operating requirements including but not limited to horse power, voltage, ampacity and rpm.
3. A main terminal block and ground lug shall be furnished for field connection of the electrical supply. The main terminal block shall be mounted to allow incoming wire bending space per he National Electric Code (NEC). A separate terminal strip shall be provided for 115 volt, single phase control power and shall be segregated from the main terminal block. Ten percent of the control terminals shall be furnished as spares.
4. All motor branch and power circuit components shall be of highest industrial quality. The short circuit current rating of all power circuit devices shall be a tested combination or evaluated per the National Electrical Code Article 409. The lowest rated power circuit component shall be the overall control panel short circuit rating and shall not be less than the fault current available. The minimum control panel rating shall not be less than 10 kA, rms symmetrical. Control assemblies operating at 120 volts nominal or less may be provided with transformers which limit the fault current and may be rated less than the minimum required short circuit rating.
5. Provide a properly sized heavy duty air circuit breaker or fused switch shall be furnished for each pump motor. All circuit breakers shall be sealed by the manufacturer after calibration to prevent tampering. The VFD Enclosure shall include a door mounted padlocking operating mechanism with interlocks which permit the door to be opened only when circuit breakers are in the "off" position. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.
6. Provide a Three Phase Voltage Monitor to monitor the incoming power and shut down its respective pump motor when required to protect the motor(s) from damage caused by phase reversal, phase loss, high voltage, low voltage, and voltage unbalance. An adjustable time delay shall be provided to minimize nuisance trips. The VFD shall automatically resume normal operation after an adjustable time delay, when power conditions return to normal.
7. Provide a Transient Voltage Surge Suppressor with a modular surge arrestor to minimize damage to the pump motors and control from transient voltage surges. The suppressor shall utilize thermally protected by heavy duty zinc oxide varistors encapsulated in a non conductive housing. Mechanical indicators shall be provided on each phase to indicate protection has been lost. The suppressor shall have a short circuit current rating of 200,000 Amps and a Maximum Discharge current rating [Imax] of 40,000 Amperes. Nominal discharge current [In] is 20,000 Amperes. Surge arrester according to UL 1449 3rd Edition,Type 2 component assembly.
8. Provide a Voltage Alert Indicator to reduce the risk of electrical arc flash by pre-verifying the electrical isolation from outside of the control panel. Hardwired to the main incoming point of termination, the indicator shall be powered by the same voltage that it indicates utilizing redundant circuitry, thereby flashing whenever voltage is present. An eight detector display shall visually alert the presence of dangerous AC or DC potentials occurring between any combination of the monitored input lines.
9. Six digit elapsed time meter (non-reset type) shall be connected to each motor starter to indicate total running time of each pump in "hours" and "tenths of hours". An integral pilot light shall be wired in parallel to indicate that the motor is energized and should be running.

B. Wiring

1. The pump station components, as furnished by the manufacturer, shall be completely pre-wired. (Note: If control panel is opted to be shipped loose, the pump station as furnished by the manufacturer shall be completely pre-wired except for the power feeder lines and final connections to pump motors, and remote alarm devices. The interconnecting wire, conduit, and other materials required shall be furnished and installed by the electrical contractor.)

2. All wiring, workmanship, and schematic wiring diagrams shall be in compliance with applicable standards and specifications for industrial controls set forth by the Joint Industrial Council (JIC), National Machine Tool Builders Association (NMTBA), and the National Electric Code (NEC).

3. All user serviceable wiring shall be type MTW or THW, 600 volts, and shall be color coded as follows:
   a) Line and load circuits, AC or DC power……black
   b) AC control circuit less than line voltage…… red
   c) DC control circuit……blue
   d) Interlock control circuit, from external source……yellow
   e) Equipment grounding conductor……green
   f) Current carrying ground…… white
   g) Hot with circuit breaker open……orange

4. Wire identification and sizing
   a) Control circuit wiring inside the panel, with the exception of internal wiring of individual components, shall be 16 gauge minimum, type MTW or THW, 600 volts. Wiring in conduit shall be 14 gauge minimum. Motor branch wiring shall be 10 gauge minimum.
   b) Motor branch conductors and other power conductors shall not be loaded above the temperature rating of the connected termination. Wires shall be clearly numbered at each end in conformance with applicable standards. All wire connectors in the control panel shall be of the ring tongue type with nylon insulated shanks. All wires on the sub-plate shall be bundled and tied. All wires extending from components mounted on door shall be terminated on a terminal block mounted on the back panel. All wiring outside the panel shall be installed in conduit.

5. Control conductors connecting components mounted on the enclosure door shall be bundled and tied in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall be allowed so that the door can swing to its full open position without undue mechanical stress or abrasion on the conductors or insulation. Bundles shall be clamped and held in place with mechanical fastening devices on each side of the hinge.

C. Conduit requirements are as follows:

1. All conduit and fittings shall be UL listed.

2. Liquid tight flexible metal conduit shall be constructed of a smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight, polyvinyl chloride cover.

3. Conduit shall be supported in accordance with articles 346, 347, and 350 of the National Electric Code.

4. Conduit shall be sized according to the National Electric Code.

D. Grounding

1. The pump station manufacturer shall ground all electrical equipment to the enclosure back panel. The mounting surface of all ground connections shall have any paint removed before making final connections.
2. The contractor shall provide an earth driven ground connection to the control panel at the main ground lug in accordance with the National Electric Code (NEC).

E. Equipment Marking

1. Permanent corrosion resistant name plate(s) shall be attached to the control and include following information:
   a) Equipment serial number
   b) Control panel short circuit rating
   c) Supply voltage, phase and frequency
   d) Current rating of the minimum main conductor
   e) Electrical wiring diagram number
   f) Motor horsepower and full load current
   g) Motor overload heater element
   h) Motor circuit breaker trip current rating
   i) Name and location of equipment manufacturer
2. Control components shall be permanently marked using the same identification keys shown on the electrical diagram. Labels shall be mounted adjacent to device being identified.
3. Switches, indicators, and instruments mounted through the control panel door shall be labeled to indicate function, position, etc. Labels shall be mounted adjacent to, or above the device.

2.10 Liquid Level Control System

A. The manufacturer of the liquid level control system must be ISO 9001:2008 revision certified, with scope of registration including design control and service after sales activities.

B. All components and functions associated with the Liquid Level Control System (Section 2.10) and the PLC Control System (Section 2.11) shall be an integral part of the Pump Station Control Panel (PSCP).

C. Pump station shall operate on utility power while such power is available, except for exercise periods as specified herein. When operating on utility power or auxiliary generator power, operation of pumps and motors shall be controlled by the level control system as specified herein. During a failure of utility power and during exercise periods, operation of the pump with the standby generator shall be controlled by the level control system as specified herein. Transfer from normal (utility power) and generator shall occur as follows.

1. PLC based controls shall be provided to accomplish the following functions:
   a) All operator adjustable settings shall be accessible via the operator interface without opening control panel door.
   b) Time delay after failure of utility power before transfer from normal to auxiliary control. Delay shall be manually adjustable from 0 to 600 seconds.
   c) Time delay after restoration of utility power before transfer from auxiliary control to normal control. Delay shall be manually adjustable from 2 to 1800 seconds.
   d) Automatic override of time delay after power restoration, upon occurrence of: generator or generator control failure.
   e) Manual override of time delay on restoration of normal power. Momentary pushbutton or similar device shall be acceptable.

f) Up to three pumps shall be permitted to run under normal power.
g) Up to two pumps shall be permitted to run under generator power.
h) Indicate the presence of utility (normal) power. Such indicator shall be the press to test type to permit the operator to verify failure of utility power.

D. Float Switch Level Control

1. The integral PLC level control system shall start and stop the pump motors in response to changes in wet well level, as set forth herein.
2. The integral level control system shall lock out one pump under auxiliary generator power.
3. The level control system shall be a float switch type system.
4. The level control system shall be designed to accomplish the following tasks:
   a) Start and stop pump motors as required by the level of liquid in the wet well.
   b) Select the sequence of pump operation upon operator command for automatic alternation.
   c) Provide alarm indications upon occurrence of predetermined malfunctions.
5. The level control system shall utilize alternation to select first one pump, then the second pump, then the third pump to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle, or in the event of excessive run time.
6. The level control system shall utilize a PLC and operator interface (O/I). Upon operator selection of automatic operation, the PLC shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump on level". When the liquid is lowered to the "pump off level", the PLC shall stop this pump. These actions shall constitute one pumping cycle. Should the wet well level continue to rise, the PLC shall start the second pump when the liquid reaches the "lag pump on level" so that two pumps are operating. Should the wet well level continue to rise, the PLC shall start the third pump when the liquid reaches the "lag lag pump on level" so that three pumps are operating.
   a) The PLC shall include integral components to perform all signal conditioning, EMI and RFI suppression, and 120 volt outputs. The PLC shall be solid state, and shall be integrated with other components to perform as described below.
   b) The PLC shall be capable of operating on a supply voltage of 24VDC in an ambient temperature range of 0 degrees C (32 degrees F) through 55 degrees C (131 degrees F). Control range shall be 0 to 12.0 feet of water with an overall repeat accuracy of (plus/minus) 0.1 feet of water. Memory shall be non volatile.
   c) The O/I (operator interface) shall be capable of operating on a supply voltage of 24VDC in an ambient temperature range of 0 degrees C (32 degrees F) through 50 degrees C (122 degrees F). Memory shall be non-volatile.
   d) The PLC level control shall consist of the following components: 6" color display, logic and output relays.
      1) Each output relay in the PLC level control shall be mechanical contact type. Each relay input shall be isolated from its output and shall provide high immunity to electrical noise. The "ON" state of each relay shall be indicated by illumination of a light emitting diode. Each output relay shall have an inductive load rating equivalent to one NEMA size 4 contactor. A pilot relay shall be incorporated for loads greater than a size 4 contactor.
   e) The PLC level control shall be equipped with LED status indicators.
   f) The PLC level control shall be equipped with operator adjustable pump start delay(s) preset at a delay time of five (5) seconds.

g) Control design in which application of power to the lag pump motor starter is contingent upon completion of the lead pump circuit shall not be acceptable.
h) The PLC level control shall be equipped with a simulator system capable of performing system cycle testing functions.
i) The PLC level control shall have internal capability of providing automatic alternation, manual selection of pump sequence operation, and alternation in the event of 10 9999 hours excessive run time.
j) The PLC level control shall be equipped with an electronic comparator and output relay to alert maintenance personnel to a high liquid level in the wet well. In the event that the wet well liquid reaches a preset high water alarm level the alarm output relay shall energize a signal relay. The signal relay shall complete a 12 volt DC circuit for an external alarm device. An indicator, visible on the front of the control panel, shall indicate that a high wet well level exists. The alarm signal shall be maintained until the wet well level has been lowered and the circuit has been manually reset. High water alarm shall be furnished with a dry contact wired to terminal blocks.
k) An alarm silence pushbutton shall be provided to permit maintenance personnel to de energize the audible alarm device while corrective actions are under way. After silencing the alarm device, manual reset of the alarm condition shall clear the alarm silence relay automatically. The pushbutton shall be integral to the operator interface.
l) The float switch level control system shall be provided with five intrinsically safe float switches.

E. Alarm Light (External)

1. Station manufacturer will supply one 12 VDC alarm light fixture with vapor-tight shatter resistant red globe, conduit box, and mounting base. The design must prevent rain water from collecting in the gasketed area of the fixture, between the base and globe. The alarm light will be shipped loose for installation to the exterior of the pump station building by the contractor.

F. Alarm Flasher

1. The alarm light circuit shall be equipped with a repeat cycle timer causing the alarm light to flash. Flash rate shall be approximately 1 second. (1/2 second on and off).

G. Alarm Horn (External)

1. Station manufacturer will supply one 12 VDC weatherproof alarm horn with projector, conduit box, and mounting base. The design must prevent rain water from collecting in any part of the horn. The alarm horn will be shipped loose for installation to the exterior of the pump station building by the contractor.

H. SCADA System

1. The Pump Station Control Panel (PSCP) provider shall coordinate with the City's SCADA System provider to ensure the required I/O are supplied. The City of Staunton currently uses:

Valley Automation, Inc.
3221 Peoples Drive
Harrisonburg, VA 22801
(540) 810-5285

2. SCADA and controls integration will be performed by Owner under a separate contract. Contractor shall install Owner-Furnished Panel CSP and associated instrumentation equipment supplied under the SCADA and controls integration contract.
3. The following SCADA inputs are anticipated:

Staunton WWPS Scada Panel CSP (IO LIST)	
PLC INPUT/OUTPUT LISTS	**Discrete**
Description	**Input**
Pump #1 HOA Selector Switch in AUTO	**X**
Pump #1 HOA Selector Switch in HAND	**X**
Pump #1 VFD RUNNING RELAY	**X**
Pump #1 VFD FAULT RELAY ALARM	**X**
Pump #1 VFD PUMP OVER-TEMPERATURE RELAY ALARM	**X**
Pump #1 VFD PUMP INTERLOCK RELAY ENERGIZED	**X**
Pump #2 HOA Selector Switch in AUTO	**X**
Pump #2 HOA Selector Switch in HAND	**X**
Pump #2 VFD RUNNING RELAY	**X**
Pump #2 VFD FAULT RELAY ALARM	**X**
Pump #2 VFD PUMP OVER-TEMPERATURE RELAY ALARM	**X**
Pump #2 VFD PUMP INTERLOCK RELAY ENERGIZED	**X**
Pump #3 HOA Selector Switch in AUTO	**X**
Pump #3 HOA Selector Switch in HAND	**X**
Pump #3 VFD RUNNING RELAY	**X**
Pump #3 VFD FAULT RELAY ALARM	**X**
Pump #3 VFD PUMP OVER-TEMPERATURE RELAY ALARM	**X**
Pump #3 VFD PUMP INTERLOCK RELAY ENERGIZED	**X**
Wet Well High Water Float	**X**
ATS: Utility Power Available	**X**
ATS: in Utility Position	**X**
ATS: in Generator Power Available	**X**
ATS: in Generator Position	**X**
ATS: Generator Running	**X**
ATS: Generator Common Alarm/Fault	**X**
DS1 - Electrical Room Door Switch	**X**
DS2 - Pump Room Door Switch	**X**
T1 - Electrical Room High Temperature Tstat	**X**
T2 - Electrical Room Low Temperature Tstat	**X**
T5 - Pump Room High Temperature Tstat	**X**
T6 - Pump Room Low Temperature Tstat	**X**
Exhaust Fan - RUNNING	**X**
Exhaust Fan - FAULT	**X**

2.11 PLC Control System

A. Programmable Logic Controller

1. The PLC shall be an Allen-Bradley CompacLogix Model L2 1769-L24ER-QE system.

2. The PLC shall operate on 24VDC power and be equipped with the communication devices, digital and analog I/O necessary to accomplish the specified operation. A minimum of 10% spare of the I/O used shall be supplied.

3. The program logic shall be stored in battery backed random access memory, as well as on a programmable, read only memory module. The memory module shall auto load and run when installed in the programmable control processor and is included to facilitate field repair or replacement of the programmable control hardware without the use of programming terminals or personal computers.
4. The power supply to the programmable control shall be industrial grade design with integral power factor correction, DC "OK" signal indicator, and adjustable voltage. Operating range shall be -10 degrees C to +60 degrees C. Power supply shall have infinite short circuit, overvoltage and overtemperature protection. Each motor starter or contactor shall be equipped with a surge suppressor.
5. An Allen-Bradley Panelview Plus 6 700 color electronic operator interface shall be provided for data entry and display. The operator interface shall be mounted on the front of the control panel with other operator controls. The operator interface shall be a TFT touch-screen terminal. A memory module shall be included.
6. Electromechanical relays and timers, when used shall be equipped with 120VAC coils and contacts rated Nema A-300 minimum.
7. All user adjustable timer settings shall be PLC based. Time delay adjustment to be accessible via the operator interface without opening control panel door.

B. Control Logic

1. Control logic shall be accomplished using programmable controllers. Electromechanical relays may be used when necessary. However, the primary control logic shall be performed by the PLC.
2. The O&M manual shall be provided with complete ladder logic program documentation including English names, rung comments, and coil/contact cross-references.
3. The control shall be pre-programmed or wired to provide the following routines:
   a) Pump alternation at lead stop
   b) Excessive pump run time alternation
   c) Jump to next pump on lead failure
   d) Start/stop pumps at normal level settings
   e) Pump start delays when called simultaneously
   f) One pump lockout when under generator power
   g) General alarm pilot light activation: Quick flashing alarm/slow flashing acknowledge/ steady on reset/off when clear
   h) Station trouble alarm (115VAC and normally open dry contact)
   i) High level alarm
   j) Pump start/stop level control
   k) Pump high temperature shutdown
   l) Automatic generator exerciser
4. The operator interface shall be equipped with the following displays and functions:
   a) Main Menu
   b) Wet Well Level Simulation
   c) High Water Alarm Status
   d) Pump High Temperature Status #1, #2, and #3
   e) Pump Speed Status #1, #2, and #3
   f) Pump Sequence Selection
   g) Alarm Silence

h) Alarm Reset
i) Alarm History
j) General Alarm Lamp Test
k) Power-up Delay Setpoint
l) Alarm Delay Setpoint
m) Pump Start Delay Setpoint
n) Alternation Time Interval Setpoint
o) Exercise Period Setpoints

3. EXECUTION

3.1 Examination

A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Station manufacturer shall provide written instruction for proper handling. Immediately after off-loading, contractor shall inspect complete pump station and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all station serial numbers and parts lists with shipping documentation. Notify the manufacturer's representative of any unacceptable conditions noted with shipper.

3.2 Installation

A. Install, level, align, and lubricate pump station as indicated on project drawings. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.

B. Suction pipe connections are vacuum tight. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on pump station piping. Install and secure all service lines (level control, air release valve or pump drain lines) as required in wet well.

C. Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to station control panel.

D. Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.

3.3 Field Quality Control

A. Operational Test

1. Prior to acceptance by owner, an operational test of all pumps, drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

2. After construction debris and foreign material has been removed form the wet well, contractor shall supply clear water volume adequate to operate station through several pumping cycles. Observe and record operation of pumps, suction and discharge gage readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment, test manual control devices, and automatic control systems. Be alert to any undue noise, vibration or other operational problems.

B. Manufacturer's Start-up Services

1. Coordinate station start-up with manufacturer's technical representative. The representative or factory service technician will inspect the completed installation. He will calibrate and adjust instrumentation, correct or supervise correction of defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures.
2. Eight (8) hours of on-site training for Owner's Operations staff shall be provided by a certified manufacturer's representative after the Owner's acceptance of the startup field test and report.
3. Contractor shall provide startup field test report and certification from the manufacturer's representative indicating that the equipment is ready to be placed into service.

3.4 Cleaning

A. Prior to acceptance, inspect interior and exterior of pump station for dirt, splashed material or damaged paint. Clean or repair accordingly. Remove from the job site all tools, surplus materials, scrap and debris.

3.5 Protection

A. The pump station should be placed into service immediately. If operation is delayed. Station is to be stored and maintained per manufacturer's written instructions.

END OF SECTION

SECTION 40 05 07
PROCESS PIPE SUPPORTS AND STANDS

1. GENERAL

1.1 DESCRIPTION

A. The work covered by this Section comprises the furnishing of all labor, material, equipment to fabricate and install pipe supports, pipe stands, anchors, and appurtenances as shown on the Drawings:

1.2 QUALITY ASSURANCE

A. Responsibility for all errors in fabrication and correct fitting of structures shown on the shop drawings is the Contractor's.

1.3 REGULATORY REQUIREMENTS

A. Metal fabrication materials shall meet the requirements of the following ASTM Standards and Specifications.

B. Structural steel, plates and shapes A-36

C. Structural bolts, A-325

D. Other Bolts, A-307

E. Steel pipe, A 53.

F. Galvanizing, A123.

G. Comply with the provisions of the following standards except as otherwise shown or specified.

1. AWS code for welding in building construction.

1.4 SUBMITTALS

A. Submit shop drawings and the Manufacturer's descriptive literature as applicable for all metal fabrications. No items shall be fabricated prior to review and approval by the Engineer. Minimum scale of drawings and elevations shall be 3/4 in. equals 1 ft., details enlarged to adequate size for clarity, show anchorage.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading

1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete in ample time to prevent delay of that Work.

B. Acceptance at Site

1. All boxes, crates, and packages shall be inspected by the Contractor upon delivery to the Site. The Contractor shall notify the Engineer, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with the Manufacturer's instructions.

C. Storage and Protection

1. Store materials to permit easy access for inspection and identification. Keep all

material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

2. Store all equipment in covered storage off the ground and prevent condensation and in accordance with the Manufacturer's recommendations for long-term storage.

2. PRODUCTS

2.1 ANCHOR BOLTS

A. All anchor bolts shall be stainless steel in accordance with Section 03 15 00 "Adhesive Anchors".

2.2 FABRICATED PIPE SUPPORTS

A. Pipe supports detailed on the drawings shall be shop fabricated.

B. All pipe supports shall be fabricated with minimum A36 steel.

C. All pipe supports shall be hot dipped galvanized after fabrication.

D. Comply with the requirements of Section 05 5000 Metal Fabrications.

2.3 MANUFACTURER'S PIPE SUPPORTS

A. Pipe supports that are specified by a Manufacturer's name and figure number shall be purchased as a complete fabricated unit.

B. All Purchased pipe supports shall be hot dipped galvanized after fabrication.

C. Accepted pipe support manufacturers shall be as follows or Engineer approved equal.

1. Grinnell

2. Standdon adjustable pipe supports as manufactured by Material Resources, Inc. 22700 N.W. Quatama Street, Hillsboro, Oregon 97124.

3. Trumbull Manufacturing

2.4 THREADED RODS, BOLTS AND NUTS

A. All threaded rods, bolts, and nuts shall be hot dipped galvanized in accordance with ASTM 153 where required as part of a support. Nuts shall be over sized and hot dipped galvanized for thread compatibility.

2.5 PIPE STANDS

A. Pipe stands where indicated or detailed on the drawings shall be fabricated by a prefabricated metal framing system as manufactured by Unistrut or Engineer approved equal.

B. All channel shall be a minimum 1-5/8 x 1-5/8 x 16 gauge Unistrut P2000 or Engineer approved equal.

C. All channel, nuts, bolts, clips, brackets and other appurtenances shall be a minimum of 304 stainless steel.

2.6 PIPE SUPPORTS BELOW THE EQUALIZATION TANK HIGH WATER LEVEL

A. All pipe supports and pipe stands located below the equalization tank high water level shall be constructed of a minimum of ASTM 304 stainless steel and shall adequately support the pipe.

B. All channel, nuts, bolts, clips, brackets and other appurtenances shall be a minimum of 304 stainless steel.

2.7 DUCTILE IRON AND STEEL PIPE SIZE CONSIDERATIONS

A. Pipe supports shall be fabricated to match the OD of the pipe they are to be supporting. Curvature of supports and u-bolts shall conform to the OD of the pipe.

B. For the stainless steel air piping pipe supports, the u-bolts shall be oversized to allow for pipe movement due to pipe expansion as indicated on the drawings. Where u-bolts are indicated to be loose, they are to be double nuted.

3. EXECUTION

3.1 INSTALLATION

A. All pipe supports and pipe stands shall be installed plumb, level, and square to the pipe and structures.

B. Hanger rods shall be secured at the structure and pipe supports with nuts to lock the rods in position to prevent movement. All rods shall be double nuted on each side of the hanger and support.

C. Coatings

1. Repair all damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and Manufacturer's written instructions.

2. Where it is necessary to assemble supports in the field with threaded pipe, all pipe threads shall be coated as described above.

END OF SECTION

APPENDIX A

Geotechnical Engineering Report

GEOTECHNICAL ENGINEERING REPORT

STAUNTON CROSSING
ELEVATED WATER TANK AND WASTEWATER PUMP STATION
CITY OF STAUNTON, VIRGINIA

JOB NUMBER: 49408.002

PREPARED FOR:

CITY OF STAUNTON, VA
P.O. BOX 58
STAUNTON, VIRGINIA 24402

July 21, 2023



TIMMONS GROUP

YOUR VISION ACHIEVED THROUGH OURS.

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EXECUTIVE SUMMARY

For your convenience, this report is summarized in outline form below. This brief summary should not be used for design or construction purposes without reviewing the more detailed conclusions and recommendations contained in this report.

1. The subsurface exploration performance of five (5) Standard Penetration Test borings to depths of approximately 10.9 to 43.6 feet below the ground surface and quantitative laboratory testing.

2. The borings encountered approximately 3 inches of surficial topsoil. Beneath the topsoil, two borings encountered fill to a depth of 4 feet. Otherwise, undisturbed residual soils, weathered rock, and auger refusal materials were encountered. Auger refusal materials (i.e., mass rock or boulders) were encountered in the borings, at depths ranging from approximately 10.9 to 43.6 feet below the ground surface. Groundwater was encountered in one of the pump station borings at a depth of approximately 4.5 feet below current grade.

3. The potential for karst features at this site is deemed to be low due to the presence of shale bedrock, which is generally considered to not be susceptible to karst development.

4. Near-surface soils were measured to of low to high plasticity and are very moisture sensitive. As such, we recommend that site grading be conducted during the typically warmer summer months, if possible. Moisture manipulation of structural fill materials should be anticipated. Where fill is present in slab-on-grade areas, the fill should be evaluated with test pit excavations and proofrolling. Excessively soft or debris-laden soils should be undercut and replaced with suitable well-compacted fill materials.

5. Excavations are expected to extend through low to high consistency soils, weathered rock, and mass rock. Some of the weathered rock is expected to be rippable. Otherwise, blasting will be required to remove non-rippable weathered rock, and mass rock.

6. On-site soils, excluding topsoil and debris-laden soils, should be suitable for re-use as structural fill. However, highly plastic soils should not be reused as structural fill within 3 feet of finished soil subgrade in the pump station area.

7. The proposed pump station, wet well, and elevated water tank structure may be supported on shallow foundations. The tank foundation should bear on weathered rock. Existing fill is not considered suitable for foundation support. Due to the presence of highly plastic soils in the proposed pump station area, foundations should bear at least 36 inches below the building's finished soil subgrade elevation.

8. We recommend the site be considered Seismic Site Classification C based on the current Virginia Building Code.

9. Imported granular backfill materials will be required for the cast-in-place retaining walls in the wet well.

10. If structural loading and proposed grades differ from those utilized in this report, we must be contacted to confirm or modify the recommendations of this report.

TIMMONS GROUP
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July 21, 2023

City of Staunton, Virginia
P.O. Box 58
Staunton, Virginia 24402

Attention: Mr. William Vaughn

Re: **Geotechnical Engineering Report**
Staunton Crossing - Elevated Water Tank & Wastewater Pump Station
City of Staunton, Virginia
Timmons Group Project No. 49408.002

Mr. Vaughn:

Timmons Group is pleased to submit this Geotechnical Engineering Report for the referenced project. The objectives of our services were to explore subsurface conditions and provide our geotechnical recommendations for site grading and foundation support.

1. PROJECT INFORMATION

The site is generally located at 1249 Richmond Avenue in the City of Staunton, Virginia. The project site is primarily comprised of an existing pump station, and woods and brush covered areas. A Site Vicinity Map is shown on Figure 1 in Appendix A.

The proposed project will consist of a new wastewater pump station and wet well structure to replace the existing pump station. In addition, a new elevated water tank will be constructed south of the pump station's location. The pump station will have a finished floor elevation near 1358 feet Mean Sea Level (MSL), and the bottom of the wet well is expected to be at approximately 1,336 feet MSL. The finished grade elevation for the elevated water tank area will be 1458 feet MSL.

Based on discussions with the project team, it is our understanding that the tank will have a capacity of 1 million gallons and approximately 250 feet in height. Based on the capacity of the tank, we expect that maximum load from this structure be approximately 10,000 kips. We expect maximum column and wall loads for the pump station elements bearing near existing grade will be 10 kips and 2 kips per linear foot, respectively.

2. FIELD EXPLORATION

The field exploration included a visual site reconnaissance by a representative of Timmons Group, performance of five (5) Standard Penetration Test (SPT) borings (B-1 through B-5), and installation of one (1) temporary PVC standpipe near the location of Boring B-2. Boring locations were selected by Timmons Group. A representative of Timmons Group established the boring locations in the field using GPS equipment. Approximate boring locations are shown on Figures 2A and 2B in Appendix A. The following is a summary of borings performed for the proposed construction:

- Wastewater Pump Station: Borings B-1 and B-2
- Elevated Water Tank: Borings B-3, B-4, and B-5

Borings were performed to auger refusal at depths of approximately 10.9 to 43.6 feet below the existing ground surface with hollow stem auger drilling techniques. Split-spoon samples of subsurface soils were taken within soil test borings at approximate 2-foot intervals above a depth of 10 feet and at 5-foot intervals below 10 feet. Two bulk samples of near-surface soil cuttings were also collected from boring locations B-1 and B-4. Standard Penetration Tests (SPT) were conducted in conjunction with split-spoon sampling in general accordance with ASTM D 1586. Within two of the borings (B-2 and B-3), materials refusing auger advancement were cored with an NQ core barrel, typically at 5-foot core intervals.

Water levels were measured in open boreholes at the time of drilling. In addition, a temporary PVC standpipe was placed in one boring to measure borehole water levels after a waiting period of at least 24 hours. Upon completion, boreholes were then backfilled up to the original ground surface with drill cuttings. The PVC standpipe was also removed. Representative portions of split-spoon soil samples and the bulk samples were returned to our laboratory for quantitative testing and visual classification in general accordance with Unified Soil Classification System (USCS) guidelines.

Boring logs and generalized soil profiles (Figures 3A and 3B), which present specific information from the borings, are included in the Appendices. Stratification lines shown on the boring logs and profiles are intended to represent approximate depths of changes in soil types. Naturally, transitional changes in soil types are often gradual and cannot be defined at particular depths. Ground surface elevations shown on these documents were estimated using a topographic survey of the site and should be considered approximate.

3. LABORATORY TESTING

Laboratory testing was performed on representative split-spoon and bulk soil samples obtained from the borings. This testing consisted of natural moisture content, Atterberg limits, grain size analysis, Standard Proctor, and California Bearing Ratio (CBR). Laboratory tests were performed

in general accordance with applicable ASTM procedures. Individual laboratory test data sheets are provided in Appendix C. A summary of laboratory test data is provided in the tables below.

Natural Moisture and Classification Tests

Boring	Depth (ft.)	Natural Moisture Content (%)	Atterberg Limits			Grain Size Analysis			USCS Classification
			LL	PL	PI	*% Fines	% Sand	% Gravel	
B-1	0.5-5	NT	47	25	22	76.5	18.4	5.1	CL
B-2	0-2	30.6	52	30	22	71.7	25.5	2.8	MH
B-2	4-6	27.8	45	25	20	86.6	12.0	1.4	CL
B-3	2-4	15.2	42	22	20	25.9	31.1	43.0	GC
B-3	6-8	37.7	63	34	29	69.8	25.2	5.0	MH
B-4	0.5-5	NT	43	26	17	53.5	32.5	14.0	CL
B-5	2-4	24.7	46	26	20	25.1	28.3	46.6	GC
B-5	6-8	37.0	66	36	30	61.6	28.0	10.4	MH

*Material passing No. 200 sieve (Clay and Silt); NT = Not Tested

Standard Proctor and CBR Testing

Boring	Depth (ft.)	Natural Moisture Content (%)	Standard Proctor		CBR	% Swell	USCS Classification
			Optimum Moisture Content (%)	Maximum Dry Density (pcf)			
B-1	0.5-5	NT	20.9	102.9	5.0	1.6	CL
B-4	0.5-5	NT	17.5	108.2	4.4	2.0	CL

NT = Not Tested

Based on the Atterberg limits testing, near-surface soils are of low to high plasticity. Based on comparison of natural moisture contents to the optimum moisture content of the bulk samples, near-surface soils appear to be near to wet of optimum moisture. Moisture manipulation of some of the near-surface soils will likely be required prior to their re-use as fill. The time of year the grading occurs will likely have a significant impact on the moisture levels of near-surface soils.

4. SITE GEOLOGY

4.1 Regional Geology

According to the 1993 Geologic Map of Virginia, the project site is located in the Valley and Ridge Physiographic Province of Virginia. This province is characterized by folded sedimentary rocks of Paleozoic age, weathered to form low, rounded ridges composed of resistant rocks, such as sandstone, and flat valleys composed of less resistant strata, such as shale or limestone. These rocks, formed during the early Paleozoic, subsequently underwent intense compressional forces during several orogenic (mountain building) events that occurred over the next 200 million years, as evidenced by the large and small scale folding and faulting observed in the Valley and Ridge province. It is this combination of structural deformation with the lithologic properties that

influence differential weathering that affected the regional topography, creating northeast-southwest trending sandstone ridges separated by valleys of carbonates and shales.

4.2 Local Geology and Karst Potential

According to the Virginia Department of Conservation and Economic Development, Division of Mineral Resources Report of Investigations 12, Plate 1, Geologic Map of the Staunton Quadrangle, Virginia, the site is underlain by the Martinsburg Formation, which consists of alternating layers of shale, limestone, and sandstone. Natural, undisturbed soils in the local area were formed by the chemical and physical weathering of the parent bedrock and are termed "residual" soils.

Rock coring at two borings within the proposed pump station and elevated water tank areas indicate that the on-site bedrock consists of shale. Shale is not considered susceptible to karst development, such as sinkholes, solution channels, and caverns. As such, the potential for karst features at this site appears to be low.

5. SUBSURFACE CONDITIONS

5.1 Ground Surface Cover

The borings encountered approximately 3 inches of surficial topsoil. These topsoil thicknesses may not be representative of the topsoil depths across the site and may extend deeper in some areas.

5.2 Existing Fill Soils

Beneath the ground surface cover, existing fill soils were encountered in Borings B-1 and B-2 to a depth of approximately 4 feet. The fill consisted of medium stiff Elastic SILT (MH), and medium stiff lean CLAY (CL). The fill material contained varying amounts of Sand and Gravel. The Standard Penetration Test (SPT) N-values within the fill ranged from 5 to 7 blows per foot. Based on past experience, well-compacted fill soils should exhibit SPT N-values of at least 8 bpf.

5.3 Residual Soils

Beneath the topsoil or existing fill soils in the above borings, undisturbed residual soils were encountered to depths of approximately 2 to 15 feet below the ground surface. These soils consisted of medium stiff to very stiff to hard SILT (ML) and Elastic SILT (MH), medium stiff lean and fat CLAY (CL, CH), and dense Clayey GRAVEL (GC). The soils of this layer contained varying amounts of Sand and rock fragments. SPT N-values within the soil profile ranged from 6 to 40 blows per foot (bpf).

5.4 Weathered Rock

Weathered rock was encountered in borings at depths ranging from approximately 2 to 10 feet below the ground surface. Weathered rock was encountered as a moderately thin layer at the location of Boring B-2 at depths ranging from about 6 to 12 feet below the ground surface. Weathered rock is defined as a residual material having Standard Penetration Test N-values of 60 blows per foot or greater. Weathered rock was sampled as very hard SILT (ML) and Elastic SILT (MH), very hard lean CLAY (CL), and very dense Silty GRAVEL (GM) with varying amounts of Sand, rock fragments, and mica.

5.5 Auger Refusal Materials

Materials refusing auger advancement were encountered in the borings at depths ranging from roughly 10.9 to 43.6 feet below the ground surface. We expect that the auger refusal materials generally represent boulders or mass rock.

Bedrock was sampled in Borings B-2 and B-3 at depths ranging from approximately 15 to 34.9 feet below the ground surface. Based on visual observation of the rock cores from these borings, the sampled materials consisted of gray shale. Within the core runs, the recovery ranged from 90 to 99 percent and rock quality designation (RQD) ranged from 33.4 to 88.1 percent. Rock core photographs are provided in Appendix B.

5.6 Groundwater

At the time of exploration, water was not encountered in the borings to the depths explored. In addition, a temporary PVC standpipe was installed at the location of borings B-2 to a depth of approximately 15 feet, below existing grade in order to obtain stabilized groundwater level readings. At the time of our exploration, groundwater was encountered in the standpipe at a depth of approximately 4.5 feet below current grade (roughly 1355.5 feet MSL).

It is important to realize that groundwater levels will fluctuate with changes in rainfall and evaporation rates. In addition, perched groundwater could be encountered within near-surface soils, particularly after rainfall and near the interface of soil and weathered rock/rock.

6. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based upon our borings, laboratory testing, engineering analysis, and past experience with similar projects and subsurface conditions.

When reviewing our conclusions and recommendations, it is important to note that prior development activities have occurred at the proposed pump station site. Existing fill was encountered in two of the borings at the proposed pump station. Based on our experience with previously developed sites, unexpected subsurface conditions could be encountered during

construction. These conditions could include debris-laden materials, abandoned utilities, and other unexpected conditions. These conditions, if encountered, can be addressed by on-site engineering evaluation at the time of construction.

6.1 Site Preparation

6.1.1 General

Site grading will be difficult during periods of extended rainfall and low temperatures that generally occur during the late autumn to early spring months. Near-surface soils are very moisture sensitive. If grading is conducted during a wet time period, soils will tend to rut and pump under rubber-tired traffic and provide poor subgrade support for slabs-on-grade. Heavy rubber-tired construction equipment should not be allowed to operate on wet or unstable subgrades at this site due to the potential for rutting and other damage to the soils. To reduce potential earthwork problems, site preparation and grading should be scheduled during the typically warmer summer months, if possible. We recommend that exposed subgrades be sloped and sealed at the end of each day to promote runoff and reduce infiltration from rainfall.

Site preparation should begin with stripping of topsoil and root mat, and removal of any other unsuitable surface materials. Approximately 3 inches of topsoil was encountered in the borings. These topsoil depths are expected to vary across the site and may extend deeper in some areas. Also, stripping activities often mix topsoil with underlying "clean" soils and cause stripping depths to be greater than actual topsoil depths, particularly during wet periods of the year. Topsoil and other soft organic laden soils should be wasted from the site or stockpiled outside the construction limits.

6.1.2 Subgrade Evaluation

After stripping activities, subgrades to receive fill and finished subgrades should be evaluated by the Geotechnical Engineer or his representative. To aid the engineer during this evaluation, exposed soil subgrades should be proofrolled with a loaded tandem axle dump truck or equivalent. Proofrolling will help to reveal the presence of unstable or otherwise unsuitable surface materials. The following methods are typically used to repair soil subgrades that are observed to rut, pump, or deflect excessively during proofrolling:

- Undercut the unstable soils to firm soils and replace them with new structural fill.
- In-place repair of near-surface soils by scarifying, drying and re-compacting, when weather conditions are suitable.

6.1.3 Undercut Potential

As previously discussed, existing fill soils were encountered in the pump station building borings to a depth of roughly 4 feet below current grades. Our experience with undocumented fill is that it

can be highly variable in both stiffness and material characteristics. In addition, unforeseen conditions could be encountered between the boring locations. Test pit excavations should be performed during construction to further increase confidence in the existing fill material's characteristics and its suitability for remaining in place beneath slabs-on-grade, and it suitability for re-use as structural fill.

6.1.4 Existing Utilities

We recommend that any existing underground utilities be relocated outside the proposed pump station footprint. Abandoned utilities should be removed from the site. Past experience indicates that poorly compacted fill soils are often located within utility trenches. For utilities that are to be removed, we recommend that trenches be cleaned of all backfill soils and backfilled with structural fill compacted to levels recommended in this report. If certain utility lines must remain in place in their current location, we recommend that the suitability of trench backfill be evaluated on a case-by-case basis.

6.1.5 Highly Plastic Soils

Pockets of highly plastic soils (CH, MH) could be present at finished soil subgrade in the pump station area. Highly plastic soils have potential for high shrink and swell behavior with changes in moisture content. We do not recommend that highly plastic soils be placed within the final 3 feet relative to finished soil subgrade in the pump station area.

6.2 Excavations

We anticipate that excavations of 10 feet and 22 feet will be required in the tank and wet well areas, respectively. Based on the borings, excavations are expected to extend through low to high consistency soils, weathered rock, and mass rock. Based on our past experience, blasting of the rock materials prior to excavation of the overburden soils can result in more efficient grading operations, and more of the blasted material will break down for re-use as fill material. Care should be used to avoid over-blasting materials beneath the specified elevation. Any over-blasted materials must be removed prior to placement of new structural fill since over-blasted materials could settle if left in place.

For confined excavations, trench safety must be evaluated on a case-by-case basis. The contractor will be responsible for all site safety, including the determination of appropriate trench safety measures according to OSHA guidelines.

Our comments regarding excavation of the on-site materials are presented below.

6.2.1 *Low to High Consistency Soils*

Past experience indicates that low to high consistency soils can be excavated by routine earth moving equipment. That is, mass excavation can be accomplished by bulldozer pushed scrapers with light to moderate pre-loosening of the higher consistency soils by tractor drawn rippers. Local excavation of moderate to higher consistency soils will likely require the use of a large track-mounted backhoe equipped with rock teeth. However, the rate of excavation in the higher consistency soils is typically slow.

6.2.2 *Weathered Rock*

Weathered rock materials were encountered in the borings starting as shallow as 2 feet below current grade, with materials refusing auger advancement occurring below the residual profile or weathered rock material at depths ranging from 10.9 to 43.6 feet below the ground surface. Past experience indicates that portions of the weathered rock (i.e., "soft" weathered rock with SPT N-values between 60 and 50/4") can be excavated using a D-8 bulldozer or equivalent equipped with a single tooth ripper, but the process can be very slow. Also, this process often creates relatively large rock pieces which are difficult to use as compacted fill.

Confined excavations, such as installation of foundations and utility trenches into weathered rock, are slow and difficult even with the use of large track-mounted excavators equipped with rock teeth. Therefore, it is generally more expedient to pre-loosen weathered rock with light blasting in confined excavations.

It is important to note that the success of ripping in mass excavation areas and confined excavations is dependent upon many factors. These include weakness seams within the rock, orientation of the seams, skill of the operator, and the diligence with which the contractor pursues excavation. As a result, it is difficult to accurately predict the quantities of materials requiring blasting.

6.2.3 *Mass Rock*

Removal of mass rock will require blasting or use of hoe rams. If blasting is performed, care should be taken by the contractor not to overshoot any areas requiring blasting beneath the proposed foundation areas since over-blasting can necessitate significant over-excavation.

We recommend that a pre-blast survey of nearby structures be performed prior to blasting. Blast-induced vibrations (peak particle velocity) must be kept below tolerable levels during blasting. Our experience has been that tolerable peak particle velocities are often defined as one inch per second or less.

6.3 Re-use of On-site Soils as Structural Fill

On-site low plasticity soils (where encountered), excluding topsoil or debris-laden soils, may be re-used as structural fill provided the moisture content can be properly controlled. However, highly

plastic soils (where encountered) should not be re-used as structural fill within 3 feet of finished soil subgrades in building areas. The soils encountered in the borings are generally of low to high plasticity and may require drying by way of disking/aerating or lime treatment if they prove to be wet of optimum moisture and therefore unable to achieve the appropriate degree of compaction at their current moisture levels. The lime percentage needed would be determined by the moisture level of soils at the time of fill placement. If lime is used to dry soils, the lime should meet the requirement of AASHTO M216 and lime mixing with on-site soils should be in accordance with the latest edition of the VDOT Road and Bridge Specifications.

The particle size of structural of fill must be controlled. A portion of the weathered rock that will require ripping and possibly blasting (or hoe rams) to achieve design subgrade levels should break down to gravel, sand, and silt sized particles upon compaction and should provide suitable material for use as structural fill. Conversely, it is likely that material containing boulders and weathered rock fragments will also be encountered where blasting is required. Structural fill should not contain rock materials greater than 3 inches in diameter. In no case should rock pieces be stacked on top of each other, which could create void spaces and lead to raveling of the soil fill.

Prevailing weather conditions will have a significant impact on the amount of moisture manipulation (i.e., drying or wetting) required prior to fill placement.

6.4 Structural Fill

On-site soils used for structural fill should be free of debris, contain less than 5 percent organics, have a maximum particle size of 3 inches, have a maximum liquid limit (LL) of 50, and have a maximum plasticity index (PI) of 30. Our recommendation is that highly plastic soils should not be placed within 3 feet of finished soil subgrades in building areas. Imported structural fill material should have a plasticity index less than 15, consist of Sand or Gravel (SP, SM, SC, SW, GP, GW), and otherwise meet the material requirements above.

Structural fill should be placed in maximum 8 to 10-inch loose lifts and compacted to at least 95 percent of the Standard Proctor maximum dry density (ASTM D 698). The final 12 inches of structural fill relative to finished subgrade should be compacted to at least 98 percent of the Standard Proctor maximum dry density. Structural fill should be maintained within 3 percent points of optimum moisture during placement and compaction.

Site preparation, including fill placement and compaction, should be observed by a qualified soils technician working under the direction of the Geotechnical Engineer. During fill placement, a sufficient amount of in-place density tests should be conducted to confirm that compaction and fill moisture is in accordance with our recommendations.

6.5 Foundations

6.5.1 Pump Station Foundations

Based on the performed borings and assumed structural loads, the light pump station loads bearing near 1358 feet MSL may be supported on shallow foundations bearing in stiff, undisturbed soils or new structural fill overlying stiff, undisturbed soils. Existing fill is not considered suitable for shallow foundation support. Shallow foundations may be designed using an allowable bearing pressure of 2,000 psf. Individual column and wall foundations should be at least 24 inches and 18 inches wide, respectively Because some near-surface soils are highly plastic, we recommend that the foundations bear at least 36 inches below finished exterior grade. Individual column and wall foundation should have minimum widths of 24 inches and 18 inches, respectively. In addition, if highly plastic soils are encountered at the footing bearing elevations, they should be undercut an additional 12 inches and replaced with lean concrete (minimum 28-day compressive strength of 1000 psi).

We expect total and differential settlements of the pump station foundations will be one inch and ½ inches, respectively, provided the recommendations of this report are properly implemented.

6.5.2 Wet Well

The 12-foot diameter, precast concrete wet well is expected to bear near elevation 1,336 feet MSL (approximately 22 feet below current grade) and within mass rock. An 8-inch, VDOT No. 57 stone bedding will be placed directly beneath the wet well. The precast concrete base for the wet well may be sized using an allowable bearing pressure of 5,000 psf. As previously mentioned, all over blasted rock must be over-excavated beneath the wet well, and the over-excavated material should be backfilled with VDOT No. 57 stone up to the design bearing elevation for the wet well. Settlement of the wet well foundation is expected to be one inch or less.

6.5.3 Elevated Water Tank Mat Foundation

For the purposes of our engineering analysis, we assumed a maximum load of 10,000 kips for the proposed elevated water tank. Based on the assumed maximum loading condition and our analysis, the proposed tank can be supported on a shallow mat foundation supported on weathered rock. The tank mat foundation may be designed using an allowable bearing pressure of 10,000 pounds per square foot (psf). We recommend the tank foundation be embedded at least 30 inches below finished exterior grade for frost protection. As such, we expect the tank foundation will bear near elevation 1455 feet. Borings indicate that weathered rock is consistently present at this elevation. The geotechnical engineer or his representative should confirm that weathered rock is present at the foundation bearing depth prior to placement of foundation concrete. Any overblasted materials must be removed below the tank foundation. If over-excavation of overblasted materials is

required below the design bearing elevation for the tank, the over-excavated materials should be backfilled with lean concrete having a minimum 28-day strength of 1,000 psi.

We expect total and differential settlements of the tank foundation will be one inch and ½ inches, respectively, provided the recommendations of this report are properly implemented.

6.5.4 Foundation Construction Considerations

Foundation excavations should be evaluated by the Geotechnical Engineer or his representative prior to reinforcing steel and concrete placement. Existing fill and over blasted rock materials are not considered suitable for foundation support. The evaluation should involve probing of foundation bearing surfaces, advancing shallow hand auger borings, and dynamic cone penetrometer (DCP) testing. Existing fill, any loose/soft soils, or disturbed rock (from blasting) should be removed and replaced soils with VDOT No. 57 stone beneath foundations. However, as discussed above, lean concrete should be used to backfill over-excavated materials below the tank foundation.

If groundwater or surface water runoff collects in any excavation, it should be removed promptly. Care should be exercised during construction of foundations in order not to disturb bearing soils and reduce their bearing strength. Concrete for the foundations should be placed as soon as practical following excavation. If concrete placement is delayed, placement of a lean concrete concrete "mud mat" should be considered in order to protect exposed foundation bearing materials.

6.6 Seismic Site Classification

Based on our past experience, it is our opinion the site should be considered Seismic Site Classification C in accordance with the current Virginia Building Code.

6.7 Below Grade Walls

Walls for the 12-foot diameter, precast concrete wet well must be designed to resist lateral earth pressures from the adjacent backfill. In addition to the lateral stresses from backfill, the walls may be subjected to surcharge loading from adjacent traffic, stockpiled materials, or stresses from nearby foundations or floor slabs. If present, these surcharge stresses should be resolved into appropriate lateral stress distributions and added to the earth pressures outlined below. Walls should have adequate factors of safety against overturning, sliding, and global failure.

We recommend that backfill placed behind cast-in-place retaining walls consist of off-site granular materials (such as relatively clean sands with less than 10 percent fines, VDOT 21B stone, or VDOT No. 57 stone). Fine-grained soils, such as clays and silts, should not be used as wall backfill. Backfill should be compacted to at least 95 percent of the soil's Standard Proctor maximum dry density (ASTM D 698) and within 3 percent points of optimum moisture. Operating heavy compaction equipment within 5 feet behind the retaining structures can create lateral earth

pressures far in excess of those recommended for design. As such, we recommend that hand-operated equipment be used within 5 feet from walls.

Recommended parameters for the backfill material types described in the paragraph above are summarized in the table below for cast-in-place concrete retaining walls. The lateral earth pressure coefficients presented below assume no friction between the wall and soil backfill ($\delta = 0$ degrees) and are based on placement of properly compacted backfill and a level backfill surface.

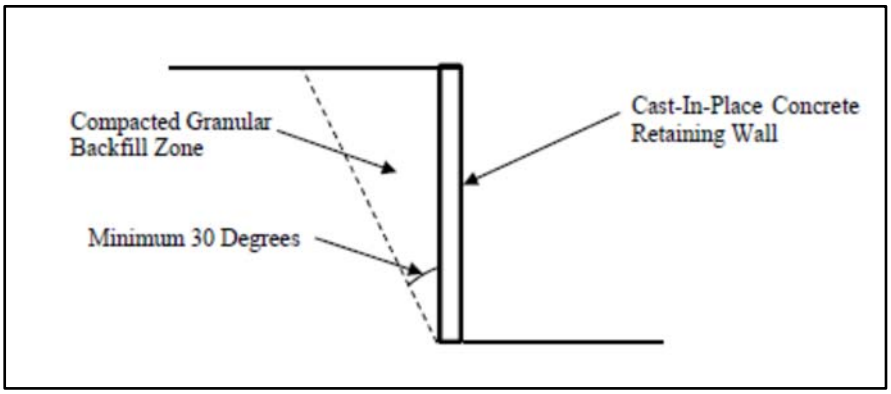
Recommended Cast-In-Place Wall Backfill Parameters (Granular Backfill)

Parameters	Value
At-Rest Equivalent Earth Pressure Coefficient	55 pcf
Active Equivalent Earth Pressure Coefficient	35 pcf
Passive Equivalent Earth Pressure Coefficient	280 pcf *
Ultimate Friction Coefficient Between Wall Foundations and Bearing Soils	0.32

**If the ground surface will be sloped in front of some retaining walls, passive earth pressure resistance must consider this sloped condition.*

The above parameters are only valid if the granular backfill material is present within a minimum 30-degree wedge behind the back of the wall, as shown in the figure below.

Recommended Zone of Granular Backfill



In addition, the walls should be designed for hydrostatic forces due to groundwater. We recommend a groundwater level equal 4 feet below the top of wet well be used to calculate hydrostatic forces on the walls.

6.8 Uplift Considerations for Below-Grade Structures

During normal operations, the proposed wet well will have both internal and external fluid pressures applied to the exterior walls. Water within the structure should balance or exceed hydrostatic forces applied to the outside of the walls from groundwater. However, if the below-grade structures will be emptied for maintenance purposes, hydrostatic pressure from groundwater

will create uplift forces on the structures. The wet well should be designed with an adequate factor of safety against uplift. A method to reduce uplift pressures on the structure during maintenance includes construction of pressure relief valves along the mat bottom. If pressure relief valves are constructed, we recommend placing a 6 to 12-inch layer of VDOT No. 57 stone beneath the structure to better facilitate drainage. The stone should be wrapped in a non-woven geotextile fabric, such as Mirafi 180N, or the equivalent.

6.9 Gravel Roadways

We anticipate that several lightly trafficked gravel access/maintenance roads will be constructed at this site. Based on the results of our borings, we expect that a gravel section of approximately 8 to 10 inches of well-compacted VDOT 21B stone, founded upon a stiff soil subgrade, will be suitable for the anticipated usage at this site. Depending on prevailing weather condition, some repair of subgrade soils could be required.

We recommend that all subgrade areas be evaluated prior to VDOT 21B placement. It may also be necessary to place a geotextile stabilization/separation fabric between the subgrade soils and gravel section, particularly if the subgrade soils are soft/wet during construction.

7. LIMITATIONS OF REPORT

The recommendations contained in this report are made on the basis of the site information made available to us and the surface and subsurface conditions that existed at the time of the exploration. While this exploration has been conducted in accordance with generally accepted geotechnical engineering practices, there remains some potential for variation of the subsurface conditions in unexplored areas of the site. If the subsurface conditions encountered during construction vary significantly from those presented in this report, we should be notified to reevaluate our recommendations. No other warranty, expressed or implied, is made as to the professional advice included in this report.

8. CLOSURE

We appreciate this opportunity to be of service to you on this project. If you have any questions regarding our services, or if we can be of further assistance, please contact us at (804) 200-6500.

Respectfully submitted,
Timmons Group

JNR

Juan Carlos Losa-Solano, E.I.T.
Geotechnical Professional

J. Nathan Reeves, P.E.
Senior Geotechnical Engineer
VA Registration No. 049619

COMMONWEALTH OF VIRGINIA
J NATHAN REEVES
Lic. No. 049619
7/21/23
PROFESSIONAL ENGINEER

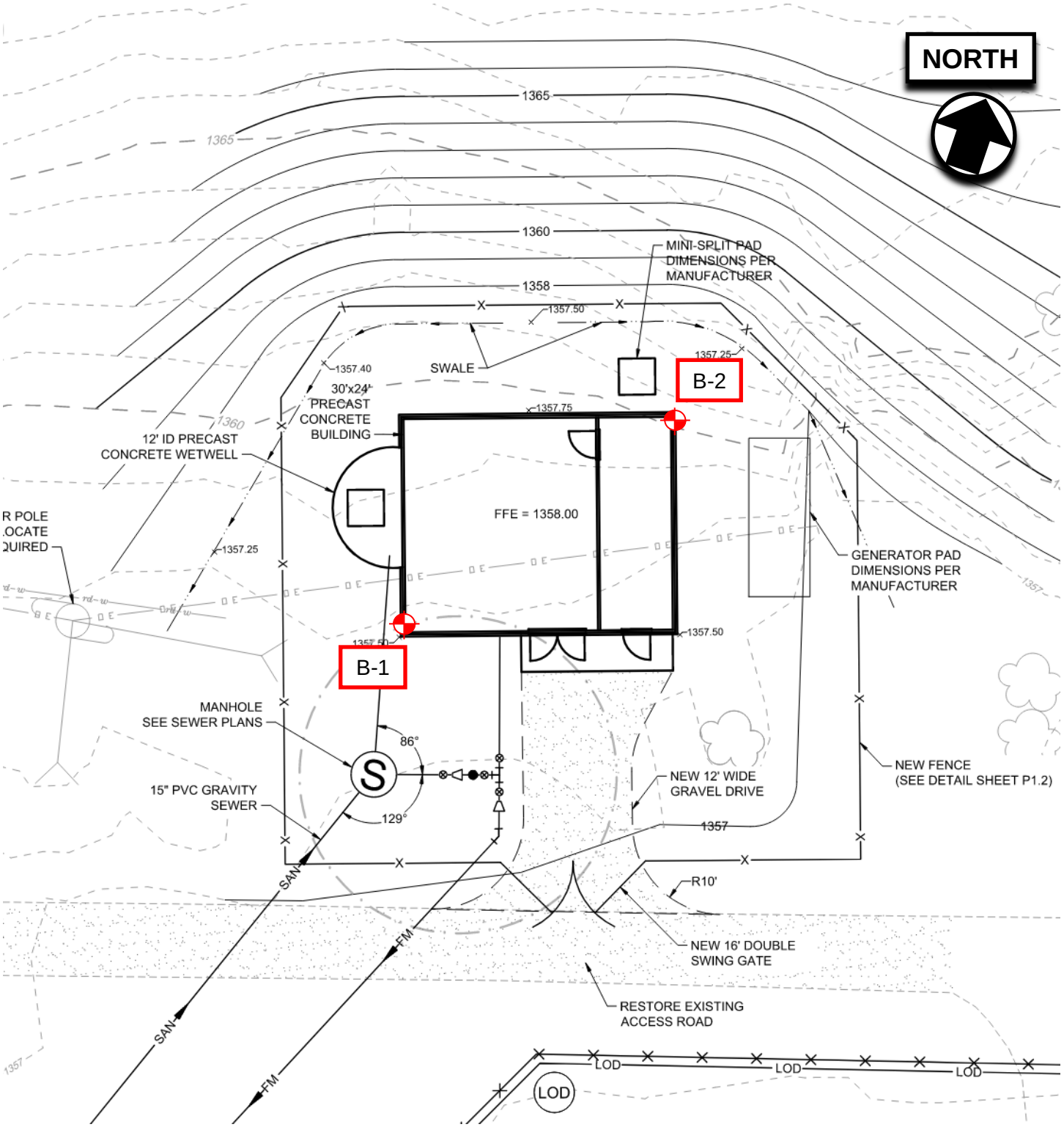
APPENDIX A

FIGURES



Source: Google Earth (2023)

SCALE:	NTS	TIMMONS GROUP YOUR VISION ACHIEVED THROUGH OURS.	**SITE VICINITY MAP** STAUNTON CROSSING PUMP STATION & ELEVATED WATER TANK CITY OF STAUNTON, VA	FIGURE 1
CHECKED BY:	JNR			
PLOTTED BY:	JCLS			
DATE:	7/17/23	PROJECT NUMBER: 49408.002		

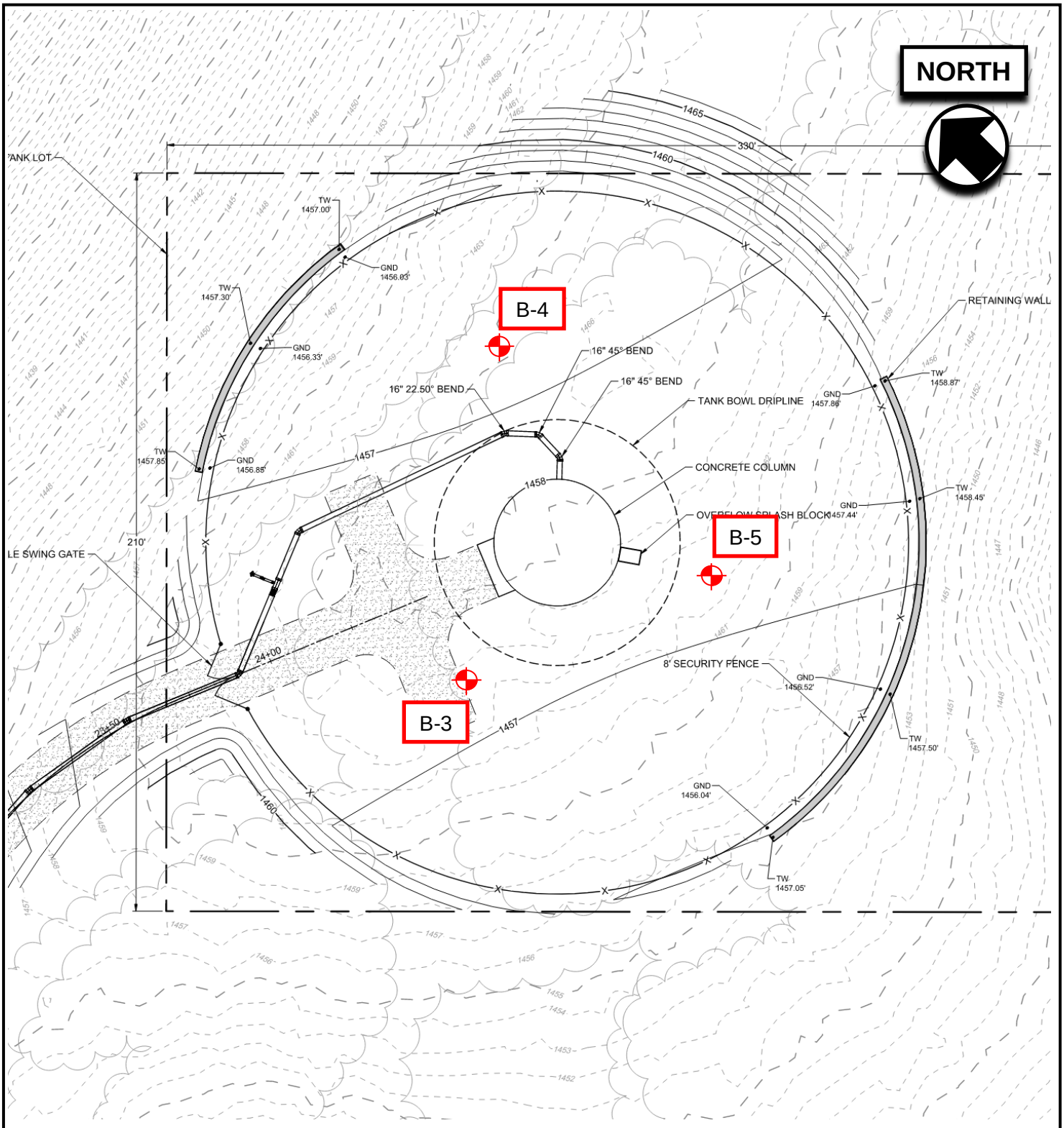


Source: Timmons Group, Staunton Crossing Utility Improvements - Phase 1 Pump Station Site Layout

Date: March 31, 2023

= APPROXIMATE LOCATION OF TEST BORING

SCALE: NTS	TIMMONS GROUP YOUR VISION ACHIEVED THROUGH OURS.	**BORING LOCATION PLAN** STAUNTON CROSSING PUMP STATION & ELEVATED WATER TANK CITY OF STAUNTON, VA	FIGURE 2A
CHECKED BY: JNR			
PLOTTED BY: JCLS			
DATE: 7/17/23	PROJECT NUMBER: 49408.002		

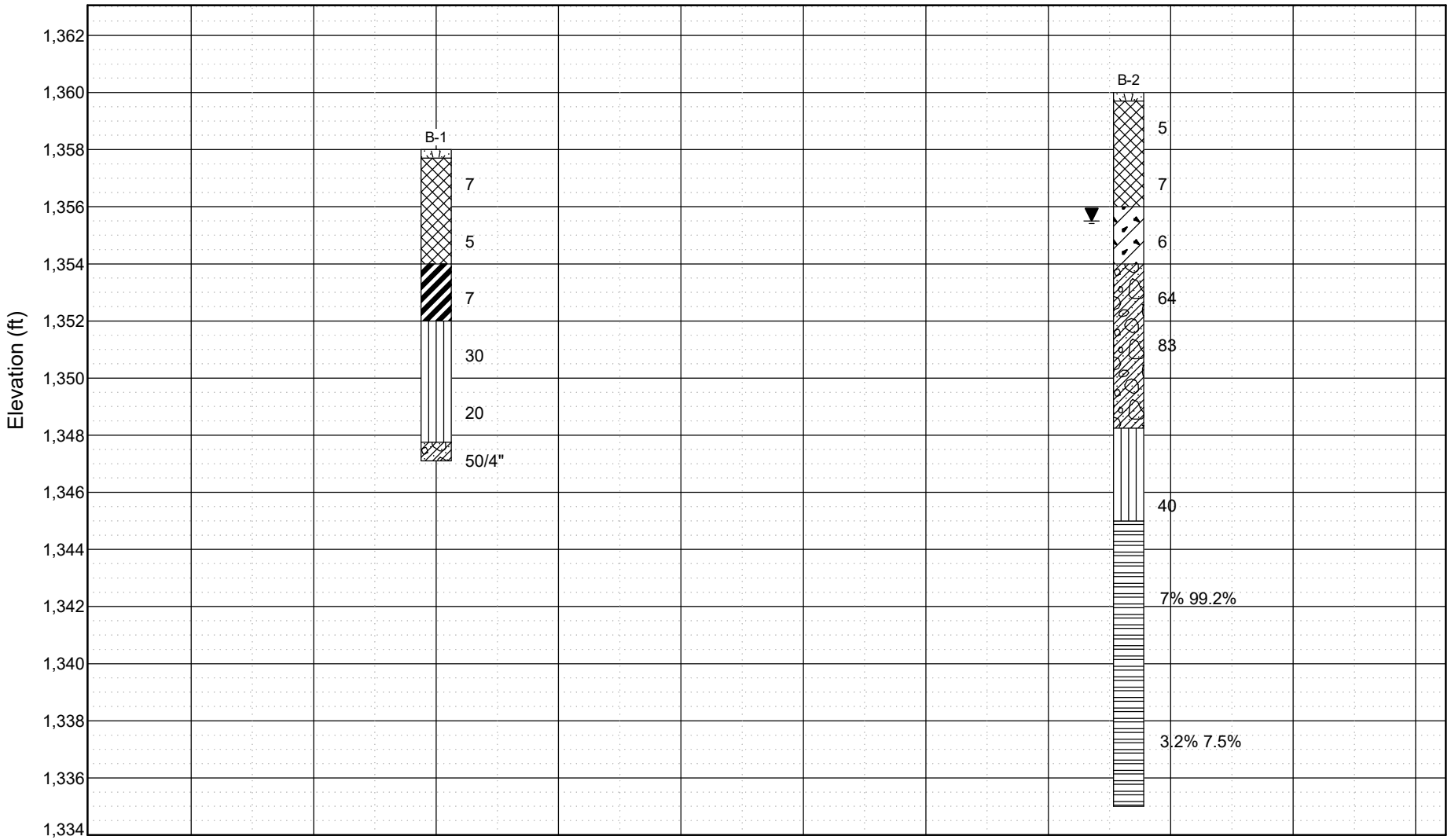


Source: Timmons Group, Staunton Crossing Utility Improvements - Phase 2 Access Road Plan and Profile

Date: June 2, 2023

= APPROXIMATE LOCATION OF TEST BORING

SCALE: NTS	TIMMONS GROUP YOUR VISION ACHIEVED THROUGH OURS.	**BORING LOCATION PLAN** STAUNTON CROSSING PUMP STATION & ELEVATED WATER TANK CITY OF STAUNTON, VA	FIGURE **2B**
CHECKED BY: JNR			
PLOTTED BY: JCLS			
DATE: 7/17/23	PROJECT NUMBER: 49408.002		



Lithology Symbols

- Topsoil
- Fill (made ground)
- High Plasticity Clay
- Silt
- Weathered Rock
- Low Plasticity Clay
- Shale

Groundwater Symbols

- At End of Drilling
- At 24 Hours

Exploration Symbols

B-01 (Exploration ID)

13 (N-Value)

53% 98%(RQD REC)

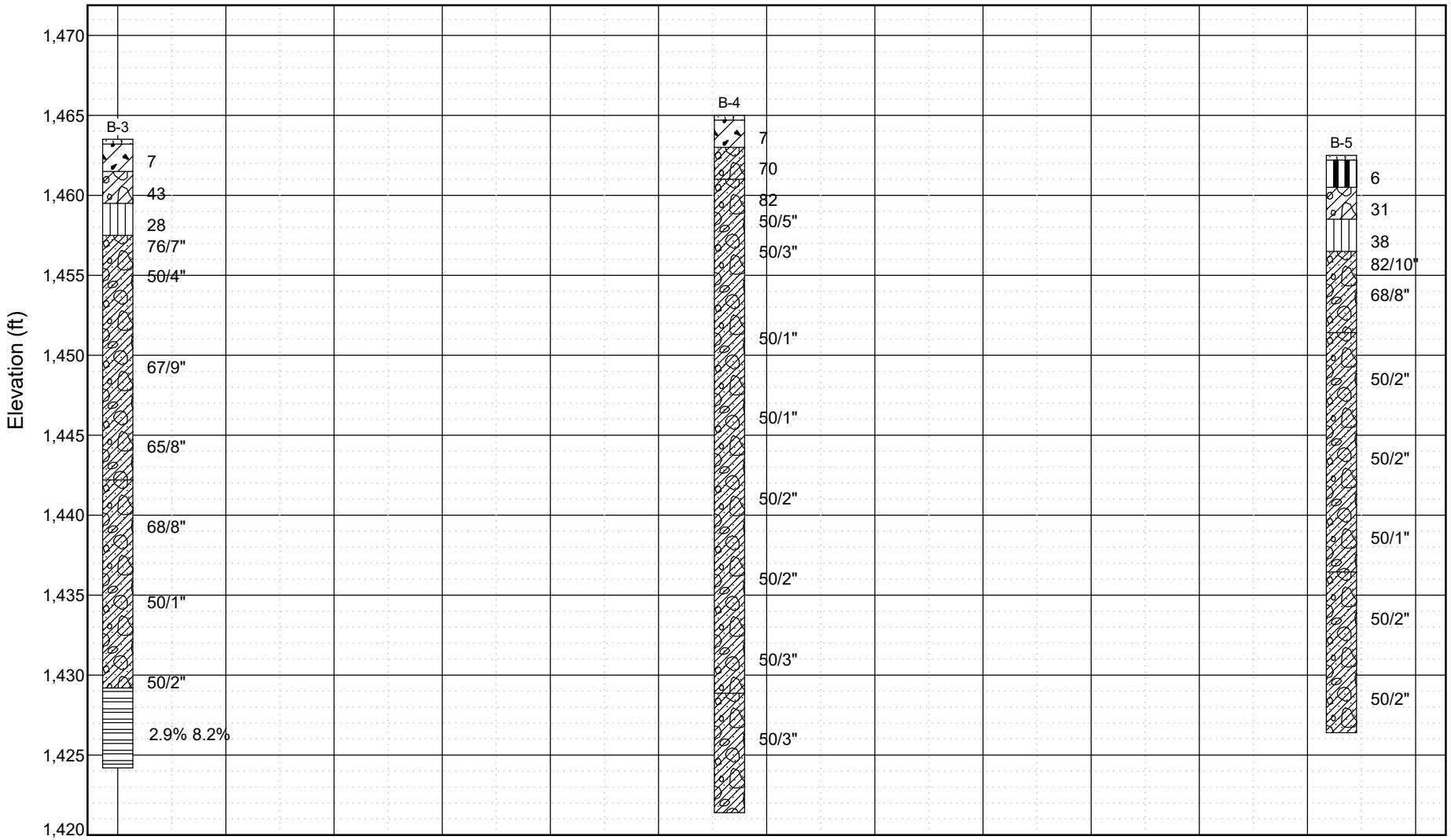
TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Timmons Group
1001 Boulders Parkway, Suite 300
Richmond, VA, 23225
Telephone: (804) 200-6500

Subsurface Profile

Staunton Crossing
Pump Station & Elevated Water Tank
City of Staunton, Virginia

PROJECT NUMBER		DRAWN BY	DATE DRAWN
49408.002		JCLS	7/17/2023
HORIZONTAL SCALE	NTS	APPROVED BY	FIGURE
VERTICAL SCALE	NTS	JNR	3A



Lithology Symbols

- Topsoil
- Low Plasticity Clay
- Clayey Gravel
- Silt
- Weathered Rock
- Shale
- Elastic Silt

Groundwater Symbols

- At End of Drilling
- At 24 Hours

Exploration Symbols

B-01 (Exploration ID)

13 (N-Value)

53% 98%(RQD REC)

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Subsurface Profile

Staunton Crossing
Pump Station & Elevated Water Tank
City of Staunton, Virginia

PROJECT NUMBER		DRAWN BY	DATE DRAWN
49408.002		JCLS	7/17/2023
HORIZONTAL SCALE	NTS	APPROVED BY	FIGURE
VERTICAL SCALE	NTS	JNR	3B

APPENDIX B

BORING LOGS

&

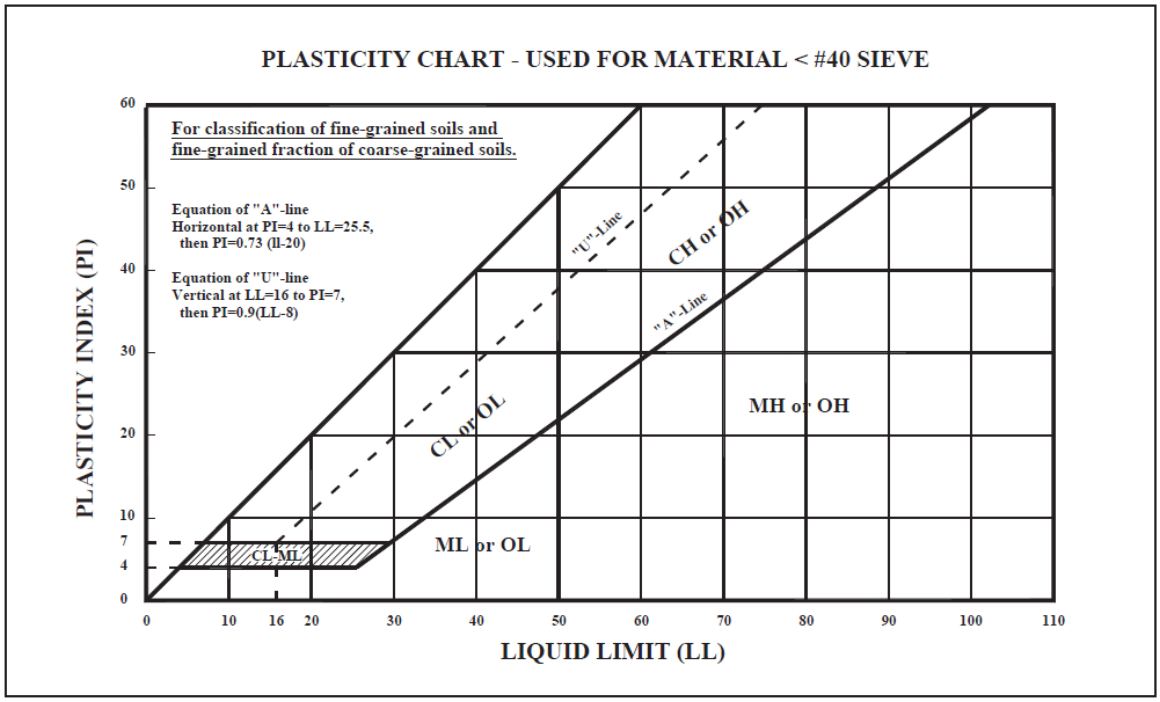
ROCK CORE PHOTO LOGS

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

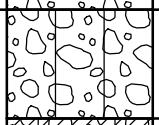
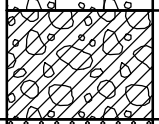
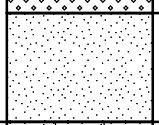
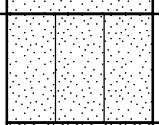
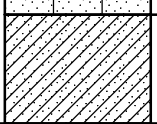
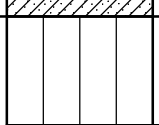
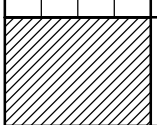
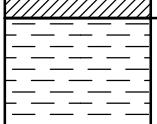
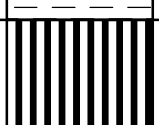
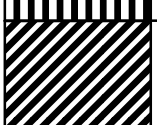
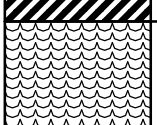
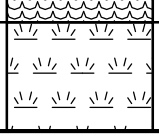
KEY TO BORING LOG TERMINOLOGY

Relative Density – Used for soils with less than 50% passing No. 200 sieve		Consistency – Used for soils with 50 percent or more passing No. 200 sieve	
Relative Density	**SPT N-Value (blows/ft)**	**Consistency**	**SPT N-Value (blows/foot)**
Very Loose	0 to 3	Very Soft	0 to 1
Loose	4 to 9	Soft	2 to 4
Medium Dense	10 to 29	Medium Stiff	5 to 8
Dense	30 to 50	Stiff	9 to 15
Very Dense	Greater than 50	Very Stiff	16 to 30
		Hard	31 to 50
		Very Hard	Greater than 50

Grain Size Terminology (U.S. Standard Sieves)		Natural Moisture Content	
Term	**Particle Size**		
Boulder	12 inches +	Dry	Very little apparent moisture, dusty
Cobble	3 to 12 inches		
Coarse Gravel	¾ to 3 inches	Moist	Damp, but no free water visible
Fine Gravel	#4 to ¾ inches		
Coarse Sand	#10 to #4		
Medium Sand	#40 to #10	Wet	Visible free water, or in cohesive soil, clearly saturated
Fine Sand	#200 to #40		
Silt and Clay	<#200		



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
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

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Timmons Group
1001 Boulders Parkway, Suite 300
Richmond, VA, 23225
Telephone: (804) 200-6500

BORING B-1

PROJECT NUMBER 49408.002 **PROJECT NAME** Staunton Crossing - Pump Station & Elevated Water Tank

CLIENT City of Staunton, Virginia **PROJECT LOCATION** City of Staunton, Virginia

DATE STARTED 3/1/2023 **COMPLETED** 3/1/2023 **GROUND ELEVATION** 1358 ft **HOLE DEPTH** 10.9 feet

DRILLING CONTRACTOR Connelly and Associates, Inc. **BOREHOLE WATER LEVELS:**

DRILLING METHOD Hollow Stem Auger **AT TIME OF DRILLING** --- Not encountered

LOGGED BY C. Losa-Solano, E.I.T. **CHECKED BY** N. Reeves, P.E. **AT 24 HOURS DRILLING** ---

NOTES **CAVE DEPTH**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	POCKET PEN. (tsf)	LAB TESTS	REMARKS
0	1358	3-inches Topsoil					
		LEAN CLAY, (CL): brown to grayish brown, moist, medium stiff, with sand, trace gravel, "FILL"		S-1, SPT 3-3-4-5 (7)			
	1355			S-2, SPT 2-2-3-4 (5)			
5		FAT CLAY, (CH): orangeish brown mottled with gray, moist, medium stiff, trace sand		S-3, SPT 2-2-5-6 (7)			
		SILT, (ML): orangeish brown mottled with gray, moist, very stiff, trace sand		S-4, SPT 7-13-17-29 (30)			
	1350			S-5, SPT 3-7-13-30 (20)			
10		SILT, (ML): dark gray, moist, very hard, trace sand, "Weathered Rock"		S-6, SPT 50/4"			

Refusal at 10.9 feet.
Bottom of borehole at 10.9 feet.

TG GEOTECH BH LOG V2.0 - GINT STD US LAB.GDT - 7/18/23 15:28 - Y:\801\GEOTECHNICAL\PROJECTS\2023 PROJECTS\49408.002_STAUNTON CROSSING ELEVATED TANK AND PUMP STATION\LOGS\STAUNTON CROSSING - 49408.002.GPJ

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Richmond, VA, 23225
Telephone: (804) 200-6500

BORING B-2

PROJECT NUMBER 49408.002 **PROJECT NAME** Staunton Crossing - Pump Station & Elevated Water Tank

CLIENT City of Staunton, Virginia **PROJECT LOCATION** City of Staunton, Virginia

DATE STARTED 3/1/2023 **COMPLETED** 3/1/2023 **GROUND ELEVATION** 1360 ft **HOLE DEPTH** 25 feet

DRILLING CONTRACTOR Connelly and Associates, Inc. **BOREHOLE WATER LEVELS:**

DRILLING METHOD Hollow Stem Auger **AT TIME OF DRILLING** --- Not encountered

LOGGED BY C. Losa-Solano, E.I.T. **CHECKED BY** N. Reeves, P.E. **AT 24 HOURS DRILLING** 4.50 ft / Elev 1355.50 ft

NOTES **CAVE DEPTH**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	POCKET PEN. (tsf)	LAB TESTS	REMARKS
0	1360	3-inches Topsoil ELASTIC SILT, (MH): orangeish brown, moist, medium stiff, with sand, trace gravel, "FILL"		S-1, SPT 1-2-3-4 (5) S-2, SPT 3-3-4-6 (7)			
5	1355	LEAN CLAY, (CL): orangeish brown, moist to wet, medium stiff, trace sand, trace rock fragments		S-3, SPT 2-3-3-4 (6)			
		ELASTIC SILT, (MH): brown mottled with gray, wet, very hard, trace sand, "Weathered Rock"		S-4, SPT 13-15-49-50 (64) S-5, SPT 5-33-50 (83)			
10	1350						
		SILT, (ML): gray, wet, hard, trace sand					
15	1345			S-6, SPT 5-24-16 (40)			
		SHALE, Decomposed to slightly weathered, moderately hard, massive, dark gray, contained intensely to moderately spaced highly dipping joints		RC-1, RC RQD=88.1% Rec=99%			
20	1340						
				RC-2, RC RQD=34.2% Rec=90%			
25	1335						

Refusal at 15.0 feet.
Bottom of borehole at 25.0 feet.

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Richmond, VA, 23225
Telephone: (804) 200-6500

BORING B-3

PROJECT NUMBER 49408.002 **PROJECT NAME** Staunton Crossing - Pump Station & Elevated Water Tank

CLIENT City of Staunton, Virginia **PROJECT LOCATION** City of Staunton, Virginia

DATE STARTED 3/6/2023 **COMPLETED** 3/6/2023 **GROUND ELEVATION** 1463.5 ft **HOLE DEPTH** 39.3 feet

DRILLING CONTRACTOR Connelly and Associates, Inc. **BOREHOLE WATER LEVELS:**

DRILLING METHOD Hollow Stem Auger **AT TIME OF DRILLING** --- Not encountered

LOGGED BY C. Losa-Solano, E.I.T. **CHECKED BY** N. Reeves, P.E. **AT 24 HOURS DRILLING** ---

NOTES **CAVE DEPTH**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	POCKET PEN. (tsf)	LAB TESTS	REMARKS
0		3-inches Topsoil		S-1, SPT 2-3-4-7 (7)			
		LEAN CLAY, (CL): orangeish brown, moist, medium stiff, trace sand, trace rock fragments					
	1460	CLAYEY GRAVEL, (GC): orangeish brown, fine to medium grained, moist, dense, with sand		S-2, SPT 12-19-24-13 (43)			
5		SILT, (ML): orangeish brown, moist, very stiff, trace sand, trace rock fragments		S-3, SPT 9-12-16-20 (28)			
		ELASTIC SILT, (MH): orangeish brown, moist, very hard, with sand, trace rock fragments, "Weathered Rock"		S-4, SPT 76/7"			
	1455			S-5, SPT 50/4"			
10							
	1450			S-6, SPT 67/9"			
15							
	1445			S-7, SPT 65/8"			
20							
		SILT, (ML): orangeish brown, moist, very hard, trace sand, trace rock fragments, "Weathered Rock"					
	1440			S-8, SPT 68/8"			
25							
	1435			S-9, SPT 50/1"			
30							
	1430			S-10, SPT 50/2"			
35							

(Continued Next Page)

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BORING B-3

PROJECT NUMBER 49408.002 **PROJECT NAME** Staunton Crossing - Pump Station & Elevated Water Tank

CLIENT City of Staunton, Virginia **PROJECT LOCATION** City of Staunton, Virginia

DATE STARTED 3/6/2023 **COMPLETED** 3/6/2023 **GROUND ELEVATION** 1463.5 ft **HOLE DEPTH** 39.3 feet

DRILLING CONTRACTOR Connelly and Associates, Inc. **BOREHOLE WATER LEVELS:**

DRILLING METHOD Hollow Stem Auger **AT TIME OF DRILLING** --- Not encountered

LOGGED BY C. Losa-Solano, E.I.T. **CHECKED BY** N. Reeves, P.E. **AT 24 HOURS DRILLING** ---

NOTES **CAVE DEPTH**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	POCKET PEN. (tsf)	LAB TESTS	REMARKS
35		SHALE, Moderately to slightly weathered, hard, massive, gray, contained intensely to highly spaced moderate dipping joints *(continued)*		RC-1, RC RQD=33.4% Rec=98%			
	1425						

Refusal at 34.9 feet.
Bottom of borehole at 39.3 feet.

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Timmons Group
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Richmond, VA, 23225
Telephone: (804) 200-6500

BORING B-4

PROJECT NUMBER 49408.002 **PROJECT NAME** Staunton Crossing - Pump Station & Elevated Water Tank

CLIENT City of Staunton, Virginia **PROJECT LOCATION** City of Staunton, Virginia

DATE STARTED 3/2/2023 **COMPLETED** 3/2/2023 **GROUND ELEVATION** 1465 ft **HOLE DEPTH** 43.6 feet

DRILLING CONTRACTOR Connelly and Associates, Inc. **BOREHOLE WATER LEVELS:**

DRILLING METHOD Hollow Stem Auger **AT TIME OF DRILLING** --- Not encountered

LOGGED BY C. Losa-Solano, E.I.T. **CHECKED BY** N. Reeves, P.E. **AT 24 HOURS DRILLING** ---

NOTES **CAVE DEPTH**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	POCKET PEN. (tsf)	LAB TESTS	REMARKS
0	1465	3-inches Topsoil					
		SANDY LEAN CLAY, (CL): orangeish brown, moist, medium stiff, trace rock fragments		S-1, SPT 3-3-4-5 (7)			
		SANDY LEAN CLAY, (CL): orangeish brown, moist, very hard, trace rock fragments, "Weathered Rock"		S-2, SPT 5-20-50 (70)			
5	1460	ELASTIC SILT, (MH): orangeish brown, moist, very hard, trace sand, trace rock fragments, "Weathered Rock"		S-3, SPT 12-32-50 (82)			
				S-4, SPT 50/5"			
				S-5, SPT 50/3"			
10	1455						
				S-6, SPT 50/1"			
15	1450						
				S-7, SPT 50/1"			
20	1445						
				S-8, SPT 50/2"			
25	1440						
				S-9, SPT 50/2"			
30	1435						
				S-10, SPT 50/3"			
35	1430						

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Timmons Group
1001 Boulders Parkway, Suite 300
Richmond, VA, 23225
Telephone: (804) 200-6500

BORING B-4

PROJECT NUMBER 49408.002 **PROJECT NAME** Staunton Crossing - Pump Station & Elevated Water Tank

CLIENT City of Staunton, Virginia **PROJECT LOCATION** City of Staunton, Virginia

DATE STARTED 3/2/2023 **COMPLETED** 3/2/2023 **GROUND ELEVATION** 1465 ft **HOLE DEPTH** 43.6 feet

DRILLING CONTRACTOR Connelly and Associates, Inc. **BOREHOLE WATER LEVELS:**

DRILLING METHOD Hollow Stem Auger **AT TIME OF DRILLING** --- Not encountered

LOGGED BY C. Losa-Solano, E.I.T. **CHECKED BY** N. Reeves, P.E. **AT 24 HOURS DRILLING** ---

NOTES **CAVE DEPTH**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	POCKET PEN. (tsf)	LAB TESTS	REMARKS
35	1430	SILTY GRAVEL, (GM): orangeish brown, moist, very dense, with sand, "Weathered Rock"		S-11, SPT 50/3"			
40	1425						

Refusal at 43.6 feet.
Bottom of borehole at 43.6 feet.

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1001 Boulders Parkway, Suite 300
Richmond, VA, 23225
Telephone: (804) 200-6500

BORING B-5

PROJECT NUMBER 49408.002 **PROJECT NAME** Staunton Crossing - Pump Station & Elevated Water Tank

CLIENT City of Staunton, Virginia **PROJECT LOCATION** City of Staunton, Virginia

DATE STARTED 3/6/2023 **COMPLETED** 3/6/2023 **GROUND ELEVATION** 1462.5 ft **HOLE DEPTH** 36.1 feet

DRILLING CONTRACTOR Connelly and Associates, Inc. **BOREHOLE WATER LEVELS:**

DRILLING METHOD Hollow Stem Auger **AT TIME OF DRILLING** --- Not encountered

LOGGED BY C. Losa-Solano, E.I.T. **CHECKED BY** N. Reeves, P.E. **AT 24 HOURS DRILLING** ---

NOTES **CAVE DEPTH**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	POCKET PEN. (tsf)	LAB TESTS	REMARKS
0		3-inches Topsoil		S-1, SPT 2-2-4-5 (6)			
		ELASTIC SILT, (MH): orangeish brown to orangeish gray, moist, medium stiff, trace sand					
	1460	CLAYEY GRAVEL, (GC): orangeish gray, fine to medium grained, moist, dense, with sand		S-2, SPT 10-13-18-21 (31)			
5		SANDY SILT, (ML): orangeish brown, moist, hard, trace rock fragments		S-3, SPT 9-15-23-30 (38)			
		ELASTIC SILT, (MH): orangeish brown mottled with gray, moist, very hard, trace sand, trace rock fragments, "Weathered Rock"		S-4, SPT 82/10"			
	1455			S-5, SPT 68/8"			
10							
		SILT, (ML): orangeish brown, moist, very hard, trace sand, trace mica, "Weathered Rock"					
	1450			S-6, SPT 50/2"			
15							
	1445						
				S-7, SPT 50/2"			
20							
	1440						
		Little rock fragments		S-8, SPT 50/1"			
25							
		SILTY GRAVEL, (GM): orangeish brown, fine to medium grained, moist, very dense, with sand, "Weathered Rock"					
	1435			S-9, SPT 50/2"			
30							
	1430						
				S-10, SPT 50/2"			
35							

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Richmond, VA, 23225
Telephone: (804) 200-6500

BORING B-5

PROJECT NUMBER 49408.002 **PROJECT NAME** Staunton Crossing - Pump Station & Elevated Water Tank

CLIENT City of Staunton, Virginia **PROJECT LOCATION** City of Staunton, Virginia

DATE STARTED 3/6/2023 **COMPLETED** 3/6/2023 **GROUND ELEVATION** 1462.5 ft **HOLE DEPTH** 36.1 feet

DRILLING CONTRACTOR Connelly and Associates, Inc. **BOREHOLE WATER LEVELS:**

DRILLING METHOD Hollow Stem Auger **AT TIME OF DRILLING** --- Not encountered

LOGGED BY C. Losa-Solano, E.I.T. **CHECKED BY** N. Reeves, P.E. **AT 24 HOURS DRILLING** ---

NOTES **CAVE DEPTH**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	POCKET PEN. (tsf)	LAB TESTS	REMARKS
35							
		Refusal at 36.1 feet. Bottom of borehole at 36.1 feet.					

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Boring B-2
Run 1: 15’ – 20’ REC. 99.0% RQD 88.1%
Run 2: 20’ – 25’ REC. 90.0% RQD 34.2%

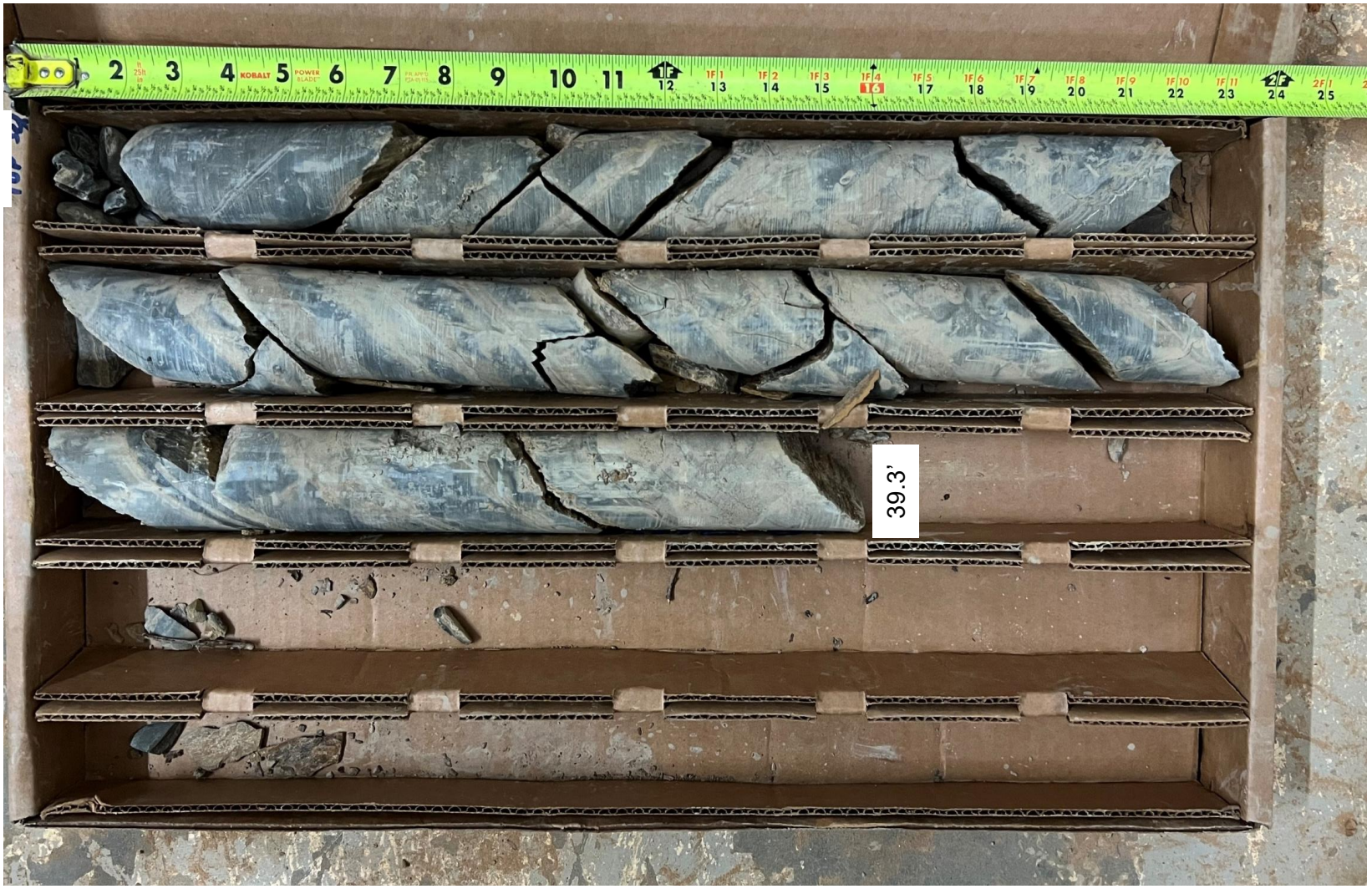


Scale:	**NTS**
Date:	**4/10/2023**
Drawn By:	**JCLS**
Project No.:	**49408.002**

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ROCK CORE PHOTO LOG
STAUNTON CROSSING
ELEVATED TANK & PUMP STATION
CITY OF STAUNTON, VIRGINIA

Boring B-3
Run 1: 34.3’ – 39.3’ REC. 98.0% RQD 33.4%



Scale:	**NTS**
Date:	**4/10/2023**
Drawn By:	**JCLS**
Project No.:	**49408.002**

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ROCK CORE PHOTO LOG
STAUNTON CROSSING
ELEVATED TANK & PUMP STATION
CITY OF STAUNTON, VIRGINIA

APPENDIX C

LABORATORY TEST RESULTS

TIMMONS GROUP
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LABORATORY SUMMARY TABLE

Project Number: 49408.002
Project Name: Staunton Crossing Water & Sewer Development
Project Location: 1249 Richmond Ave, Staunton, Virginia
Client Name: City of Staunton, Virginia

Lab No.	Boring Number	Sample Number	Sample Depth (feet)	USCS	MC (%)	Grain Size Analysis			Atterberg Limits			MDD (pcf)	OMC (%)	CBR				
						G (%)	S (%)	F (%)	LL	PL	PI			Uncorrected		Corrected		% Swell
														0.1"	0.2"	0.1"	0.2"	
8511	B-01	Bulk	0.5 to 5	CL	---	5.1	18.4	76.5	47	25	22	102.9	20.9	5.0	5.8	---	---	1.6
8512	B-02	S-1	0 to 2	MH	30.6	2.8	25.5	71.7	52	30	22	---	---	---	---	---	---	---
8513	B-02	S-3	4 to 6	CL	27.8	1.4	12.0	86.6	45	25	20	---	---	---	---	---	---	---
8514	B-03	S-2	2 to 4	GC	15.2	43.0	31.1	25.9	42	22	20	---	---	---	---	---	---	---
8515	B-03	S-4	6 to 8	MH	37.7	5.0	25.2	69.8	63	34	29	---	---	---	---	---	---	---
8516	B-04	Bulk	0.5 to 5	CL	---	14.0	32.5	53.5	43	26	17	108.2	17.5	4.0	4.7	4.4	4.8	2.0
8517	B-05	S-2	2 to 4	GC	24.7	46.6	28.3	25.1	46	26	20	---	---	---	---	---	---	---
8518	B-05	S-4	6 to 8	MH	37.0	10.4	28.0	61.6	66	36	30	---	---	---	---	---	---	---

Form No. TR-Moisture Content
Revision No. 0.1
Revision Date: 5/18/18

LABORATORY DETERMINATION OF WATER CONTENT

AASHTO T265 Method B

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PROJECT INFORMATION

Project #:	49408.002	**Report Date:**	6/15/2023
Project Name:	Staunton Crossing Water & Sewer Development	**Test Date(s):**	5/22/2023
Project Location:	1249 Richmond Ave, Staunton, Virginia	**Tested By:**	Matthew Thornton
Client Name:	City of Staunton, Virginia		

SAMPLE INFORMATION

Sampled By:	Connelly and Associates, Inc.	**Sample Date(s):**	3/1/23 to 3/6/23
Sampling Method:	Split Barrel & Bulk Samples		

Lab Number:	8512	8513	8514	8514	8517	8518	
Sample Locaton:	**B-02**	**B-02**	**B-03**	**B-03**	**B-05**	**B-05**	
Sample Number:	S-1	S-3	S-2	S-2	S-2	S-4	
Sample Depth (ft):	**0 to 2**	**4 to 6**	**2 to 4**	**2 to 4**	**2 to 4**	**6 to 8**	
Tare Number:	407	715	510	510	T110	702	
Tare Weight (g):	123.51	124.98	125.75	125.75	122.84	126.18	
Wet Soil + Tare (g):	234.01	233.22	205.57	205.57	241.86	222.11	
Dry Soil + Tare (g):	208.13	209.68	195.05	195.05	218.26	196.22	
Water Weight (g):	25.88	23.54	10.52	10.52	23.6	25.89	
Dry Soil Weight (g):	84.62	84.7	69.3	69.3	95.42	70.04	
***Water Content* (%):**	**30.6**	**27.8**	**15.2**	**15.2**	**24.7**	**37.0**	
USCS (ASTM D 2487):	MH	CL	GC	GC	GC	MH	
Approx. Max Grain Size:	3/8"	3/8"	1"	1"	3/4"	3/8"	
Mass Less Than Minimum?	Yes	Yes	Yes	Yes	Yes	Yes	
More than One Material?	No	No	No	No	No	No	
Alternate Oven Temperature:	---	---	---	---	---	---	
Describe Excluded Material:	---	---	---	---	---	---	

References / Comments / Deviations:

Matthew Thornton	Matthew Thornton	Laboratory Manager	6/15/23
Technical Responsibility	*Signature*	*Position*	*Date*

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Material Classification

ASTM D2487

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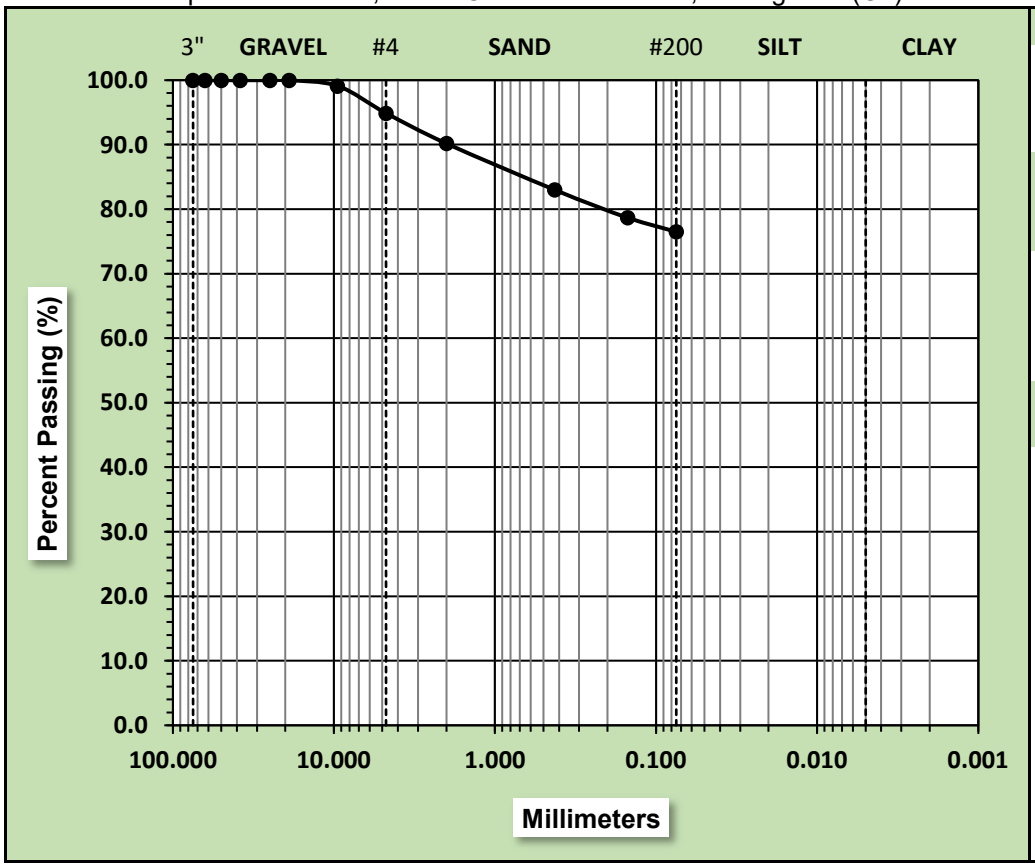
PROJECT INFORMATION

Project #:	49408.002	Report Date:	6/15/2023
Project Name:	Staunton Crossing Water & Sewer Development		
Project Location:	1249 Richmond Ave, Staunton, Virginia		
Client Name:	City of Staunton, Virginia		

SAMPLE INFORMATION

Location:	B-01	Sample #:	Bulk	Sample Date:	3/1/2023
Depth:	0.5 to 5 feet	Offset:	N/A	Lab Control #:	8511

Material Description: Brown, LEAN CLAY WITH SAND, trace gravel (CL)



Soil Properties	
As-Received Moisture Content	---
Specific Gravity	---
Liquid Limit	47
Plastic Limit	25
Plastic Index	22
Group Symbol	CL
%Passing	
3"	
2.5"	
2"	
1.5"	
1"	
3/4"	100.0
3/8"	99.1
#4	94.9
#10	90.2
#40	83.0
#100	78.7
#200	76.5

Maximum Particle Size 3/4" **Gravel 5.1%** **Sand 18.4%** **Silt and Clay 76.5%**

C_u --- **C_c** ---

Description of Sand & Gravel Particles: Rounded, Angular, Hard, Soft, Friable

Notes:

References:

AASHTO T11 & T88 tested on 5/23/23 & 6/2/23 by Ken Pruner
AASHTO T89 Method B & T90 tested on 6/14/23 by Matthew Thornton

Matthew Thornton		Laboratory Manager	6/15/23
Technical Responsibility	*Signature*	*Position*	*Date*

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MOISTURE-DENSITY RELATIONSHIP REPORT

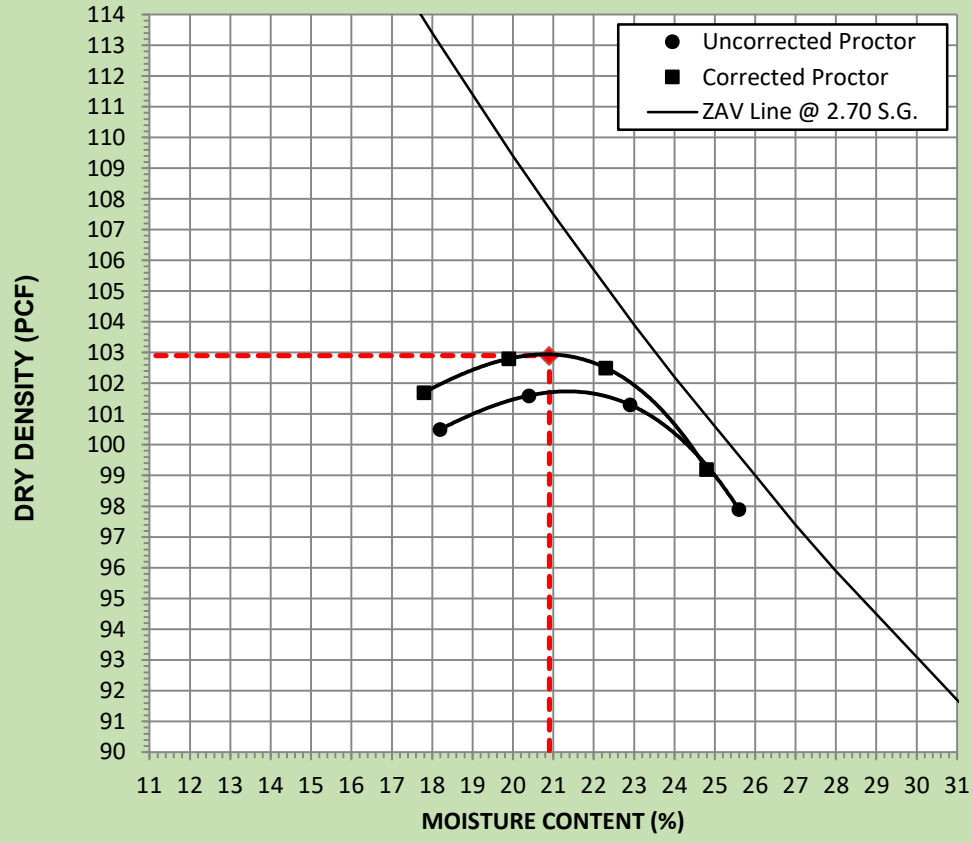
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PROJECT INFORMATION			
Project #:	49408.002	Report Date:	6/15/2023
Project Name:	Staunton Crossing Water & Sewer Development	Test Date(s):	5/31/2023
Project Location:	1249 Richmond Ave, Staunton, Virginia	Tested By:	Ken Pruner
Client Name:	City of Staunton, Virginia		

SAMPLE INFORMATION					
Location:	B-01	Sample #:	Bulk	Sample Date:	3/1/2023
Depth:	0.5 to 5 feet	Offset:	N/A	Lab Control #:	8511
Material Description:	Brown, LEAN CLAY WITH SAND, trace gravel (CL)				

Corrected Maximum Dry Density	102.9 PCF	Corrected Optimum Moisture Content	20.9 %

AASHTO T-99 Method A



Soil Properties	
As-Received Moisture Content	---
Assumed Specific Gravity	2.70
Liquid Limit	47
Plastic Limit	25
Plastic Index	22
%Passing	
1.5"	
3/4"	100.0
3/8"	99.1
No. 4	94.9
No. 10	90.2
No. 40	83.0
No. 200	76.5
Uncorrected Moisture-Density	
MDD (pcf)	101.8
OMC (%)	21.4
Assumed Properties of Oversize Fraction	
Sp.Gr.(OD)	2.100
Absorption	10.5%

The Moisture-Density Curves Displayed represent the Fine Fraction with & without an Oversize Correction.
Air-dried material passing a No. 4 sieve was prepared then compacted with a circular, manual rammer.

References / Comments / Deviations:

Matthew Thornton	Matthew Thornton	Laboratory Manager	6/15/23
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-CBR
Revision No. 1
Revision Date: 05/18/18

CBR (California Bearing Ratio) of Laboratory Compacted Soil

AASHTO T193

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PROJECT INFORMATION

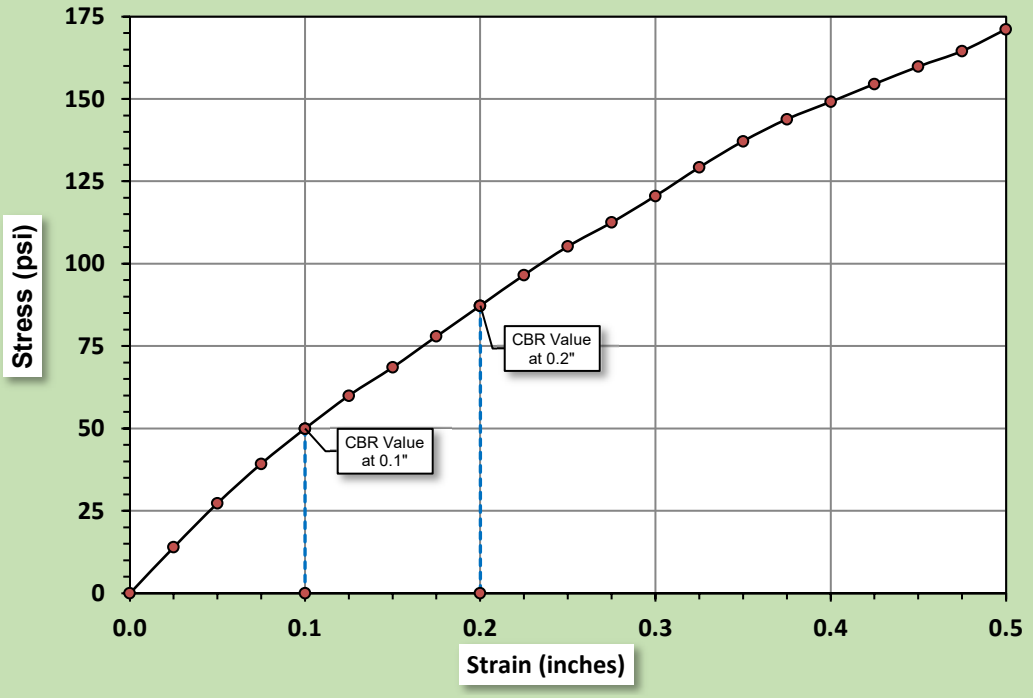
Project #:	49408.002	Report Date:	6/15/2023
Project Name:	Staunton Crossing Water & Sewer Development	Test Date(s):	6/7/23 to 6/12/23
Project Location:	1249 Richmond Ave, Staunton, Virginia	Tested By:	KP and MLT
Client Name:	City of Staunton, Virginia		

SAMPLE INFORMATION

Location:	B-01	Sample #:	Bulk	Sample Date:	3/1/2023
Depth:	0.5 to 5 feet	Offset:	N/A	Lab Control #:	8511

Material Description: Brown, LEAN CLAY WITH SAND, trace gravel (CL)

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 5.0	CBR at 0.2 in. 5.8	CBR at 0.1 in ---	CBR at 0.2 in ---



Soil Properties

As-Received Moisture Content	---
Liquid Limit	47
Plastic Limit	25
Plastic Index	22

%Passing	
1.5"	
3/4"	100.0
3/8"	99.1
No. 4	94.9
No. 10	90.2
No. 40	83.0
No. 100	78.7
No. 200	76.5

AASHTO T-99 Method A

MDD (pcf)	102.9
OMC (%)	20.9

Before Soaking		*After Soaking*	
Compactive Effort (Blows Per Layer)	72	Final Dry Density (pcf)	101.1
Initial Dry Density (pcf)	102.7	Average Final Moisture Content	24.0%
Moisture Content of Compacted Specimen	21.1%	Moisture Content (top 1" after soaking)	25.5%
Percent Compaction	99.8%	Percent Swell	1.6%

Soak Time (hours): 96 Surcharge Weight (lb): 20 Surcharge Stress (psf): 102

AASHTO T-99 Method A was performed on grading complying with CBR specification.

AASHTO T193 was performed on the entire gradation compacted in a 6" CBR mold.

% Retained on 3/4" sieve: 0.0

References / Comments / Deviations:

Matthew Thornton	Matthew Thornton	Laboratory Manager	6/15/23
Technical Responsibility	*Signature*	*Position*	*Date*

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Material Classification

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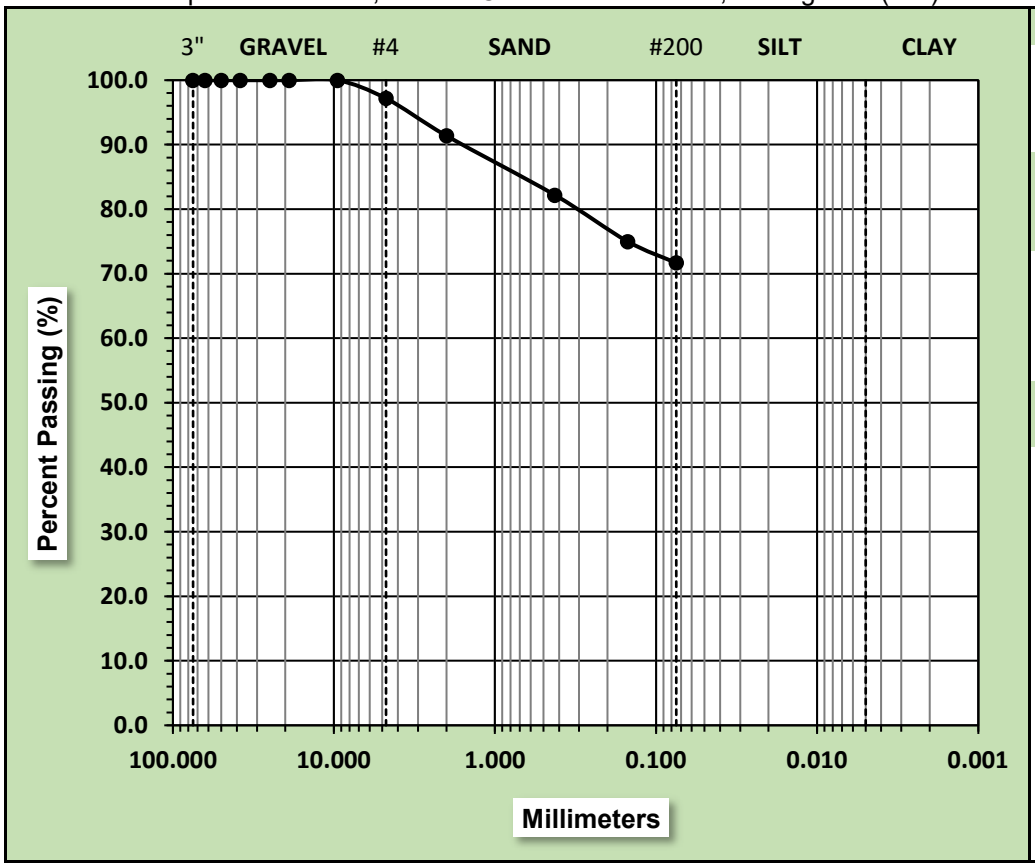
PROJECT INFORMATION

Project #:	49408.002	Report Date:	6/15/2023
Project Name:	Staunton Crossing Water & Sewer Development		
Project Location:	1249 Richmond Ave, Staunton, Virginia		
Client Name:	City of Staunton, Virginia		

SAMPLE INFORMATION

Location:	B-02	Sample #:	S-1	Sample Date:	3/1/2023
Depth:	0 to 2 feet	Offset:	N/A	Lab Control #:	8512

Material Description: Brown, ELASTIC SILT WITH SAND, trace gravel (MH)



Soil Properties	
Natural Moisture Content	30.6%
Specific Gravity	---
Liquid Limit	52
Plastic Limit	30
Plastic Index	22
Group Symbol	MH
%Passing	
3"	
2.5"	
2"	
1.5"	
1"	
3/4"	
3/8"	100.0
#4	97.2
#10	91.4
#40	82.2
#100	75.0
#200	71.7

Maximum Particle Size 3/8" **Gravel** 2.8% **Sand** 25.5% **Silt and Clay** 71.7%

C_u --- C_c ---

Description of Sand & Gravel Particles: Rounded, Angular, Soft, Friable

Notes:

References: AASHTO T265 Method B tested on 5/22/23 by Matthew Thornton
AASHTO T11 & T88 tested on 5/23/23 & 6/15/23 by KP and MLT
AASHTO T89 Method B & T90 tested on 6/14/23 by Matthew Thornton

Matthew Thornton	Matthew Thornton	Laboratory Manager	6/15/23
Technical Responsibility	*Signature*	*Position*	*Date*

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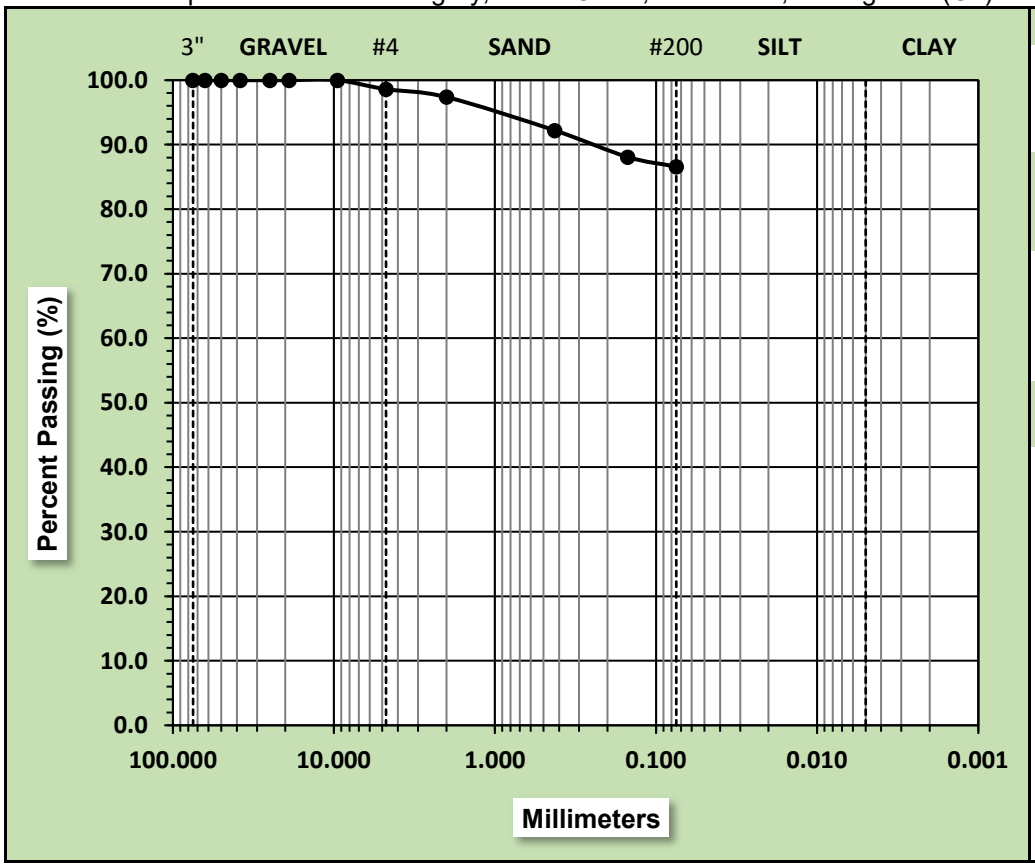
PROJECT INFORMATION

Project #:	49408.002	Report Date:	6/15/2023
Project Name:	Staunton Crossing Water & Sewer Development		
Project Location:	1249 Richmond Ave, Staunton, Virginia		
Client Name:	City of Staunton, Virginia		

SAMPLE INFORMATION

Location:	B-02	Sample #:	S-3	Sample Date:	3/1/2023
Depth:	4 to 6 feet	Offset:	N/A	Lab Control #:	8513

Material Description: Brown and gray, LEAN CLAY, trace sand, trace gravel (CL)



Soil Properties	
Natural Moisture Content	27.8%
Specific Gravity	---
Liquid Limit	45
Plastic Limit	25
Plastic Index	20
Group Symbol	CL
%Passing	
3"	
2.5"	
2"	
1.5"	
1"	
3/4"	
3/8"	100.0
#4	98.6
#10	97.4
#40	92.2
#100	88.1
#200	86.6

Maximum Particle Size 3/8" **Gravel** 1.4% **Sand** 12.0% **Silt and Clay** 86.6%

C_u --- **C_c** ---

Description of Sand & Gravel Particles: Rounded, Angular, Soft, Friable

Notes:

References: AASHTO T265 Method B tested on 5/22/23 by Matthew Thornton
AASHTO T11 & T88 tested on 5/23/23 & 6/15/23 by KP and MLT
AASHTO T89 Method B & T90 tested on 6/14/23 by Matthew Thornton

Matthew Thornton	Matthew Thornton	Laboratory Manager	6/15/23
Technical Responsibility	*Signature*	*Position*	*Date*

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Material Classification

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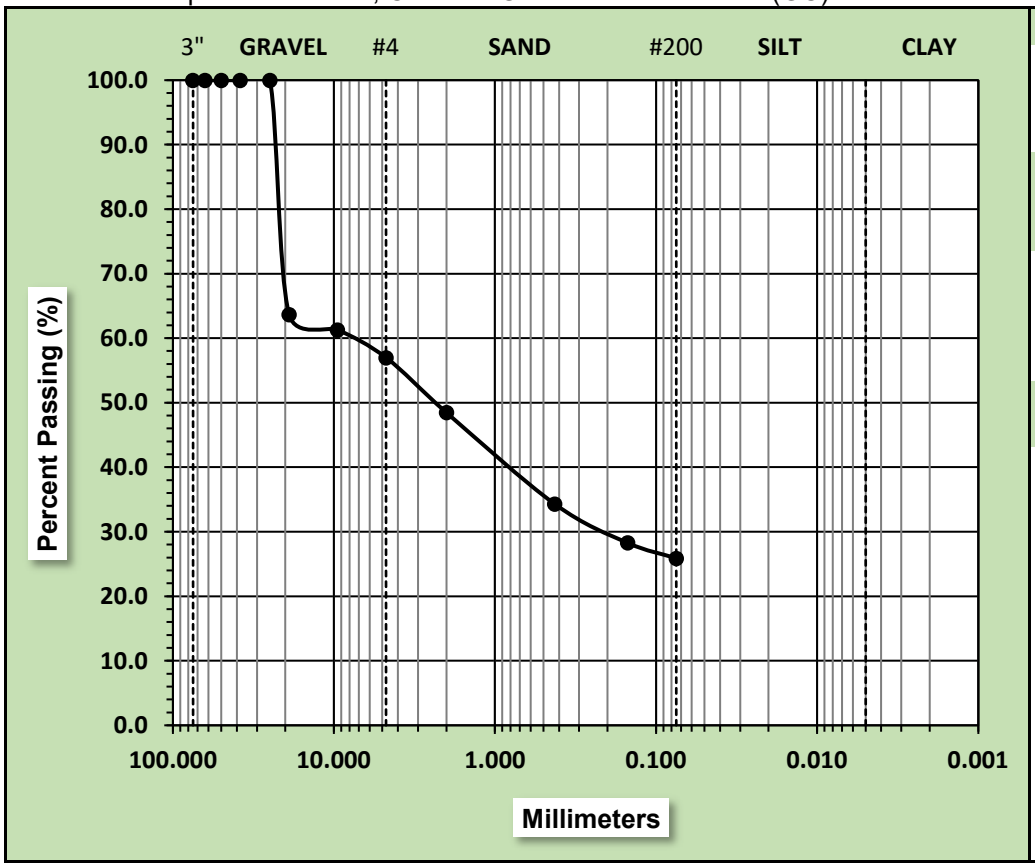
PROJECT INFORMATION

Project #:	49408.002	Report Date:	6/15/2023
Project Name:	Staunton Crossing Water & Sewer Development		
Project Location:	1249 Richmond Ave, Staunton, Virginia		
Client Name:	City of Staunton, Virginia		

SAMPLE INFORMATION

Location:	B-03	Sample #:	S-2	Sample Date:	3/6/2023
Depth:	2 to 4 feet	Offset:	N/A	Lab Control #:	8514

Material Description: Brown, CLAYEY GRAVEL WITH SAND (GC)



Soil Properties	
Natural Moisture Content	15.2%
Specific Gravity	---
Liquid Limit	42
Plastic Limit	22
Plastic Index	20
Group Symbol	CL
%Passing	
3"	
2.5"	
2"	
1.5"	
1"	100.0
3/4"	63.7
3/8"	61.3
#4	57.0
#10	48.5
#40	34.3
#100	28.3
#200	25.9

Maximum Particle Size 1" **Gravel** 43.0% **Sand** 31.1% **Silt and Clay** 25.9%

C_u --- C_c ---

Description of Sand & Gravel Particles: Rounded, Angular, Soft, Friable

Notes:

References: AASHTO T265 Method B tested on 5/22/23 by Matthew Thornton
AASHTO T11 & T88 tested on 5/23/23 & 6/15/23 by KP and MLT
AASHTO T89 Method B & T90 tested on 6/14/23 by Matthew Thornton

Matthew Thornton	Matthew Thornton	Laboratory Manager	6/15/23
Technical Responsibility	*Signature*	*Position*	*Date*

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Material Classification

ASTM D2487

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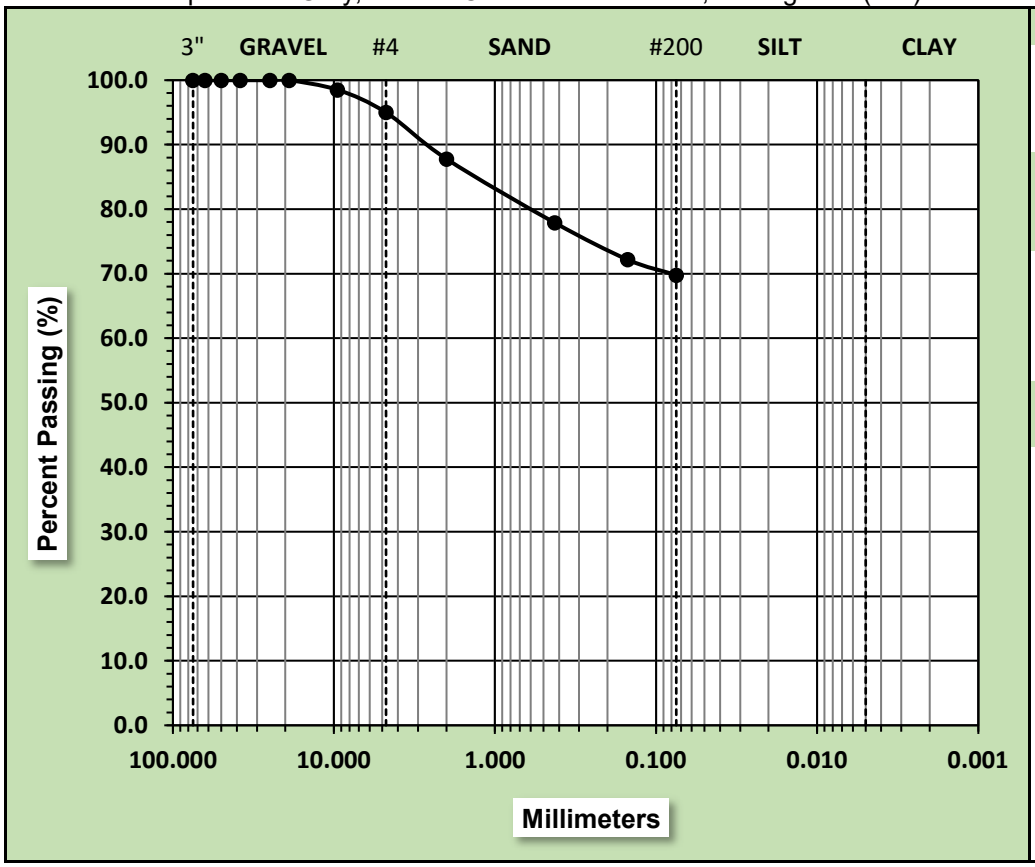
PROJECT INFORMATION

Project #:	49408.002	Report Date:	6/15/2023
Project Name:	Staunton Crossing Water & Sewer Development		
Project Location:	1249 Richmond Ave, Staunton, Virginia		
Client Name:	City of Staunton, Virginia		

SAMPLE INFORMATION

Location:	B-03	Sample #:	S-4	Sample Date:	3/6/2023
Depth:	6 to 8 feet	Offset:	N/A	Lab Control #:	8515

Material Description: Gray, ELASTIC SILT WITH SAMPLE, trace gravel (MH)



Soil Properties	
Natural Moisture Content	37.7%
Specific Gravity	---
Liquid Limit	63
Plastic Limit	34
Plastic Index	29
Group Symbol	MH
%Passing	
3"	
2.5"	
2"	
1.5"	
1"	
3/4"	100.0
3/8"	98.5
#4	95.0
#10	87.8
#40	77.9
#100	72.2
#200	69.8

Maximum Particle Size 3/4" **Gravel 5.0%** **Sand 25.2%** **Silt and Clay 69.8%**

C_u --- **C_c** ---

Description of Sand & Gravel Particles: Rounded, Angular, Soft, Friable

Notes:

References: AASHTO T265 Method B tested on 5/22/23 by Matthew Thornton
AASHTO T11 & T88 tested on 5/23/23 & 6/15/23 by KP and MLT
AASHTO T89 Method B & T90 tested on 6/14/23 by Matthew Thornton

Matthew Thornton	Matthew Thornton	Laboratory Manager	6/15/23
Technical Responsibility	*Signature*	*Position*	*Date*

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Material Classification

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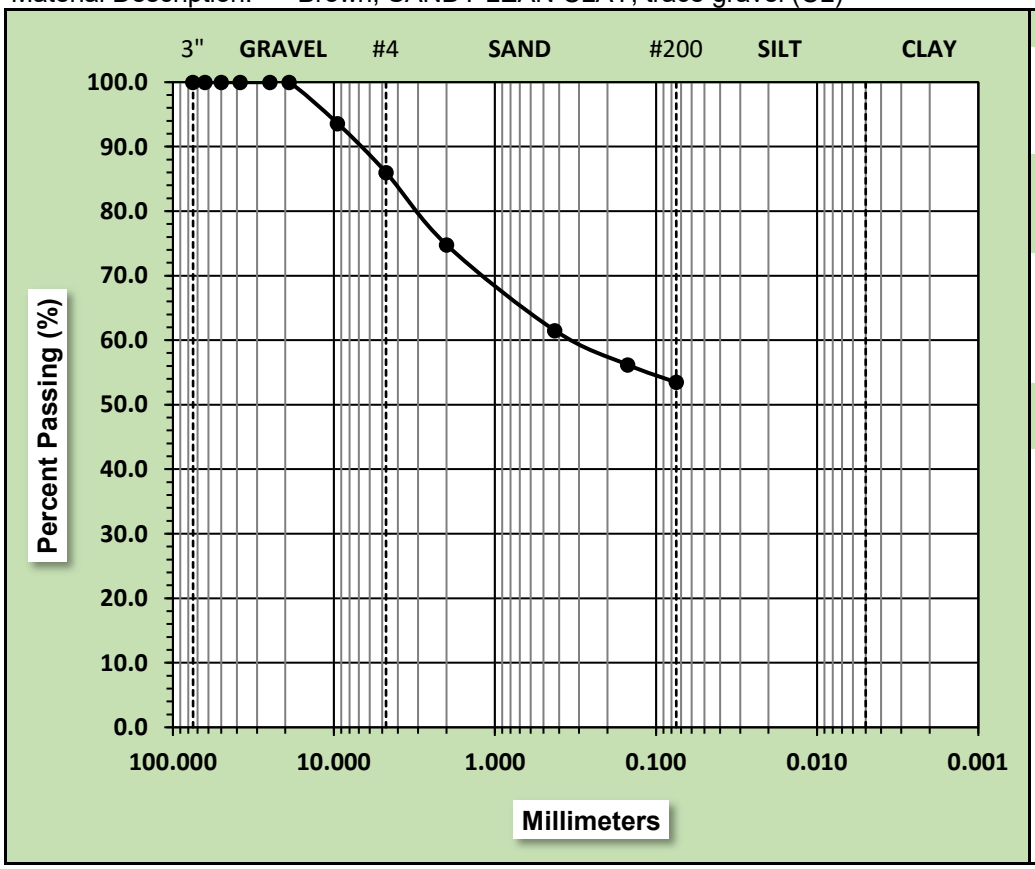
PROJECT INFORMATION

Project #:	49408.002	Report Date:	6/15/2023
Project Name:	Staunton Crossing Water & Sewer Development		
Project Location:	1249 Richmond Ave, Staunton, Virginia		
Client Name:	City of Staunton, Virginia		

SAMPLE INFORMATION

Location:	B-04	Sample #:	Bulk	Sample Date:	3/2/2023
Depth:	0.5 to 5 feet	Offset:	N/A	Lab Control #:	8516

Material Description: Brown, SANDY LEAN CLAY, trace gravel (CL)



Soil Properties	
As-Received Moisture Content	---
Specific Gravity	---
Liquid Limit	43
Plastic Limit	26
Plastic Index	17
Group Symbol	CL
%Passing	
3"	
2.5"	
2"	
1.5"	
1"	
3/4"	100.0
3/8"	93.6
#4	86.0
#10	74.8
#40	61.5
#100	56.2
#200	53.5

Maximum Particle Size 3/4" **Gravel 14.0%** **Sand 32.5%** **Silt and Clay 53.5%**

C_u --- **C_c** ---

Description of Sand & Gravel Particles: Rounded, Angular, Hard, Soft, Friable

Notes:

References:

AASHTO T11 & T88 tested on 5/23/23 & 6/2/23 by Ken Pruner
AASHTO T89 Method B & T90 tested on 6/1/23 by Ken Pruner

Matthew Thornton	Matthew Thornton	Laboratory Manager	6/15/23
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-T85 C127
Revision No. 0.1
Revision Date: 6/3/21

Specific Gravity and Absorption of Coarse Aggregate

☑ AASHTO T 85 ☐ ASTM C 127

TIMMONS GROUP
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PROJECT INFORMATION

Project #:	49408.002	Report Date:	5/26/2023
Project Name:	Staunton Crossing Water & Sewer Development	Test Date(s):	6/2/23 to 6/5/23
Project Location:	1249 Richmond Avenue, Staunton, Virginia	Tested By:	Ken Pruner
Client Name:	City of Staunton, Virginia		

SAMPLE INFORMATION

Location:	B-04	Sample #:	Bulk	Sample Date:	3/2/2023
Depth:	0.5 to 5 feet	Offset:	N/A	Lab Control #:	8516
Material Description:	Material retained on the No. 4 sieve				
Sampling Method:	Soil Boring	Reduction Method:	ASTM C 702 Quartering		

TEST DATA

	Pan No. BOX =	321.2	grams
	Pan + oven-dry specimen =	2831.3	grams
A:	Mass of the oven-dry specimen =	2510.1	grams
B:	Mass of the saturated surface-dry specimen =	2774.2	grams
C:	Mass of specimen in water =	1579.1	grams

CALCULATIONS

Bulk Specific Gravity (Oven-Dry) =	2.100	
Bulk Specific Gravity (Saturated Surface-Dry) =	2.321	
Apparent Specific Gravity =	2.696	
Absorption =	10.5%	

☐ Specific gravity and absorption were determined without first drying the aggregate

References / Comments / Deviations:

Matthew Thornton	Matthew Thornton	Laboratory Manager	6/15/23
Technical Responsibility	*Signature*	*Position*	*Date*

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MOISTURE-DENSITY RELATIONSHIP REPORT

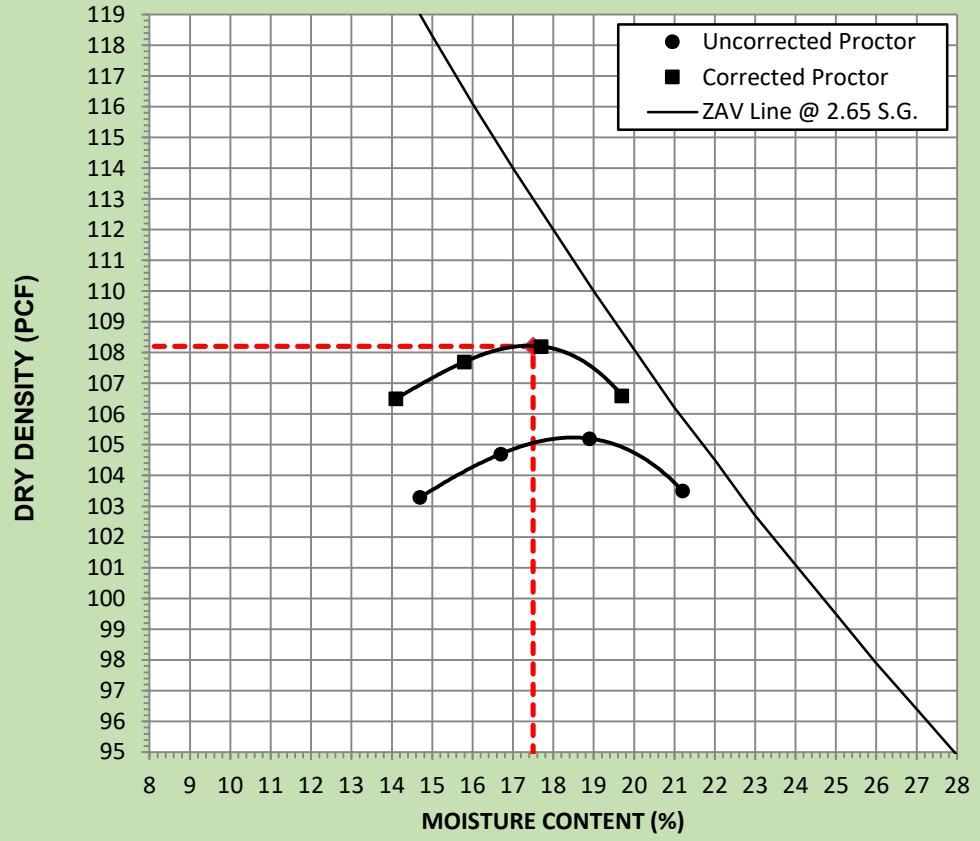
TIMMONS GROUP
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PROJECT INFORMATION			
Project #:	49408.002	Report Date:	6/15/2023
Project Name:	Staunton Crossing Water & Sewer Development	Test Date(s):	5/31/2023
Project Location:	1249 Richmond Ave, Staunton, Virginia	Tested By:	Ken Pruner
Client Name:	City of Staunton, Virginia		

SAMPLE INFORMATION					
Location:	B-04	Sample #:	Bulk	Sample Date:	3/2/2023
Depth:	0.5 to 5 feet	Offset:	N/A	Lab Control #:	8516
Material Description:	Brown, SANDY LEAN CLAY, trace gravel (CL)				

Corrected Maximum Dry Density	108.2 PCF	Corrected Optimum Moisture Content	17.5 %

AASHTO T-99 Method A



Soil Properties	
As-Received Moisture Content	---
Assumed Specific Gravity	2.65
Liquid Limit	43
Plastic Limit	26
Plastic Index	17
%Passing	
1.5"	
3/4"	100.0
3/8"	93.6
No. 4	86.0
No. 10	74.8
No. 40	61.5
No. 200	53.5
Uncorrected Moisture-Density	
MDD (pcf)	105.3
OMC (%)	18.6
Oversize Fraction (AASHTO T85)	
Sp.Gr.(OD)	2.100
Absorption	10.5%

The Moisture-Density Curves Displayed represent the Fine Fraction with & without an Oversize Correction.
Air-dried material passing a No. 4 sieve was prepared then compacted with a circular, manual rammer.

References / Comments / Deviations:

Matthew Thornton	Matthew Thornton	Laboratory Manager	6/15/23
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-CBR
Revision No. 1
Revision Date: 05/18/18

CBR (California Bearing Ratio) of Laboratory Compacted Soil

AASHTO T193

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

PROJECT INFORMATION

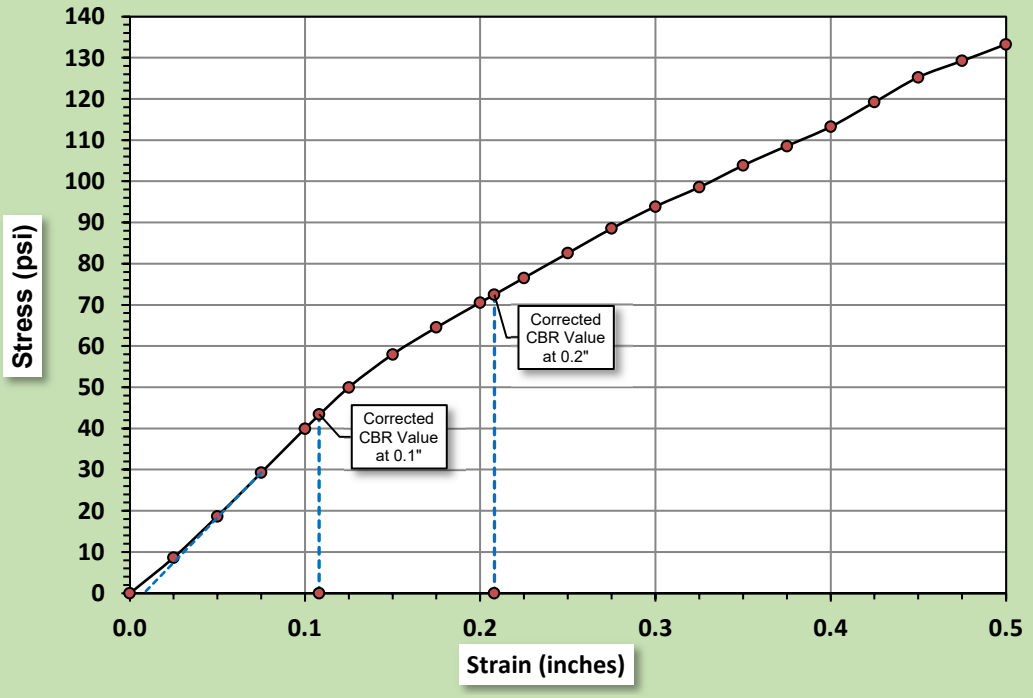
Project #:	49408.002	Report Date:	6/15/2023
Project Name:	Staunton Crossing Water & Sewer Development	Test Date(s):	6/7/23 to 6/12/23
Project Location:	1249 Richmond Ave, Staunton, Virginia	Tested By:	KP and MLT
Client Name:	City of Staunton, Virginia		

SAMPLE INFORMATION

Location:	B-04	Sample #:	Bulk	Sample Date:	3/2/2023
Depth:	0.5 to 5 feet	Offset:	N/A	Lab Control #:	8516

Material Description: Brown, SANDY LEAN CLAY, trace gravel (CL)

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 4.0	CBR at 0.2 in. 4.7	CBR at 0.1 in 4.4	CBR at 0.2 in 4.8



Soil Properties

As-Received Moisture Content	---
Liquid Limit	43
Plastic Limit	26
Plastic Index	17

%Passing

1.5"	
3/4"	100.0
3/8"	93.6
No. 4	86.0
No. 10	74.8
No. 40	61.5
No. 100	56.2
No. 200	53.5

AASHTO T-99 Method A

MDD (pcf)	108.2
OMC (%)	17.5

Before Soaking		*After Soaking*	
Compactive Effort (Blows Per Layer)	64	Final Dry Density (pcf)	105.7
Initial Dry Density (pcf)	107.8	Average Final Moisture Content	21.4%
Moisture Content of Compacted Specimen	17.8%	Moisture Content (top 1" after soaking)	22.7%
Percent Compaction	99.6%	Percent Swell	2.0%

Soak Time (hours): 96 Surcharge Weight (lb): 20 Surcharge Stress (psf): 102

AASHTO T-99 Method A was performed on grading complying with CBR specification.

AASHTO T193 was performed on the entire gradation compacted in a 6" CBR mold.

% Retained on 3/4" sieve: 0.0

References / Comments / Deviations:

Matthew Thornton	Matthew Thornton	Laboratory Manager	6/15/23
Technical Responsibility	*Signature*	*Position*	*Date*

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Timmons Group / 430 Southlake Boulevard Suite B-15 Richmond, VA 23236 / p 804.200.6500

Material Classification

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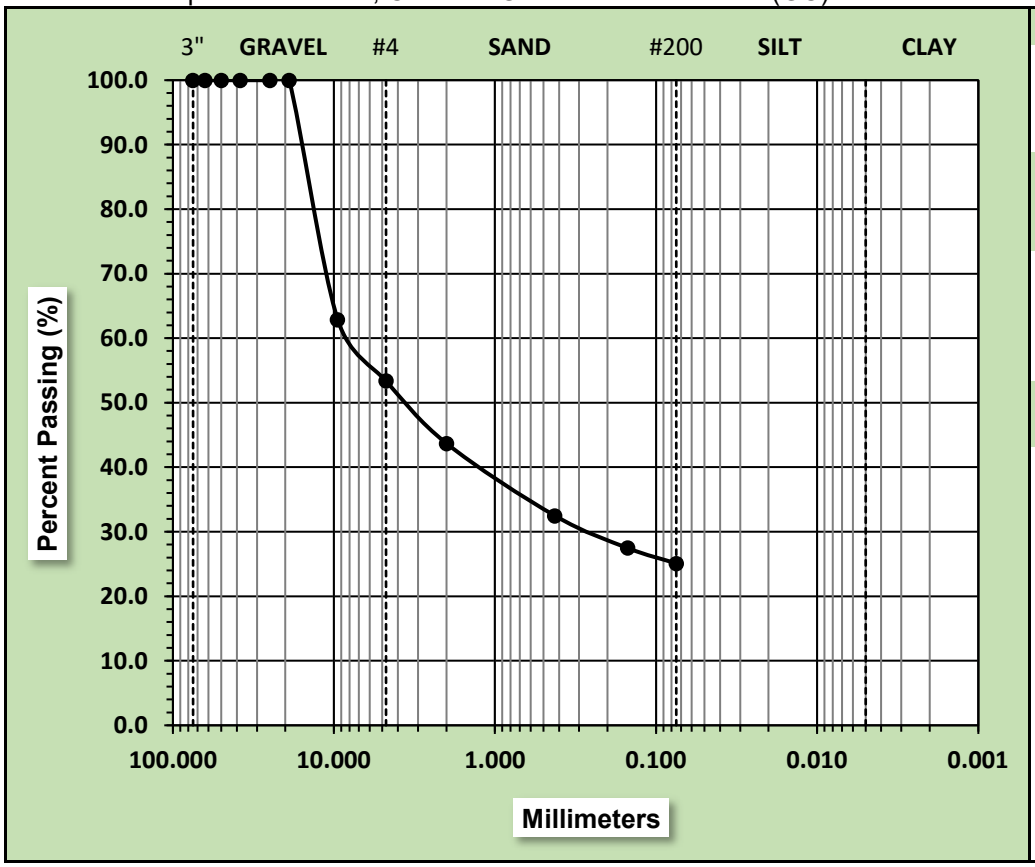
PROJECT INFORMATION

Project #:	49408.002	Report Date:	6/15/2023
Project Name:	Staunton Crossing Water & Sewer Development		
Project Location:	1249 Richmond Ave, Staunton, Virginia		
Client Name:	City of Staunton, Virginia		

SAMPLE INFORMATION

Location:	B-05	Sample #:	S-2	Sample Date:	3/6/2023
Depth:	2 to 4 feet	Offset:	N/A	Lab Control #:	8517

Material Description: Brown, CLAYEY GRAVEL WITH SAND (GC)



Soil Properties	
Natural Moisture Content	24.7%
Specific Gravity	---
Liquid Limit	46
Plastic Limit	26
Plastic Index	20
Group Symbol	CL
%Passing	
3"	
2.5"	
2"	
1.5"	
1"	
3/4"	100.0
3/8"	62.9
#4	53.4
#10	43.7
#40	32.5
#100	27.5
#200	25.1

Maximum Particle Size 3/4" **Gravel 46.6%** **Sand 28.3%** **Silt and Clay 25.1%**

C_u --- **C_c** ---

Description of Sand & Gravel Particles: Rounded, Angular, Soft, Friable

Notes:

References: AASHTO T265 Method B tested on 5/22/23 by Matthew Thornton
AASHTO T11 & T88 tested on 5/23/23 & 6/15/23 by KP and MLT
AASHTO T89 Method B & T90 tested on 6/1/23 by Ken Pruner

Matthew Thornton	Matthew Thornton	Laboratory Manager	6/15/23
Technical Responsibility	*Signature*	*Position*	*Date*

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Material Classification

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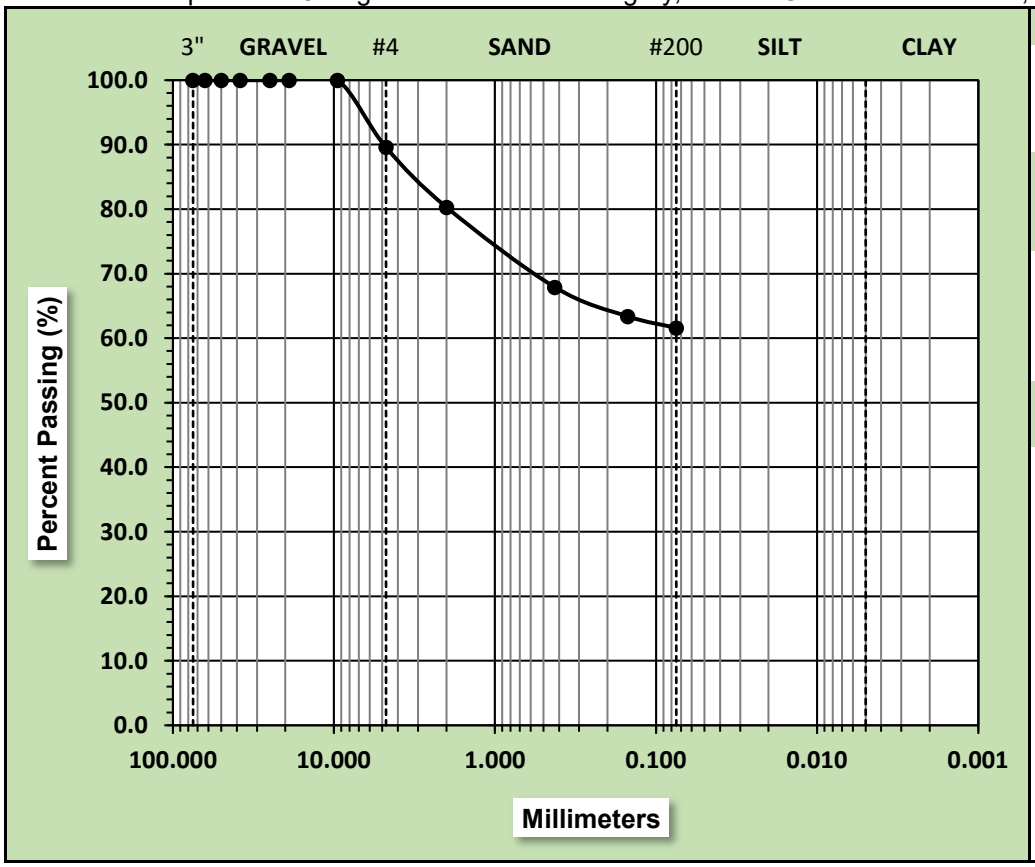
PROJECT INFORMATION

Project #:	49408.002	Report Date:	6/15/2023
Project Name:	Staunton Crossing Water & Sewer Development		
Project Location:	1249 Richmond Ave, Staunton, Virginia		
Client Name:	City of Staunton, Virginia		

SAMPLE INFORMATION

Location:	B-05	Sample #:	S-4	Sample Date:	3/6/2023
Depth:	6 to 8 feet	Offset:	N/A	Lab Control #:	8518

Material Description: Orange-brown mottled with gray, ELASTIC SILT WITH SAND, trace gravel (MH)



Soil Properties	
Natural Moisture Content	37.0%
Specific Gravity	---
Liquid Limit	66
Plastic Limit	36
Plastic Index	30
Group Symbol	MH
%Passing	
3"	
2.5"	
2"	
1.5"	
1"	
3/4"	
3/8"	100.0
#4	89.6
#10	80.3
#40	67.9
#100	63.4
#200	61.6

Maximum Particle Size 3/8" **Gravel 10.4%** **Sand 28.0%** **Silt and Clay 61.6%**

C_u --- **C_c** ---

Description of Sand & Gravel Particles: Rounded, Angular, Soft, Friable

Notes:

References: AASHTO T265 Method B tested on 5/22/23 by Matthew Thornton
AASHTO T11 & T88 tested on 5/23/23 & 6/15/23 by KP and MLT
AASHTO T89 Method B & T90 tested on 6/1/23 by Ken Pruner

Matthew Thornton	Matthew Thornton	Laboratory Manager	6/15/23
Technical Responsibility	*Signature*	*Position*	*Date*

Information included in this report relates only to material sampled at the time of testing.
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APPENDIX B

Valley Automation Proposal

December 1, 2023

Mr. Lyle Hartt
City Engineer
City of Staunton
116 W. Beverley St.
Staunton, VA. 24401

RE: Staunton Crossing Utility Improvements - Phase 1 SCADA

Mr. Lyle Hartt:

Thank you for contacting the offices of Valley Automation. Per request, we are providing a quotation to provide services as described in the Scope of Work. Valley Automation Inc. is a certified SWaM business and VA Class A Contractor. Valley Automation Inc. is a Rockwell Silver Level certified Systems Integrator. Valley Automation Inc. is an Inductive Ignition certified integrator.

Valley Automation shall provide the following goods and services to provide Supervisory, Control, And Data Acquisition (SCADA) and controls integration for the new Suction Lift Pump Station. A SCADA control panel shall be provided that will provide monitoring and control per specification section 33 2313, paragraph 2.10.H – Liquid Level Control System with the Staunton WWPS SCADA Panel CSP (IO List) and drawings.

Scope of Work:
Valley Automation shall provide the following items:
STAUNTON WWPS SCADA PANEL (certified UL508A) -

1. Enclosure, NEMA12/4 with –
   A. Subpanel
   B. Ground Bar
   C. Ground Strap
   D. Light Kit with door switch
2. Transient Voltage Suppression System (TVSS)
3. Circuit Protection, as required.
4. Receptacle, din-rail mount.
5. Power Supply, 120VAC to 24VDC, 120W.
6. Uninterruptible Power Supply (UPS) – the purpose of the UPS is to supply power to the critical systems; communications modem and programmable logic controller.
7. Interposing isolation relays (as required).
8. Programmable Logic Control system –

A. 5069-L306ER – CompactLogix 5380 Controller, 600KB, 8 I/Os, 16 nodes, Standard.
B. 5069-IB16 – 5069 Compact I/O 16 Channel 24VDC Sink Input Module (Qty. 3)
C. 5069-OB16 – 5069-Compact I/O 16 Channel 24VDC Source Output Module (Qty. 1)

9. Fortigate Firewall communications.
10. Customer-use terminals
11. EthernetIP Network Switch, unmanaged, 8-port RJ45

To accomplish satisfactory completion of this project, Valley Automation will provide the following services:

Engineering –

1. Project Management
2. Design
3. Cellular Signal Testing – VAI shall conduct a cellular signal survey to ascertain the signal strength at the site. A signal level of RSS = -85dB or greater is desired to achieve reliable cellular communications.
4. Submittals – per specification
5. Programming –
   A. Programmable Logic Controller code.
   B. Communications Modem
   C. SCADA (Wonderware) – add site to the Owner's SCADA system.
6. Factory Acceptance Testing –
   A. F.A.T. testing plan. Submitted and Approved by Owner.
   B. Conducted at the Valley Automation Inc. Wallace Panel Shop (Luray VA.) Witnessed by Owner's representatives.
7. Coordinate with the Pump Station Control Panel (PSCP) provider.
8. Onsite Power & IO testing and Supervision.
9. Commissioning
10. Site Acceptance Testing –
    A. S.A.T. testing plan. Submitted and Approved by Owner.
    B. Witnessed by Owner's representatives.
11. Training of Owner's representatives.

Technical/Shop –

1. Fabrication of SCADA Panel.
2. F.A.T. Support.
3. Shipping
4. Onsite SCADA Panel terminations.
5. Power & IO Testing and Commissioning support.
6. S.A.T. support.

City of Staunton shall provide the following goods and services to satisfactorily complete this project:

1. With the General Contractor, provide a safe working environment per OSHA Standards.
2. Installation of control panels, instrumentation, conduit, and wiring shall be performed by "others."
3. Valley Automation Inc. is not providing the Pump Station Control Panel, PSCP. It is our understanding this is to be provided by the pump station contractor as part of their packaged system.
4. The City of Staunton is responsible for acquiring an account with the service provider for communications.

Exclusions:

1. The customer service provider is responsible for providing the building ethernet access system box. Installation of the box, power, and optical fiber is the to be performed by "others."

Costs:

[redacted]

Net 30 Terms Apply
Does not include applicable taxes.

Valley Automation, Inc. shall be held harmless for any delays regarding delivery of equipment. Current delays from vendors are out of the control of Valley Automation, Inc. Immediate procurement shall take place for all hardware items upon receipt of a purchase order. Valley Automation, Inc. shall update the customer on anticipated delivery dates as information is presented for review.

Payment Schedule / Milestone Payments:

1. Valley Automation Inc. shall use a Schedule of Values format for applications for payment.
2. The Schedule of Values shall use progress payments based on performance task completion.
3. Performance tasks and percentage of value shall be determined by contract between Valley Automation Inc. and Mr. Lyle Hartt.

All work to be performed during normal business hours, Monday – Friday, 8 a.m. to 5 p.m.
Any additional work, or work outside of normal business hours, shall be performed at Valley Automation Inc. Standard Rates. [See Appendix A]

Valley Automation, Inc is prepared to start on this project upon the receipt of a purchase order. Receipt of purchase order signifies City of Staunton acceptance of all terms and conditions described in the Scope of Work.

Valley Automation Inc. appreciates the opportunity to provide City of Staunton this proposal for your consideration. If you have any questions, please contact Patrick Embry or Greg Kempfer.

Patrick C. Embry
Sr. Systems Engineer – Owner
Valley Automation, Inc.
1316 East Main St.
Luray, VA 22825
O: (540) 743-7772
C: (540) 271-3854

Greg Kempfer
Sr. Automation Engineer
Valley Automation, Inc.
3221 Peoples Drive, Suite 160
Harrisonburg, VA 22801
O: (540) 433-3666
C: (540) 810-5285

Sincerely,
Greg Kempfer
Sr. Automation Engineer
Valley Automation, Inc.

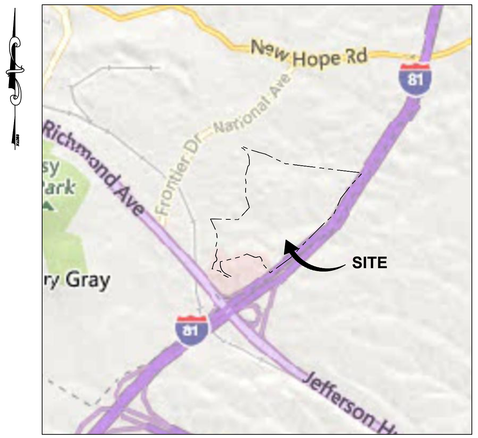
STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER

CITY OF STAUNTON, VIRGINIA

SITE DATA

OWNER:
CITY OF STAUNTON
ATTN: LYLE HARTT, PE
CITY ENGINEER
116 WEST BEVERLEY STREET
STAUNTON, VA 24401
PHONE: 540-332-3858
EMAIL: HARTTLM@CI.STAUNTON.VA.US

ENGINEER:
TIMMONS GROUP
ATTN: BRUCE STRICKLAND JR, PE
1001 BOULDERS PARKWAY, SUITE 300
RICHMOND, VA 23225
PHONE: 804-200-6389
EMAIL: BRUCE.STRICKLAND@TIMMONS.COM



VICINITY MAP
SCALE: 1" = 2,000'

SHEET INDEX	
SHEET NUMBER	**SHEET NAME**
G1.0	COVER SHEET
G1.1	GENERAL NOTES
C1.0	EROSION AND SEDIMENT CONTROL NARRATIVE
C1.1	EROSION AND SEDIMENT CONTROL DETAILS
S1.0	SANITARY SEWER SHEET INDEX
S1.1	SANITARY SEWER PLAN AND PROFILE
F1.0	FORCEMAIN SHEET INDEX
F1.1	FORCE MAIN PLAN AND PROFILE
F1.2	FORCE MAIN PLAN AND PROFILE
F1.3	FORCE MAIN PLAN AND PROFILE
F1.4	FORCE MAIN PLAN AND PROFILE
U1.0	UTILITY DETAILS
U1.1	UTILITY DETAILS
P1.0	PUMP STATION SITE DEMOLITION PLAN
P1.1	PUMP STATION SITE LAYOUT
P1.2	PUMP STATION SITE DETAILS
P2.0	PUMP STATION LAYOUT
P2.1	PUMP STATION SECTIONS
P2.2	PUMP STATION SECTIONS
P2.3	WET WELL PENETRATION DETAIL
P2.4	PUMP DATA
P3.0	PUMP STATION MECHANICAL DETAILS
P3.1	PUMP STATION MECHANICAL DETAILS
E1.0	ELECTRICAL POWER DISTRIBUTION AND NOTES
E1.1	ELECTRICAL SCHEDULES NOTES AND DIAGRAMS
E1.2	ELECTRICAL PLAN VIEWS AND DETAILS
M1.1	LEGEND, ABBREVIATIONS, SCHEDULES AND DETAILS
M2.1	HVAC PLAN
D1.1	LEGEND, ABBREVIATIONS, SCHEDULES AND DETAILS
D2.1	PLUMBING PLAN

SUBMITTED: MARCH 31, 2023
REVISED: NOVEMBER 17, 2023

NOTE: A VSMP REGISTRATION STATEMENT IS NOT REQUIRED FOR THIS LINEAR DEVELOPMENT PROJECT IN ACCORDANCE WITH DEQ GUIDANCE MEMO NO. 15-2003. ADDITIONALLY, THIS PROJECT ACHIEVES COMPLIANCE WITH PART IIB OF VSMP TECHNICAL CRITERIA BY A NEGLIGIBLE INCREASE IN IMPERVIOUSNESS AND NEGLIGIBLE CHANGE IN WATER QUALITY/QUANTITY.

MISS UTILITY OF VIRGINIA
THE CONTRACTOR SHALL CALL "MISS UTILITY" 48 HOURS PRIOR TO THE START OF EXCAVATION. CONTRACTOR SHALL VERIFY LOCATION AND ELEVATION OF ALL UNDERGROUND UTILITIES SHOWN ON PLANS IN AREAS OF CONSTRUCTION PRIOR TO STARTING WORK. CONTACT THE ENGINEER IMMEDIATELY IF THE LOCATION OR ELEVATION IS DIFFERENT FROM THAT SHOWN ON THE PLAN. IF THERE APPEARS TO BE A CONFLICT, AND/OR UPON DISCOVERY OF ANY UTILITY NOT SHOWN ON PLAN. THE DEVELOPER SHALL BE RESPONSIBLE FOR THE RELOCATION OF ANY UTILITY WITHIN THE EXISTING AND/OR RIGHT-OF-WAY REQUIRED BY THE DEVELOPMENT. CONTACT MISS UTILITY OF VIRGINIA: 1-800-552-7001 (TOLL FREE) OR DIAL 811.

CITY PROJECT No. A00124

COMMONWEALTH OF VIRGINIA
BRUCE W. STRICKLAND JR.
Lic. No. 056612
11/17/2023
PROFESSIONAL ENGINEER

THIS DRAWING PREPARED AT THE
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REVISION DESCRIPTION	DATE
VDH SUBMITTAL	05-08-2023
REVISED PER CITY COMMENTS	06-30-2023
REVISED PER CITY COMMENTS	11-17-2023

DATE: 3/31/2023
DRAWN BY: Z. MOUNTJOY
DESIGNED BY: J. CARTER
CHECKED BY: B. STRICKLAND
SCALE:

TIMMONS GROUP

STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER
CITY OF STAUNTON, VIRGINIA
COVER SHEET

JOB NO. 49408
SHEET NO. G1.0

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EXISTING UTILITY OWNERS

SEWER AND WATER:

CITY OF STAUNTON
DEPARTMENT OF PUBLIC WORKS
1911 CRAIGMONT ROAD
STAUNTON, VA 24402
CONTACT: DAVID IRVIN
PHONE: (540) 332-3892
EMAIL: IRVINDH@CI.STAUNTON.VA.US

ELECTRICAL:

DOMINION ENERGY
2 TECHNOLOGY DRIVE
STAUNTON, VA 24401
PHONE: (866) 366-4357 ((866)-DOM-HELP)

RESTRAINED JOINT NOTES:

1. THRUST RESTRAINTS SHALL BE PROVIDED ON ALL VALVES, FITTINGS, BENDS, TEES, AND DEAD ENDS. THRUST RESTRAINTS SHALL EXTEND A MINIMUM OF ONE FULL JOINT OF PIPE IN EACH DIRECTION. ADDITIONAL RESTRAINED LENGTH SHALL BE PROVIDED AS INDICATED BELOW. THRUST RESTRAINTS SHALL BE MANUFACTURED BY EBAA IRON OR APPROVED EQUAL AND THE SERIES INDICATED BELOW:

DUCTILE IRON PIPE MECHANICAL JOINTS: SERIES 1100
DUCTILE IRON PIPE PUSH ON JOINTS: SERIES 1700

RESTRAINED LENGTHS SHALL APPLY IN EACH DIRECTION

CALCULATION ASSUMPTIONS

SOIL TYPE:	MH (GRANULAR)
SAFETY FACTOR:	1.5 to 1.0
TRENCH TYPE:	3
DEPTH OF BURY:	3.5'
TEST PRESSURE:	150 psi

FITTING	12" FORCE MAIN	12" POLYWRAPPED FORCE MAIN
11.25° BEND	18'	18'
22.5° BEND	18'	18'
45° BEND	18'	36'
90° BEND	54'	72'
VALVE	72'	144'
PLUG	72'	144'

BURIED DUCTILE IRON PIPE NOTES:

1. POLYETHYLENE ENCASEMENT, WHERE REQUIRED, SHALL CONFORM TO AWWA C105 AND ANSI A21.5. THE POLYETHYLENE SHALL HAVE A MINIMUM THICKNESS OF 8 MIL, SHALL BE TUBING TYPE AND SHALL BE MANUFACTURED OF VIRGIN MATERIAL. THE TAPE USED FOR INSTALLATION OF POLYETHYLENE TUBING SHALL BE PLASTIC-BACKED ADHESIVE WITH A THICKNESS OF 12 MILS AND A MINIMUM WIDTH OF 1-1/2". THE TAPE SHALL BE CAPABLE OF BONDING TO METAL, BITUMINOUS COATING AND POLYETHYLENE AT A TEMPERATURE RANGE OF 32 TO 120 DEGREES FAHRENHEIT.

GENERAL NOTES:

1. THE CONTRACTOR SHALL PAY FOR AND OBTAIN ALL REQUIRED PERMITS AND DELIVER COPIES TO THE OWNER AT THE PRE-CONSTRUCTION MEETING.
2. CONTRACTOR SHALL NOTIFY PROPERTY OWNERS (IN WRITING) OF ANY WORK SCHEDULED ADJACENT TO OR THROUGH THEIR PROPERTY A MINIMUM OF ONE WEEK IN ADVANCE PRIOR TO THE COMMENCEMENT OF ANY STAKING OR CONSTRUCTION ACTIVITY.
3. HORIZONTAL DATUM: NAD 83
   VERTICAL DATUM: NAVD 88
4. STAKING FOR CONSTRUCTION, TO ASSURE PROPER LOCATION OF PROJECT COMPONENTS SHALL BE PERFORMED BY A LICENSED LAND SURVEYOR.
5. ALL EXISTING PROPERTY MARKERS ARE TO REMAIN UNDISTURBED. IF DISTURBANCE OCCURS, REPLACEMENT MUST BE PERFORMED BY A LICENSED LAND SURVEYOR AT THE CONTRACTOR'S EXPENSE.
6. PREVIOUSLY ARRANGED ACCESS EASEMENTS, STAGING AREAS, STORAGE AREAS, ETC., IF ANY, ARE SHOWN ON THE DRAWINGS. ADDITIONAL LAND USE RIGHTS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
7. WORK AREAS SHALL BE KEPT AT ALL TIMES FREE OF DEBRIS AND HAZARDOUS MATERIAL TO THE SATISFACTION OF THE INSPECTOR.
8. THE CONTRACTOR SHALL COORDINATE STORAGE OF MATERIALS, PARKING OF VEHICLES, AND RESTRICTIONS OF WORK WITH THE INSPECTOR.
9. CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF ALL EXISTING FEATURES (EXCEPT TREES), SUCH AS GUARDRAIL, SIDEWALKS, BRICKWORK, CULVERTS, FENCES, SHRUBS, PLANTERS, ETC. TO THEIR ORIGINAL LOCATION AND CONDITION WHICH EXISTED PRIOR TO CONSTRUCTION. TOTAL REPLACEMENT MAY BE NECESSARY.
10. THE LOCATION OF EXISTING UTILITIES ACROSS OR ALONG THE ROUTE OF THE PROPOSED WORK IS NOT NECESSARILY SHOWN ON THE PLANS, AND WHEN SHOWN, IS ONLY APPROXIMATELY CORRECT. IN ADDITION TO CONTACTING MISS UTILITY PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR SHALL, ON HIS OWN INITIATIVE, HORIZONTALLY AND VERTICALLY LOCATE ALL EXISTING UNDERGROUND LINES, FACILITIES, AND STRUCTURES. THE CONTRACTOR IS RESPONSIBLE FOR REPAIRING ANY UNDERGROUND LINES, FACILITIES, AND STRUCTURES DAMAGED.
11. CONTRACTOR SHALL COORDINATE WITH THE LOCAL UTILITY COMPANIES PRIOR TO CONSTRUCTING PORTIONS OF WORK IMMEDIATELY ADJACENT TO UTILITY STRUCTURES. THE COSTS OF POLE AND/OR OTHER STRUCTURE STABILIZATION DURING WORK SHALL BE BORNE BY THE CONTRACTOR.
12. ALL WORK SHALL BE SUBJECT TO INSPECTION BY BOTH STATE AND LOCAL INSPECTORS.
13. FINAL ACCEPTANCE BY THE OWNER WILL NOT BE MADE UNTIL ALL WORK SHOWN ON THE APPROVED CONTRACT DOCUMENTS IS COMPLETED, INCLUDING PAVING, GRADING, RESTORATION AND ALL ADJUSTMENTS.
14. CONTRACTOR SHALL RESTORE EXISTING DITCH TO ORIGINAL CONDITION AND ENSURE THAT POSITIVE DRAINAGE IS MAINTAINED WITHIN THE DITCH. PAVEMENT AND SHOULDERS MUST ALSO BE RESTORED TO THEIR ORIGINAL CONDITION.
15. CONTRACTOR SHALL ENSURE THAT PUBLIC AND PRIVATE ENTRANCE CULVERTS ARE FREE OF ANY CONSTRUCTION DEBRIS.
16. ALL MATERIALS AND CONSTRUCTION WITHIN THE PUBLIC RIGHT OF WAY SHALL BE IN ACCORDANCE WITH THE CURRENT EDITION OF THE VIRGINIA DEPARTMENT OF TRANSPORTATION'S ROAD AND BRIDGE SPECIFICATIONS, ROAD AND BRIDGE STANDARDS AND WORK AREA PROTECTION MANUAL.
17. ANY WORK TO OCCUR WITHIN THE LIMITS OF DISTURBANCE OF THE CROSSING WAY ROAD EXTENSION SHALL BE COORDINATED WITH DPW AND VDOT PRIOR TO COMMENCING.
18. ANY RIGHT-OF-WAY OR ROADSIDE WORK THAT MAY AFFECT TRAFFIC WILL REQUIRE A TRAFFIC MAINTENANCE PLAN, AND MUST BE SUBMITTED TO AND APPROVED BY DPW PRIOR TO ANY WORK THAT MAY AFFECT TRAFFIC.
19. CONTRACTOR SHALL VERIFY LOCATION AND ELEVATION OF ALL UNDERGROUND UTILITIES SHOWN ON PLANS IN AREAS OF CONSTRUCTION PRIOR TO STARTING WORK. CONTACT THE ENGINEER IMMEDIATELY IF LOCATION OR ELEVATION IS DIFFERENT FROM THAT SHOWN ON PLAN. IF THERE APPEARS TO BE A CONFLICT, OR UPON DISCOVERY OF ANY UTILITY NOT SHOWN ON THIS PLAN, CALL "MISS UTILITY" AT 811.
20. THE CONTRACTOR SHALL VERIFY THE ELEVATIONS OF ALL POINTS OF CONNECTION OR PROPOSED WORK TO EXISTING CURBS, SANITARY LINES, WATER LINES, ETC., PRIOR TO CONSTRUCTION.
21. SOIL STABILIZATION IS REQUIRED WITHIN 7 DAYS FOR ALL AREAS WHERE CLEARING, GRADING, EXCAVATION OR OTHER LAND DISTURBING ACTIVITIES HAVE PERMANENTLY CEASED OR WHERE LAND DISTURBANCE ACTIVITIES HAVE BEEN TEMPORARILY SUSPENDED FOR AN ANTICIPATED DURATION OF GREATER THAN 7 DAYS, OR UPON COMPLETION OF GRADING OPERATIONS FOR A SPECIFIED AREA. SOIL STABILIZATION SHALL BEGIN AS SOON AS PRACTICABLE, BUT NOT LATER THAN THE SEVEN DAYS FOLLOWING THE DAY WHEN LAND DISTURBING ACTIVITIES TEMPORARILY OR PERMANENTLY CEASED.

WATER AND SEWER NOTES:

1. ALL CONSTRUCTION, MATERIALS AND INSTALLATIONS SHALL CONFORM TO THE LATEST EDITION OF STANDARDS AND SPECIFICATIONS, DEPARTMENT OF PUBLIC WORKS ("DPW"), CITY OF STAUNTON, VIRGINIA.
2. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AND SPECIFICATIONS FOR ALL PROPOSED PRODUCTS TO BE USED DURING UTILITY CONSTRUCTION TO DPW FOR REVIEW AND CONCURRENCE PRIOR TO PROCURING ANY MATERIALS. USING MARKINGS, HIGHLIGHTING AND/OR NOTES, SUBMITTAL SHEETS SHALL CLEARLY IDENTIFY THE SPECIFIC PRODUCT TO BE USED, AND THE PURPOSE TO WHICH IT IS TO BE PUT.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING DPW TO SCHEDULE A PRE-CONSTRUCTION MEETING AT LEAST 48 HOURS (TWO WORKING DAYS) PRIOR TO STARTING ANY WORK ON THIS PROJECT. ALL WORK SHALL BE SUBJECT TO INSPECTION. CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS PRIOR TO REQUESTING A PRE-CONSTRUCTION MEETING.
4. CONTRACTOR SHALL INCLUDE IN HIS BID PRICE THE COSTS FOR LOCATING AND UNCOVERING ALL SEWER MANHOLES AND VALVE BOXES AFTER SURFACE TREATMENT OF ROADS, AND FOR ADJUSTING THEM TO THE FINAL ROAD GRADES AS NEEDED.
5. CONTRACTOR SHALL VERIFY LOCATION AND ELEVATION OF ALL UNDERGROUND UTILITIES. THE LOCATIONS AND ELEVATIONS OF EXISTING UTILITIES ACROSS OR ALONG THE LINE OF THE PROPOSED WORK MAY NOT BE SHOWN ON THE PLANS AND WHERE SHOWN MAY BE ONLY APPROXIMATELY CORRECT.
6. CONTRACTOR SHALL INCLUDE IN HIS BID PRICE THE COST OF LOCATING ALL UNDERGROUND LINES AND STRUCTURES AS NECESSARY TO COMPLETE THE WORK. NO CLAIMS FOR DAMAGES OR EXTRA COMPENSATION SHALL ACCRUE TO THE CONTRACTOR DUE TO THE PRESENCE OF EXISTING UTILITIES OR FROM ANY DELAY DUE TO REMOVAL OR REARRANGEMENT OF THE SAME. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE CAUSED TO UNDERGROUND STRUCTURES.
7. CONTRACTOR SHALL CALL "MISS UTILITY" TOLL FREE AT 811 PRIOR TO START OF CONSTRUCTION.
8. DATUM FOR ALL ELEVATIONS SHOWN IS NATIONAL GEODETIC SURVEY.
9. SERVICE SADDLES MUST BE USED ON ALL WATER SERVICE CONNECTIONS.
10. FIRE HYDRANTS SHALL BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W-10.
11. ALL FIRE HYDRANTS SHALL BE NATIONAL STANDARD THREADS AND SHALL BE PAINTED TO AWWA STANDARDS.
12. MINIMUM DESIGN COVER OVER WATER LINES IS 3 FEET. EXCEPTIONS DUE TO UNUSUAL CIRCUMSTANCES IN THE FIELD MUST BE APPROVED BY DPW.
13. MINIMUM DESIGN COVER OVER GRAVITY SEWER LINES IS 3 FEET. EXCEPTIONS DUE TO UNUSUAL CIRCUMSTANCES IN THE FIELD MUST BE APPROVED BY DPW. DUCTILE IRON PIPE (DIP) MUST BE USED WHERE COVER IS LESS THAN 3 FEET, AND WHERE COVER IS MORE THAN 15 FEET IN OTHER AREAS.
14. MINIMUM DESIGN COVER OVER SANITARY SEWER FORCE MAINS IS 3 FEET. EXCEPTIONS DUE TO UNUSUAL CIRCUMSTANCES IN THE FIELD MUST BE APPROVED BY DPW.
15. A SANITARY SEWER CLEANOUT SHALL BE INSTALLED ON EACH SEWER SERVICE LATERAL AT THE EDGE OF THE ROW/UTILITY EASEMENT, IN ACCORDANCE WITH DPW STANDARDS.
16. VANDAL PROOF COVERS SHALL BE USED ON ALL MANHOLES IN EASEMENTS. WATERTIGHT COVERS SHALL BE USED IN FLOOD PLAINS.
17. DETECTABLE MARKING TAPE IS REQUIRED ON ALL BURIED LINES.
18. COPPER TRACER WIRE AND TRACER WIRE ACCESS BOXES SHALL BE INSTALLED ON ALL WATER MAINS AND ALL SEWAGE FORCE MAINS.
19. ON WATER SYSTEMS, TRACER WIRE ACCESS BOXES WITH MOW COLLARS SHALL BE INSTALLED ADJACENT TO ALL FIRE HYDRANTS.
20. ON SEWAGE FORCE MAINS TRACER WIRE ACCESS BOXES SHALL BE INSTALLED AT THE FOLLOWING LOCATIONS:
    a. ADJACENT TO THE BYPASS CONNECTION RISER ON THE PUMP STATION SITE.
    b. ADJACENT TO THE DISCHARGE MANHOLE FOR THE FORCE MAIN.
    c. OTHER INTERMEDIATE LOCATIONS AS DETERMINED BY DPW AND SHOWN ON THE PLANS.
21. GRAVITY SEWERS WHICH RECEIVE PUMPED FLOW SHALL BE PROTECTED AGAINST SULFIDE ATTACK FOR A DISTANCE OF 2,000 FEET DOWNSTREAM FROM THE POINT OF ENTRY OF THE PUMPED FLOW. THIS SHALL BE ACCOMPLISHED BY THE USE OF ACID-RESISTANT PIPE AND MANHOLES IN ACCORDANCE WITH DPW STANDARDS.
22. NO PERMANENT STRUCTURES OR TREES SHALL BE LOCATED WITHIN ANY UTILITY EASEMENT.
23. PRIOR TO REQUESTING ANY ACCEPTANCE INSPECTION, CONTRACTOR SHALL FLUSH AND CLEAN OUT GRAVITY SEWER MAINS AS NEEDED, PERFORM CCTV RECORDINGS OF ALL GRAVITY SEWER MAINS AND MANHOLES, AND SUBMIT CCTV RECORDINGS TO DPW FOR REVIEW.
24. FINAL ACCEPTANCE BY CITY WILL NOT OCCUR UNTIL ALL WORK SHOWN ON APPROVED UTILITY PLANS IS COMPLETED INCLUDING CURB & GUTTER, PAVING, GRADING AND ALL REQUIRED ADJUSTMENTS.
25. WETLANDS SHALL NOT BE IMPACTED WITHIN THE PROJECT LIMITS OF THIS PLAN SET.
26. DPW OR THEIR DESIGNEE WILL INSPECT ALL PUBLIC WATER AND SANITARY SEWER MAINS, CONNECTIONS AND APPURTENANCES THERETO, AS SHOWN ON THE APPROVED UTILITY PLANS, LOCATED WITHIN DEDICATED EASEMENTS AND/OR PUBLIC RIGHTS-OF-WAY. OTHER LINES TO BE INSTALLED ON SITE SUCH AS ROOF DRAINS, FOUNDATION DRAINS, PRIVATE WATER SUPPLY LINES, PRIVATE SANITARY SEWER LINES, ETC., MUST BE APPROVED BY THE DEPARTMENT OF BUILDING INSPECTIONS PRIOR TO INSTALLATION AND ARE TO BE INSPECTED BY THEM BEFORE BACKFILLING/COVERING.
27. CONCURRENT INSPECTIONS BY THE DEPARTMENT OF BUILDING INSPECTIONS AND DPW WILL BE PERFORMED FOR THE FOLLOWING: MAINLINE BACKFLOW PREVENTERS; MONITORING MANHOLES; GREASE TRAPS; EXCLUSION METERS; IRRIGATION METERS. DPW WILL INSPECT TO ENSURE THAT THE PROPER APPURTENANCE, AS SHOWN ON THE APPROVED UTILITY PLANS, HAS BEEN INSTALLED AND TESTED IN ACCORDANCE WITH DPW STANDARDS.

UTILITY NOTES:

1. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PROTECT AND MAINTAIN UNINTERRUPTED SERVICE EXCEPT AS ALLOWED BY THE INSPECTOR.
2. ANY DAMAGE TO EXISTING STRUCTURES SHALL BE REPAIRED IMMEDIATELY TO THE SATISFACTION OF THE INSPECTOR, AT THE CONTRACTOR'S EXPENSE.
3. ALL TIE-IN CONNECTIONS SHALL BE APPROVED BY THE INSPECTOR PRIOR TO BACKFILLING.
4. COMPACT EACH LAYER OF FILL OR BACKFILL TO NOT LESS THAN THE FOLLOWING PERCENTAGES OF THE MAXIMUM DENSITY AT OPTIMUM MOISTURE CONTENT AS DETERMINED BY ASTM D 698 (AASHTO T-99). REFER TO THE GEOTECHNICAL ENGINEERING REPORT FOR ADDITIONAL BACKFILL AND COMPACTION REQUIREMENTS.
   4.A. 100 PERCENT BENEATH AND WITHIN 25 FEET OF BUILDINGS AND STRUCTURES, INCLUDING THOSE SHOWN FOR FUTURE CONSTRUCTION.
   4.B. 95 PERCENT BENEATH PAVEMENTS, WALKS, AND ROAD SHOULDERS, INCLUDING THOSE SHOWN FOR FUTURE CONSTRUCTION.
   4.C. 90 PERCENT IN OTHER UNPAVED AREAS.
5. AFTER BACKFILLING, FINISHED GRADE ABOVE TRENCH SHALL BE RESTORED TO AS GOOD OR BETTER THAN EXISTING CONDITIONS WHICH EXISTED PRIOR TO CONSTRUCTION.
6. BLASTING OF ROCK IS STRICTLY PROHIBITED WITHOUT WRITTEN PRIOR AUTHORIZATION FROM THE OWNER.
7. TRENCHES WITHIN PRIVATE AND PUBLIC PAVED AREAS (GRAVEL, ASPHALT, CONCRETE, ETC.) SUBJECT TO VEHICULAR LOADS SHALL BE FULLY BACKFILLED WITH SELECT AGGREGATE MATERIAL (VDOT 21A OR 21B).

LEGEND

EXISTING		PROPOSED
	PROPERTY LINE	
	RIGHT-OF-WAY LINE	
	EASEMENT	
X	FENCE	X
	CONCRETE	
	ASPHALT	
	GRAVEL	
46.34 x	SPOT ELEVATION	
	LIGHT	
	SIGN	
50	CONTOUR	50
W	WATER LINE	W
SAN	SANITARY SEWER	SAN
FM	SANITARY SEWER FORCEMAIN	FM
	SANITARY MANHOLE	
	SANITARY CLEANOUT	
	SANITARY PRESSURE CONNECTION	
	STORM SEWER	
OHP	OVERHEAD ELECTRIC	
UGP	UNDERGROUND ELECTRIC	
UGT	UNDERGROUND TELECOM	
	ELECTRICAL MANHOLE	
E	ELECTRICAL PEDESTAL	
	TELECOM HANDHOLE	
T	TELECOM MANHOLE	
T	TELECOM PEDESTAL	
	MAILBOX	
	UTILITY POLE	
	FIRE HYDRANT	
	WATER STUB OUT	
	WATER VALVE	
	WATER METER	
	BUSH	
	CONIFEROUS TREE	
	DECIDUOUS TREE	

SPECIAL NOTE:

DIG WITH CARE KEEP VIRGINIA SAFE

THE PROJECT AREA CONTAINS EXISTING OVERHEAD AND UNDERGROUND UTILITIES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO LOCATE AND CONFIRM THE LOCATION AND STATUS OF ALL EXISTING UTILITIES WITHIN THE PROJECT AREA PRIOR TO CONSTRUCTION.

ABBREVIATIONS

APPROX	APPROXIMATE	LOD	LIMITS OF DISTURBANCE
ARV	AIR RELEASE VALVE	MAX	MAXIMUM
ASSY	ASSEMBLY	MECH	MECHANICAL
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS	MH	MANHOLE
		MIN	MINIMUM
AWWA	AMERICAN WATER WORKS ASSOCIATION	N/F	NOW OR FORMERLY
BI	BLACK IRON	NIC	NOT IN CONTRACT
BLDG	BUILDING	NPT	NATIONAL PIPE THREAD
BM	BENCHMARK	OC	ON CENTER
BMP	BEST MANAGEMENT PRACTICE	OCEW	ON CENTER EACH WAY
		OHE	OVERHEAD ELECTRIC
BV	BALL VALVE	MPT	MALE PIPE THREAD
CL	CLASS	PE	PLAIN END / POLYETHYLENE
CO	CLEAN OUT		
CONC	CONCRETE	PEP	POLYETHYLENE PIPE
DI	DUCTILE IRON	PROP	PROPOSED
DIA	DIAMETER	PVC	POLYVINYL CHLORIDE
DIP	DUCTILE IRON PIPE	REQ	REQUIRED
EA	EACH	RCP	REINFORCED CONCRETE PIPE
ELEV	ELEVATION		
ESC	EROSION AND SEDIMENT CONTROL	ROW	RIGHT OF WAY
		SCH	SCHEDULE
ESMT	EASEMENT	SF	SQUARE FEET / SILT FENCE
EX	EXISTING		
FFE	FINISHED FLOOR ELEVATION	SS	STAINLESS STEEL
		STA	STATION
FH	FIRE HYDRANT	STD	STANDARD
FLG	FLANGE	STR	STRUCTURE
FO	FIBER OPTIC	TW	TOP OF WALL
FPT	FEMALE PIPE THREAD	TYP	TYPICAL
HDPE	HIGH DENSITY POLYETHELENE	VDOT	VIRGINIA DEPARTMENT OF TRANSPORTATION
HORIZ	HORIZONTAL	WV	WATER VALVE
INV	INVERT	W/	WITH

COMMONWEALTH OF VIRGINIA
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GENERAL NOTES

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EROSION AND SEDIMENT CONTROL NARRATIVE:

PROJECT DESCRIPTION
THE PURPOSE OF THIS PROJECT IS TO PROVIDE UPGRADED SEWER SERVICE TO THE STAUNTON CROSSING DEVELOPMENT IN STAUNTON, VIRGINIA. THE PROJECT WILL INCLUDE A REPLACEMENT WASTEWATER PUMP STATION, NEW 12" FORCE MAIN BETWEEN THE REPLACEMENT WASTEWATER PUMP STATION AND NATIONAL AVENUE, AND NEW 15" SANITARY SEWER BETWEEN CROSSING WAY AND THE REPLACEMENT WASTEWATER PUMP STATION. THERE IS APPROXIMATELY 1,500 LINEAR FEET OF NEW SANITARY SEWER, AND APPROXIMATELY 5,800 LINEAR FEET OF NEW FORCE MAIN.

AREA OF DISTURBANCE
TOTAL AREA DISTURBED: 7.85 ACRES
AREA TAKEN FROM CONSTRUCTION PLAN "LIMITS OF DISTURBANCE" (LOD).

EXISTING SITE CONDITIONS
THE PROJECT AREA IS LOCATED IN PREVIOUSLY DEVELOPED CORRIDORS AND AREAS ALONG THE NEWLY CONSTRUCTED EXTENSION OF CROSSING WAY.

ADJACENT AREAS
ADJACENT AREAS INCLUDE THE PREVIOUSLY DEVELOPED LAND TO THE NORTH, UNDEVELOPED FORESTED LAND TO THE EAST, INTERSTATE 81 TO THE SOUTH, STATE ROUTE 250 TO THE WEST.

OFFSITE AREAS
THERE WILL BE NO OFF-SITE LAND DISTURBANCES ASSOCIATED WITH THIS PROJECT. SPOILS WILL BE DISPOSED OF IN STRICT ACCORDANCE WITH LOCAL, STATE, AND FEDERAL REQUIREMENTS.

SOIL TYPES AND CHARACTERISTICS
SOILS WERE EVALUATED BASED ON USGS SOIL SURVEY INFORMATION. SEE SOILS MAP, THIS SHEET.

CRITICAL AREAS
THERE ARE DELINEATED WETLANDS AND STEEP SLOPES ADJACENT TO THE PROJECT.

PROPOSED TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES
SILT FENCE WILL SERVE AS THE PRIMARY EROSION CONTROL MEASURE THROUGHOUT CONSTRUCTION. ROCK CHECK DAMS AND CULVERT INLET PROTECTION WILL PROVIDE EROSION CONTROL FOR EXISTING DITCHES AND CULVERTS. TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED FIRST AND WILL BE MONITORED AND MAINTAINED THROUGHOUT ALL PHASES OF CONSTRUCTION.

MAINTENANCE
ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE MAINTAINED IN ACCORDANCE WITH THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK. ALL MEASURES SHALL BE INSPECTED WEEKLY AND AFTER ALL RAIN EVENTS. IF THE SEDIMENT TRAPPING MEASURE IS NO LONGER USEFUL IT SHALL BE REPLACED.

STRUCTURAL PRACTICES AND MAINTENANCE PROCEDURES
THE CONTRACTOR SHALL CONSTRUCT AND MAINTAIN ALL MEASURES NECESSARY TO PREVENT SOIL FROM ERODING OR BEING TRACKED ONTO ADJACENT PROPERTY, STREETS, DRAINAGE SYSTEMS, AND WATERWAYS. ALL VEGETATIVE AND STRUCTURAL EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE CONSTRUCTED AND MAINTAINED ACCORDING TO MINIMUM STANDARDS AND SPECIFICATIONS OF THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK AND VIRGINIA REGULATION 9 VAC 25-840-40. THE MINIMUM STANDARDS OF THE VIRGINIA EROSION AND SEDIMENT CONTROL REGULATIONS SHALL BE ADHERED TO UNLESS OTHERWISE WAIVED OR APPROVED BY A VARIANCE FROM THE CITY OF STAUNTON.

3.02 TEMPORARY STONE CONSTRUCTION ENTRANCE
TEMPORARY STONE CONSTRUCTION ENTRANCE SHALL BE CONSTRUCTED AS SHOWN ON THE PLANS OR AS DIRECTED BY CITY INSPECTOR. IF THIS MEASURE BECOMES COVERED WITH SOIL OR PUSHED INTO THE SOIL BY CONSTRUCTION TRAFFIC, IT SHALL BE REPLACED WITH A DEPTH OF STONE EQUAL TO THE ORIGINAL APPLICATION. THE CONSTRUCTION ENTRANCE SHALL BE CONSTRUCTED PRIOR TO ANY OTHER WORK TAKING PLACE.

3.05 SILT FENCE
A TEMPORARY SEDIMENT BARRIER CONSTRUCTED OF POSTS, FILTER FABRIC AND, IN SOME CASES, A WIRE SUPPORT FENCE, PLACED ACROSS OR AT THE TOE OF A SLOPE OR IN A MINOR DRAINAGE WAY TO INTERCEPT AND DETAIN SEDIMENT AND DECREASE FLOW VELOCITIES FROM DRAINAGE AREAS OF LIMITED SIZE; APPLICABLE WHERE SHEET AND RILL EROSION OR SMALL CONCENTRATED FLOWS MAY BE A PROBLEM. MAXIMUM EFFECTIVE LIFE OF 6 MONTHS.

3.08 CULVERT INLET PROTECTION
A SEDIMENT FILTER LOCATED AT THE INLET TO STORM SEWER CULVERTS WHICH PREVENTS SEDIMENT FROM ENTERING, ACCUMULATING IN, AND BEING TRANSFERRED BY THE CULVERT. IT ALSO PROVIDES EROSION CONTROL AT CULVERTS DURING THE PHASE OF A PROJECT WHERE ELEVATION AND DRAINAGE PATTERNS ARE CHANGING, CAUSING ORIGINAL CONTROL MEASURES TO BE INEFFECTIVE.

3.20 ROCK CHECK DAM
SMALL, TEMPORARY STONE DAMS CONSTRUCTED ACROSS A DRAINAGE DITCH TO REDUCE THE VELOCITY OF CONCENTRATED FLOWS, REDUCING EROSION OF THE SWALE OR DITCH. LIMITED TO USE IN SMALL OPEN CHANNELS WHICH DRAIN 10 ACRES OR LESS; SHOULD NOT BE USED IN LIVE STREAMS.

3.31 TEMPORARY SEEDING
ESTABLISHMENT OF TEMPORARY VEGETATIVE COVER ON DISTURBED AREAS THAT WILL NOT BE BROUGHT TO FINAL GRADE FOR PERIODS OF 30 DAYS TO ONE YEAR BY SEEDING WITH APPROPRIATE RAPIDLY GROWING PLANTS.

3.32 PERMANENT SEEDING
ESTABLISHMENT OF PERENNIAL VEGETATIVE COVER BY PLANTING SEEDS ON ROUGH-GRADED AREAS THAT WILL NOT BE BROUGHT TO FINAL GRADE FOR A YEAR OR MORE OR WHERE PERMANENT, LONG-LIVED VEGETATIVE COVER IS NEEDED ON FINE-GRADED AREAS.

GENERAL EROSION AND SEDIMENT CONTROL NOTES

ES-1: UNLESS OTHERWISE INDICATED, ALL VEGETATIVE AND STRUCTURAL EROSION AND SEDIMENT CONTROL PRACTICES WILL BE CONSTRUCTED AND MAINTAINED ACCORDING TO MINIMUM STANDARDS AND SPECIFICATIONS OF THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK AND THE VIRGINIA EROSION AND SEDIMENT CONTROL REGULATIONS 9VAC25-840.

ES-2: THE PLAN APPROVING AUTHORITY MUST BE NOTIFIED ONE WEEK PRIOR TO THE PRE-CONSTRUCTION CONFERENCE, ONE WEEK PRIOR TO THE COMMENCEMENT OF LAND DISTURBING ACTIVITY, AND ONE WEEK PRIOR TO THE FINAL INSPECTION.

ES-3: ALL EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE PLACED PRIOR TO OR AS THE FIRST STEP IN CLEARING EACH PIPELINE ROUTE.

ES-4: A COPY OF THE APPROVED EROSION AND SEDIMENT CONTROL PLAN SHALL BE MAINTAINED ON THE SITE AT ALL TIMES.

ES-5: PRIOR TO COMMENCING LAND DISTURBING ACTIVITIES IN AREAS OTHER THAN INDICATED ON THESE PLANS (INCLUDING, BUT NOT LIMITED TO, OFF-SITE BORROW OR WASTE AREAS), THE CONTRACTOR SHALL SUBMIT A SUPPLEMENTARY EROSION CONTROL PLAN TO THE OWNER FOR REVIEW AND APPROVAL BY THE PLAN APPROVING AUTHORITY.

ES-6: THE CONTRACTOR IS RESPONSIBLE FOR INSTALLATION OF ANY ADDITIONAL EROSION CONTROL MEASURES NECESSARY TO PREVENT EROSION AND SEDIMENTATION AS DETERMINED BY THE PLAN APPROVING AUTHORITY.

ES-7: ALL DISTURBED AREAS ARE TO DRAIN TO APPROVED SEDIMENT CONTROL MEASURES AT ALL TIMES DURING LAND DISTURBING ACTIVITIES AND DURING CONSTRUCTION UNTIL FINAL STABILIZATION IS ACHIEVED.

ES-8: DURING ANY DEWATERING OPERATIONS, WATER WILL BE PUMPED INTO AN APPROVED FILTERING DEVICE.

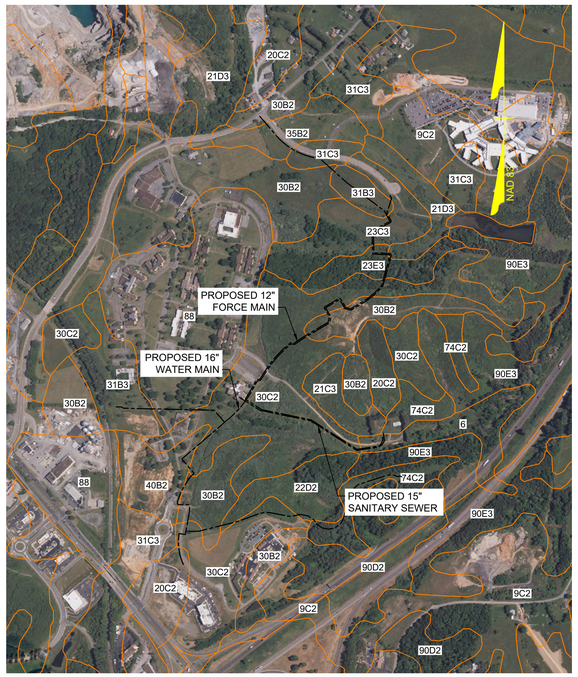
ES-9: THE CONTRACTOR SHALL INSPECT ALL EROSION CONTROL MEASURES PERIODICALLY AND AFTER EACH RUNOFF-PRODUCING RAINFALL EVENT. ANY NECESSARY REPAIRS OR CLEANUP TO MAINTAIN THE EFFECTIVENESS OF THE EROSION CONTROL DEVICES SHALL BE MADE IMMEDIATELY.

MANAGEMENT STRATEGIES

1. PROVIDE SEDIMENT TRAPPING MEASURES AS A FIRST STEP IN GRADING AND SEED AND MULCH IMMEDIATELY FOLLOWING INSTALLATION.
2. PROVIDE TEMPORARY SEEDING OR OTHER STABILIZATION IMMEDIATELY AFTER GRADING.
3. ISOLATE TRENCHING FOR UTILITIES AND DRAINAGE FROM DOWNSTREAM CONVEYANCES IN ORDER TO MINIMIZE PERIMETER CONTROLS.
4. ALL EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE MAINTAINED UNTIL THEY ARE NO LONGER REQUIRED TO COMPLY WITH THE CONTRACT DOCUMENTS OR STATE LAW.

PERMANENT STABILIZATION

ALL NON-PAVED AREAS DISTURBED BY CONSTRUCTION SHALL BE STABILIZED WITH PERMANENT SEEDING IMMEDIATELY FOLLOWING FINISH GRADING. TOPSOIL SHALL BE PLACED TO A DEPTH OF 4" & SEEDING SHALL BE IN ACCORDANCE WITH STD. & SPEC. 3.32, PERMANENT SEEDING. IMPORTED TOPSOIL SHALL BE OBTAINED FROM A SITE WITH AN APPROVED ESC PLAN. SEED TYPE SHALL BE AS SPECIFIED FOR "MINIMUM CARE LAWNS" AND "GENERAL SLOPES" IN THE HANDBOOK. MULCH (STRAW OR FIBER) IN ACCORDANCE WITH STD. & SPEC. 3.35, SHALL BE USED ON ALL SEEDED SURFACES. EROSION CONTROL BLANKETS WILL BE INSTALLED OVER FILL SLOPES WHICH HAVE BEEN BROUGHT TO FINAL GRADE AND HAVE BEEN SEEDED TO PROTECT THE SLOPES FROM RILL & GULLY EROSION AND TO ALLOW THE SEED TO GERMINATE PROPERLY. IN ALL SEEDING OPERATIONS SEED, FERTILIZER AND LIME SHALL BE APPLIED PER RECOMMENDATIONS OF THE SOIL TEST PRIOR TO MULCHING.



EROSION AND SEDIMENT MINIMUM STANDARDS:

AN EROSION AND SEDIMENT CONTROL PROGRAM ADOPTED BY A DISTRICT OR LOCALITY MUST BE CONSISTENT WITH THE FOLLOWING CRITERIA, TECHNIQUES AND METHODS:

MS-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 SITE. TEMPORARY SOIL STABILIZATION SHALL BE APPLIED WITHIN SEVEN DAYS TO DENUDED AREAS THAT MAY NOT BE AT FINAL GRADE BUT WILL REMAIN DORMANT FOR LONGER THAN 30 DAYS. PERMANENT STABILIZATION SHALL BE APPLIED TO AREAS THAT ARE TO BE LEFT DORMANT FOR MORE THAN ONE YEAR.

MS-2: DURING CONSTRUCTION OF THE PROJECT, SOIL STOCKPILES AND BORROW AREAS SHALL BE STABILIZED OR PROTECTED WITH SEDIMENT TRAPPING MEASURES. THE APPLICANT IS RESPONSIBLE FOR THE TEMPORARY PROTECTION AND PERMANENT STABILIZATION OF ALL SOIL STOCKPILES ON SITE AS WELL AS BORROW AREAS AND SOIL INTENTIONALLY TRANSPORTED FROM THE PROJECT SITE.

MS-3: A PERMANENT VEGETATIVE COVER SHALL BE ESTABLISHED ON DENUDED AREAS NOT OTHERWISE PERMANENTLY STABILIZED. PERMANENT VEGETATION SHALL NOT BE CONSIDERED ESTABLISHED UNTIL A GROUND COVER IS ACHIEVED THAT IS UNIFORM, MATURE ENOUGH TO SURVIVE AND WILL INHIBIT EROSION.

MS-4: SEDIMENT BASINS AND TRAPS, PERIMETER DIKES, SEDIMENT BARRIERS AND OTHER MEASURES INTENDED TO TRAP SEDIMENT SHALL BE CONSTRUCTED AS A FIRST STEP IN ANY LAND-DISTURBING ACTIVITY AND SHALL BE MADE FUNCTIONAL BEFORE UPSLOPE LAND DISTURBANCE TAKES PLACE.

MS-5: STABILIZATION MEASURES SHALL BE APPLIED TO EARTHEN STRUCTURES SUCH AS DAMS, DIKES AND DIVERSIONS IMMEDIATELY AFTER INSTALLATION.

MS-6: SEDIMENT TRAPS AND SEDIMENT BASINS SHALL BE DESIGNED AND CONSTRUCTED BASED UPON THE TOTAL DRAINAGE AREA TO BE SERVED BY THE TRAP OR BASIN.

A. THE MINIMUM STORAGE CAPACITY OF A SEDIMENT TRAP SHALL BE 134 CUBIC YARDS PER ACRE OF DRAINAGE AREA AND THE TRAP SHALL ONLY CONTROL DRAINAGE AREAS LESS THAN THREE ACRES.

B. SURFACE RUNOFF FROM DISTURBED AREAS THAT IS COMPRISED OF FLOW FROM DRAINAGE AREAS GREATER THAN OR EQUAL TO THREE ACRES SHALL BE CONTROLLED BY A SEDIMENT BASIN. THE MINIMUM STORAGE CAPACITY OF A SEDIMENT BASIN SHALL BE 134 CUBIC YARDS PER ACRE OF DRAINAGE AREA. THE OUTFALL SYSTEM SHALL, AT A MINIMUM, MAINTAIN THE STRUCTURAL INTEGRITY OF THE BASIN DURING A TWENTY-FIVE YEAR STORM OF 24-HOUR DURATION. RUNOFF COEFFICIENTS USED IN RUNOFF CALCULATIONS SHALL CORRESPOND TO A BARE EARTH CONDITION OR THOSE CONDITIONS EXPECTED TO EXIST WHILE THE SEDIMENT BASIN IS UTILIZED.

MS-7: CUT AND FILL SLOPES SHALL BE DESIGNED AND CONSTRUCTED IN A MANNER THAT WILL MINIMIZE EROSION. SLOPES THAT ARE FOUND TO BE ERODING EXCESSIVELY WITHIN ONE YEAR OF PERMANENT STABILIZATION SHALL BE PROVIDED WITH ADDITIONAL SLOPE STABILIZING MEASURES UNTIL THE PROBLEM IS CORRECTED.

MS-8: CONCENTRATED RUNOFF SHALL NOT FLOW DOWN CUT OR FILL SLOPES UNLESS CONTAINED WITHIN AN ADEQUATE TEMPORARY OR PERMANENT CHANNEL, FLUME OR SLOPE DRAIN STRUCTURE.

MS-9: WHENEVER WATER SEEPS FROM A SLOPE FACE, ADEQUATE DRAINAGE OR OTHER PROTECTION SHALL BE PROVIDED.

MS-10: ALL STORM SEWER INLETS THAT ARE MADE OPERABLE DURING CONSTRUCTION SHALL BE PROTECTED SO THAT SEDIMENT-LADEN WATER CANNOT ENTER THE CONVEYANCE SYSTEM WITHOUT FIRST BEING FILTERED OR OTHERWISE TREATED TO REMOVE SEDIMENT.

MS-11: BEFORE NEWLY-CONSTRUCTED STORMWATER CONVEYANCE CHANNELS OR PIPES ARE MADE OPERATIONAL, ADEQUATE OUTLET PROTECTION AND ANY REQUIRED TEMPORARY OR PERMANENT CHANNEL LINING SHALL BE INSTALLED IN BOTH THE CONVEYANCE CHANNEL AND RECEIVING CHANNEL.

MS-12: WHEN WORK IN A LIVE WATERCOURSE IS PERFORMED, PRECAUTIONS SHALL BE TAKEN TO MINIMIZE ENCROACHMENT, CONTROL SEDIMENT TRANSPORT AND STABILIZE THE WORK AREA TO THE GREATEST EXTENT POSSIBLE DURING CONSTRUCTION. NONERODIBLE MATERIAL SHALL BE USED FOR THE CONSTRUCTION OF CAUSEWAYS AND COFFERDAMS. EARTHEN FILL MAY BE USED FOR THESE STRUCTURES IF ARMORED BY NONERODIBLE COVER MATERIALS.

MS-13: WHEN A LIVE WATERCOURSE MUST BE CROSSED BY CONSTRUCTION VEHICLES MORE THAN TWICE IN ANY SIX-MONTH PERIOD, A TEMPORARY VEHICULAR STREAM CROSSING CONSTRUCTED OF NONERODIBLE MATERIAL SHALL BE PROVIDED.

MS-14: ALL APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS PERTAINING TO WORK IN OR CROSSING LIVE WATERCOURSES SHALL BE MET.

MS-15: THE BED AND BANKS OF A WATERCOURSE SHALL BE STABILIZED IMMEDIATELY AFTER WORK IN THE WATERCOURSE IS COMPLETED.

MS-16: UNDERGROUND UTILITY LINES SHALL BE INSTALLED IN ACCORDANCE WITH THE FOLLOWING STANDARDS IN ADDITION TO OTHER APPLICABLE CRITERIA:

a. NO MORE THAN 500 LINEAR FEET OF TRENCH MAY BE OPENED AT ONE TIME.

b. EXCAVATED MATERIAL SHALL BE PLACED ON THE UPHILL SIDE OF TRENCHES.

c. EFFLUENT FROM DEWATERING OPERATIONS SHALL BE FILTERED OR PASSED THROUGH AN APPROVED SEDIMENT TRAPPING DEVICE, OR BOTH, AND DISCHARGED IN A MANNER THAT DOES NOT ADVERSELY AFFECT FLOWING STREAMS OR OFF-SITE PROPERTY.

d. MATERIAL USED FOR BACKFILLING TRENCHES SHALL BE PROPERLY COMPACTED IN ORDER TO MINIMIZE EROSION AND PROMOTE STABILIZATION.

e. RESTABILIZATION SHALL BE ACCOMPLISHED IN ACCORDANCE WITH THESE REGULATIONS.

f. APPLICABLE SAFETY REGULATIONS SHALL BE COMPLIED WITH.

MS-17: WHERE CONSTRUCTION VEHICLE ACCESS ROUTES INTERSECT PAVED OR PUBLIC ROADS, PROVISIONS SHALL BE MADE TO MINIMIZE THE TRANSPORT OF SEDIMENT BY VEHICULAR TRACKING ONTO THE PAVED SURFACE. WHERE SEDIMENT IS TRANSPORTED ONTO A PAVED OR PUBLIC ROAD SURFACE, THE ROAD SURFACE SHALL BE CLEANED THOROUGHLY AT THE END OF EACH DAY. SEDIMENT SHALL BE REMOVED FROM THE ROADS BY SHOVELING OR SWEEPING AND TRANSPORTED TO A SEDIMENT-CONTROL DISPOSAL AREA. STREET WASHING SHALL BE ALLOWED ONLY AFTER SEDIMENT IS REMOVED IN THIS MANNER. THIS PROVISION SHALL APPLY TO INDIVIDUAL DEVELOPMENT LOTS AS WELL AS TO LARGER LAND-DISTURBING ACTIVITIES.

SOILS LEGEND

MAP UNIT SYMBOL	MAP UNIT NAME
6	AQUENTS, LOAMY-SKELETAL
9C2	BERKS-WEIKERY CHANNERY SILT LOAM, 7 TO 15 PERCENT SLOPES, ERODED
20C2	CHILHOWIE SILTY CLAY LOAM, 7 TO 15 PERCENT SLOPES, ERODED
21C3	CHILHOWIE CHANNERY SILTY CLAY LOAM, 7 TO 15 PERCENT SLOPES, SEVERELY ERODED
21D3	CHILHOWIE CHANNERY SILTY CLAY LOAM, 15 TO 25 PERCENT SLOPES, SEVERELY ERODED
22D2	CHILHOWIE-EDOM COMPLEX, 15 TO 25 PERCENT SLOPES, ERODED
23C3	CHILHOWIE-EDOM SHALY SILTY CLAY LOAMS, 7 TO 15 PERCENT SLOPES, SEVERELY ERODED
23E3	CHILHOWIE-EDOM CHANNERY SILTY CLAY LOAMS, 15 TO 45 PERCENT SLOPES, SEVERELY ERODED
30B2	EDOM SILT LOAM, 2 TO 7 PERCENT SLOPES, ERODED
30C2	EDOM SILT LOAM, 7 TO 15 PERCENT SLOPES, ERODED
31B3	EDOM SILTY CLAY LOAM, 2 TO 7 PERCENT SLOPES, SEVERELY ERODED
31C3	EDOM SILTY CLAY LOAM, 7 TO 15 PERCENT SLOPES, SEVERELY ERODED
35B2	ENDCAV SILT LOAM, 2 TO 7 PERCENT SLOPES, ERODED
40B2	FREDERICK-CHRISTIAN SILT LOAMS, 2 TO 7 PERCENT SLOPES, ERODED
74C2	SEQUOIA-BERKS SILT LOAMS, 7 TO 15 PERCENT SLOPES, ERODED
88	URBAN LAND
90D2	WEIKERT-BERKS CHANNERY SILT LOAMS, 15 TO 25 PERCENT SLOPES, ERODED
90E3	WEIKERT-BERKS CHANNERY SILT LOAMS, 25 TO 50 PERCENT SLOPES, SEVERELY ERODED

MINIMUM STANDARDS (CONTINUED):

MS-18: ALL TEMPORARY EROSION AND SEDIMENT-CONTROL MEASURES SHALL BE REMOVED WITHIN 30 DAYS AFTER FINAL SITE STABILIZATION OR AFTER THE TEMPORARY MEASURES ARE NO LONGER NEEDED, UNLESS OTHERWISE AUTHORIZED BY THE LOCAL PROGRAM AUTHORITY. TRAPPED SEDIMENT AND THE DISTURBED SOIL AREAS RESULTING FROM THE DISPOSITION OF TEMPORARY MEASURES SHALL BE PERMANENTLY STABILIZED TO PREVENT FURTHER EROSION AND SEDIMENTATION.

MS-19: PROPERTIES AND WATERWAYS DOWNSTREAM FROM DEVELOPMENT SITES SHALL BE PROTECTED FROM SEDIMENT DEPOSITION, EROSION AND DAMAGE DUE TO INCREASES IN VOLUME, VELOCITY AND PEAK FLOW RATE OF STORMWATER RUNOFF FOR THE STATED FREQUENCY STORM OF 24-HOUR DURATION IN ACCORDANCE WITH THE FOLLOWING STANDARDS AND CRITERIA:

A. CONCENTRATED STORMWATER RUNOFF LEAVING A DEVELOPMENT SITE SHALL BE DISCHARGED DIRECTLY INTO AN ADEQUATE NATURAL OR MAN-MADE RECEIVING CHANNEL, PIPE OR STORM SEWER SYSTEM. FOR THOSE SITES WHERE RUNOFF IS DISCHARGED INTO A PIPE OR PIPE SYSTEM, DOWNSTREAM STABILITY ANALYSES AT THE OUTFALL OF THE PIPE OR PIPE SYSTEM SHALL BE PERFORMED.

B. ADEQUACY OF ALL CHANNELS AND PIPES SHALL BE VERIFIED IN THE FOLLOWING MANNER:

(1) THE APPLICANT SHALL DEMONSTRATE THAT THE TOTAL DRAINAGE AREA TO THE POINT OF ANALYSIS WITHIN THE CHANNEL IS ONE HUNDRED TIMES GREATER THAN THE CONTRIBUTING DRAINAGE AREA OF THE PROJECT IN QUESTION; OR

(2) NATURAL CHANNELS SHALL BE ANALYZED BY THE USE OF A TWO-YEAR STORM TO VERIFY THAT STORMWATER WILL NOT OVERTOP CHANNEL BANKS NOR CAUSE EROSION OF CHANNEL BED OR BANDS; AND

(3) ALL PREVIOUSLY CONSTRUCTED MAN-MADE CHANNELS SHALL BE ANALYZED BY THE USE OF A TEN-YEAR STORM TO VERIFY THAT STORMWATER WILL NOT OVERTOP ITS BANKS AND BY THE USE OF A TWO-YEAR STORM TO DEMONSTRATE THAT STORMWATER WILL NOT CAUSE EROSION OF CHANNEL BED OR BANKS; AND

(4) PIPES AND STORM SEWER SYSTEMS SHALL BE ANALYZED BY THE USE OF A TEN-YEAR STORM TO VERIFY THAT STORMWATER WILL BE CONTAINED WITHIN THE PIPE OR SYSTEM.

C. IF EXISTING NATURAL RECEIVING CHANNELS OR PREVIOUSLY CONSTRUCTED MAN-MADE CHANNELS OR PIPES ARE NOT ADEQUATE,THE APPLICANT SHALL:

(1) IMPROVE THE CHANNEL TO A CONDITION WHERE A TEN-YEAR STORM WILL NOT OVERTOP THE BANKS AND A TWO-YEAR STORM WILL NOT CAUSE EROSION TO THE CHANNEL BED OR BANKS; OR

(2) IMPROVE THE PIPE OR PIPE SYSTEM TO A CONDITION WHERE THE TEN-YEAR STORM IS CONTAINED WITHIN THE APPURTENANCES; OR

(3) DEVELOP A SITE DESIGN THAT WILL NOT CAUSE THE PRE-DEVELOPMENT PEAK RUNOFF RATE FROM A TWO-YEAR STORM TO INCREASE WHEN RUNOFF OUTFALLS INTO A NATURAL CHANNEL OR WILL NOT CAUSE THE PRE-DEVELOPMENT PEAK RUNOFF RATE FROM A TEN-YEAR STORM TO INCREASE WHEN RUNOFF OUTFALLS INTO A MAN-MADE CHANNEL; OR

(4) PROVIDE A COMBINATION OF CHANNEL IMPROVEMENT, STORMWATER DETENTION OR OTHER MEASURES WHICH ARE SATISFACTORY TO THE PLAN-APPROVING AUTHORITY TO PREVENT DOWNSTREAM EROSION.

D. THE APPLICANT SHALL PROVIDE EVIDENCE OF PERMISSION TO MAKE THE IMPROVEMENTS.

E. ALL HYDROLOGIC ANALYSES SHALL BE BASED ON THE EXISTING WATERSHED CHARACTERISTICS AND THE ULTIMATE DEVELOPMENT OF THE SUBJECT PROJECT.

F. IF THE APPLICANT CHOOSES AN OPTION THAT INCLUDES STORMWATER DETENTION HE SHALL OBTAIN APPROVAL FROM THE LOCALITY OF A PLAN FOR MAINTENANCE REQUIREMENTS OF THE DETENTION FACILITIES. THE PLAN SHALL SET FORTH THE MAINTENANCE REQUIREMENTS OF THE FACILITY AND THE PERSON RESPONSIBLE FOR PERFORMING THE MAINTENANCE.

G. OUTFALL FROM A DETENTION FACILITY SHALL BE DISCHARGED TO A RECEIVING CHANNEL, AND ENERGY DISSIPATERS SHALL BE PLACED AT THE END OF ALL DETENTION FACILITIES AS NECESSARY TO PROVIDE A STABILIZED TRANSITION FROM THE FACILITY TO THE RECEIVING CHANNEL.

H. ALL ON-SITE CHANNELS MUST BE VERIFIED TO BE ADEQUATE.

I. INCREASED VOLUMES OF SHEET FLOWS THAT MAY CAUSE EROSION OR SEDIMENTATION ON ADJACENT PROPERTY SHALL BE DIVERTED TO A STABLE OUTLET, ADEQUATE CHANNEL, PIPE OR PIPE SYSTEM, OR TO A DETENTION FACILITY.

J. IN APPLYING THESE STORMWATER RUNOFF CRITERIA, INDIVIDUAL LOTS OR PARCELS IN A RESIDENTIAL, COMMERCIAL OR INDUSTRIAL DEVELOPMENT SHALL NOT BE CONSIDERED TO BE SEPARATE DEVELOPMENT PROJECTS. INSTEAD, THE DEVELOPMENT, AS A WHOLE, SHALL BE CONSIDERED TO BE A SINGLE DEVELOPMENT PROJECT. HYDROLOGIC PARAMETERS THAT REFLECT THE ULTIMATE DEVELOPMENT CONDITION SHALL BE USED IN AL ENGINEERING CALCULATIONS.

K. ALL MEASURES USED TO PROTECT PROPERTIES AND WATERWAYS SHALL BE EMPLOYED IN A MANNER WHICH MINIMIZES IMPACTS ON THE PHYSICAL, CHEMICAL AND BIOLOGICAL INTEGRITY OF RIVERS, STREAMS AND OTHER WATERS OF THE STATE.

L. ANY PLAN APPROVED PRIOR TO JULY 1, 2014, THAT PROVIDES FOR STORMWATER MANAGEMENT THAT ADDRESSES ANY FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS FOR NATURAL OR MAN-MADE CHANNELS SHALL SATISFY THE FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS FOR NATURAL OR MAN-MADE CHANNELS IF THAT PRACTICES ARE DESIGNED TO (I) DETAIN THE WATER QUALITY VOLUME AND TO RELEASE IT OVER 48 HOURS; (II) DETAIN AND RELEASE OVER A 24-HOUR PERIOD THE EXPECTED RAINFALL RESULTING FROM THE ONE YEAR, 24-HOUR STORM; AND (III) REDUCE THE ALLOWABLE PEAK FLOW RATE RESULTING FROM THE 1.5, 2, AND 10-YEAR, 24-HOUR STORMS TO A LEVEL THAT IS LESS THAN OR EQUAL TO THE PEAK FLOW RATE FROM THE SITE ASSUMING IT WAS IN A GOOD FORESTED CONDITION, ACHIEVED THROUGH MULTIPLICATION OF THE FORESTED PEAK FLOW RATE BY A REDUCTION FACTOR THAT IS EQUAL TO THE RUNOFF VOLUME FROM THE SITE WHEN IT WAS IN A GOOD FORESTED CONDITION DIVIDED BY THE RUNOFF VOLUME FROM THE SITE IN ITS PROPOSED CONDITION, AND SHALL BE EXEMPT FROM ANY FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS FOR NATURAL OR MAN-MADE CHANNELS AS DEFINED IN ANY REGULATIONS PROMULGATED PURSUANT TO 10.1-562 OR 10.1-5700 OF THE ACT.

M. FOR PLANS APPROVED ON AND AFTER JULY 1, 2014, THE FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS OF 10.1-561 A OF THE ACT AND THIS SUBSECTION SHALL BE SATISFIED BY COMPLIANCE WITH WATER QUANTITY REQUIREMENTS IN THE STORMWATER MANAGEMENT ACT (10.1-603.2 ET SEQ. OF THE CODE OF VIRGINIA) AND ATTENDANT REGULATIONS, UNLESS SUCH LAND-DISTURBING ACTIVITIES ARE IN ACCORDANCE WITH 4VAC50-60-48 OF THE VIRGINIA STORMWATER MANAGEMENT PROGRAM (VSMP) PERMIT REGULATIONS.

N. COMPLIANCE WITH THE WATER QUANTITY MINIMUM STANDARDS SET OUT IN 4VAC50-60-66 OF THE VIRGINIA STORMWATER MANAGEMENT PROGRAM (VSMP) PERMIT REGULATION SHALL BE DEEMED TO SATISFY THE REQUIREMENTS OF MINIMUM STANDARD 19.

COMMONWEALTH OF VIRGINIA
BRUCE W. STRICKLAND JR.
Lic. No. 056612
11/17/2023
PROFESSIONAL ENGINEER

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YOUR VISION ACHIEVED THROUGH OURS.

REVISION DESCRIPTION	DATE
VDH SUBMITTAL	05-08-2023
REVISED PER CITY COMMENTS	06-30-2023
REVISED PER CITY COMMENTS	11-17-2023

DATE 3/31/2023
DRAWN BY Z. MOUNTJOY
DESIGNED BY B. STRICKLAND
CHECKED BY B. STRICKLAND
SCALE AS SHOWN

TIMMONS GROUP

STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER
CITY OF STAUNTON, VIRGINIA
EROSION AND SEDIMENT CONTROL NARRATIVE

JOB NO. 49408
SHEET NO. C1.0

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Linear Utility Project - Erosion & Sediment Control Notes

Underground utility lines shall be installed in accordance with the following standards in addition to other applicable criteria:

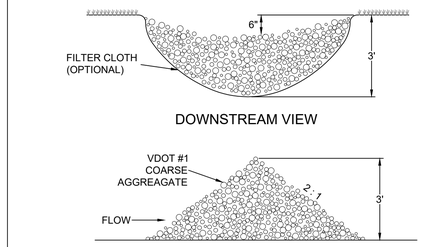
1. No more than 500 linear feet of trench may be opened at one time
2. Excavated material shall be placed on the uphill side of trenches
3. Effluent from dewatering operations shall be filtered or passed through an approved sediment trapping device, or both, and discharged in a manner that does not adversely affect flowing streams or off-site property
4. Material used for backfilling trenches shall be properly compacted in order to minimize erosion and promote stabilization
5. Soil stabilization shall be accomplished in accordance with the requirements in the *Standards & Specifications of the Department of Public Utilities*, and the *Virginia Erosion and Sediment Control Handbook*.
6. Contractor shall comply with applicable safety regulations at all times.
7. It shall be the Developer's responsibility to inspect all erosion control devices periodically and after every rainfall. Any necessary repairs or cleanup to maintain the effectiveness of the erosion control devices shall be made immediately.
8. No disturbed area will be denuded for more than 30 calendar days.
9. All erosion and siltation measures are to be put in place prior to or as the first step in clearing and grading.
10. All storm and sanitary sewer lines not in streets are to be mulched and seeded immediately after backfilling. No more than five hundred linear feet are to be open at one time.
11. All temporary earth berms, diversions, and silt dams are to be mulched and seeded for vegetative cover immediately after grading. Straw or hay mulch is required. The same applies to all soil stockpiles on site as well as soil (intentionally) transported from the project site.
12. During construction, all storm sewer inlets will be protected by silt traps, maintained and modified as required by construction progress.
13. Temporary seeding will be applied within seven days to denuded areas that may not be at final grade, but which may remain dormant (undisturbed) for longer than thirty days. For temporary seeding use 50% of recommended amounts used for permanent seeding of fertilizer and lime and 100% of required amounts of seed and mulch.
14. All erosion control devices must be installed and maintained in accordance with the latest edition of the *Virginia Erosion and Sediment Control Handbook*.
15. If during construction, additional erosion control devices are found necessary, they shall be installed as directed by the City Engineer.

Linear Utility Project – Stormwater Management Notes

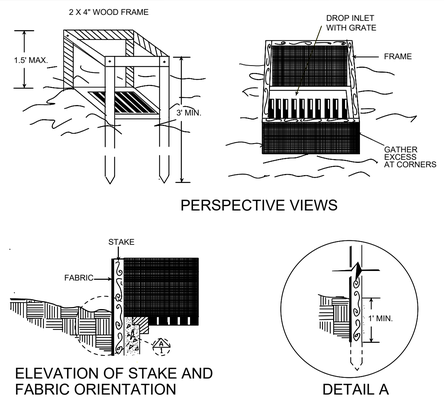
In accordance with **VDEQ Guidance Memo No. 15-2003** (dated 23 April 2015) any linear utility project being constructed without General VPDES Permit Coverage for Stormwater Management, shall be conducted in the following manner:

1. The project will not significantly alter the predevelopment runoff characteristics of the land surface after the completion of construction and final stabilization.
2. The project will be managed so that less than one (1) acre of land disturbance occurs on a daily basis.
3. The disturbed land where work has been completed will be adequately stabilized on a daily basis.
4. The environment will be protected from erosion and sedimentation damage associated with the land-disturbing activity.
5. The engineer and contractor will design, install, implement and maintain pollution prevention measures to:
   - A. Minimize the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other wash waters.
   - B. Minimize the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste, and other materials present on-site to precipitation and to stormwater.
   - C. Minimize the discharge of pollutants from spills and leaks and implement chemical spill and leak prevention and response procedures.
   - D. Prohibit the discharge of wastewater from the washout of concrete.
   - E. Prohibit the discharge of wastewater from the washout and cleanout of stucco, paint, form release oils, curing compounds, and other construction materials.
   - F. Prohibit the discharge of fuels, oils or other pollutants used in vehicle and equipment operation and maintenance.

Form F-14
06/2020



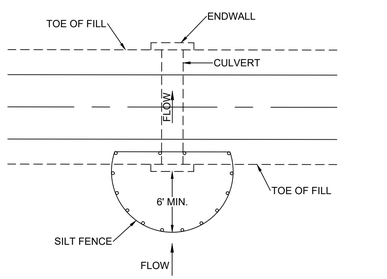
CD ROCK CHECK DAM 3.20-1
(2 ACRES OR LESS OF DRAINAGE AREA)
NO SCALE



SPECIFIC APPLICATION

THIS METHOD OF INLET PROTECTION IS APPLICABLE WHERE THE INLET DRAINS A RELATIVELY FLAT AREA (SLOPE NO GREATER THAN 5%) WHERE THE INLET SHEET OR OVERLAND FLOWS (NOT EXCEEDING 1 C.F.S.) ARE TYPICAL. THE METHOD SHALL NOT APPLY TO INLETS RECEIVING CONCENTRATED FLOWS, SUCH AS IN STREET OR HIGHWAY MEDIANS.

IP SILT FENCE DROP INLET PROTECTION 3.07-1
NO SCALE



CIP SILT FENCE CULVERT INLET PROTECTION 3.08-1
NO SCALE

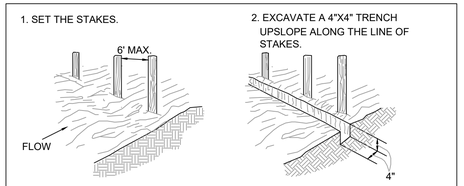
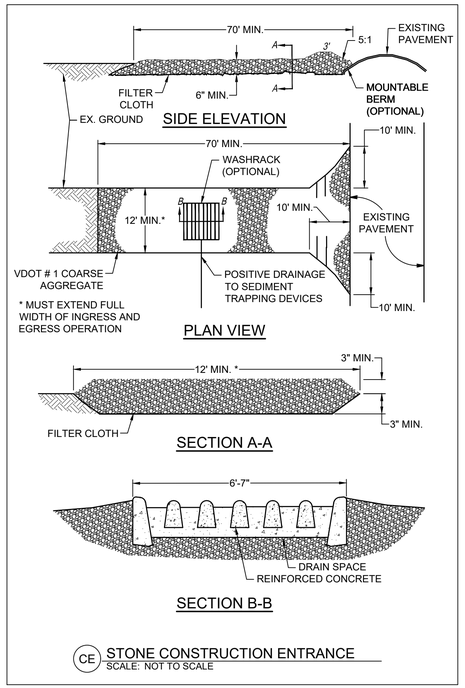


PLATE 3.05-2

SF CONSTRUCTION OF A SILT FENCE (WITHOUT WIRE SUPPORT)
No Scale



CE STONE CONSTRUCTION ENTRANCE
SCALE: NOT TO SCALE

EROSION CONTROL LEGEND

LABEL	SYMBOL	STANDARD NAME	SPEC.#
CE		CONSTRUCTION ENTRANCE	3.02
SF		SILT FENCE	3.05-2
IP		INLET PROTECTION	3.07-1
CIP		CULVERT INLET PROTECTION	3.08-1
CD		ROCK CHECK DAM	3.20
TS	TS	TEMPORARY SEEDNG	3.31
PS	PS	PERMANENT SEEDING	3.32
MU	MU	MULCHING	3.35
LOD	LOD	LIMITS OF DISTURBANCE	

*NOTE: PS AS LABELED ON PLAN SHEETS IS INTENDED TO INCLUDE MU

TABLE 3.32-C
SITE SPECIFIC SEEDING MIXTURES
FOR APPALACHIAN/MOUNTAIN AREA

MINIMUM CARE LAWN	TOTAL LBS. PER ACRE
COMMERCIAL OR RESIDENTIAL	200-250 LBS.
KENTUCKY 31 OR TURF-TYPE TALL FESCUE	90-100%
IMPROVED PERENNIAL RYEGRASS *	0-10%
KENTUCKY BLUEGRASS	0-10%
HIGH MAINTENANCE LAWN	
MINIMUM OF THREE (3) UP TO FIVE (5) VARIETIES OF BLUEGRASS FROM APPROVED LIST FOR USE IN VIRGINIA.	125 LBS.
GENERAL SLOPE (3:1 OR LESS)	
KENTUCKY 31 FESCUE	128 LBS.
RED TOP GRASS	2 LBS.
SEASONAL NURSE CROP **	20 LBS.
	150 LBS.
LOW-MAINTENANCE SLOPE (STEEPER THAN 3:1)	
KENTUCKY 31 FESCUE	108 LBS.
RED TOP GRASS	2 LBS.
SEASONAL NURSE CROP **	20 LBS.
CROWNVETCH ***	20 LBS.
	150 LBS.

* PERENNIAL RYEGRASS WILL GERMINATE FASTER AND AT LOWER SOIL TEMPERATURES THAN FESCUE, THEREBY PROVIDING COVER AND EROSION RESISTANCE FOR SEEDBED.

** USE SEASONAL NURSE CROP IN ACCORDANCE WITH SEEDING DATES AS STATED BELOW:
MARCH, APRIL THROUGH MAY 15TH..... ANNUAL RYE
MAY 16TH THROUGH AUGUST 15TH..... FOXTAIL MILLET
AUGUST 16TH THROUGH SEPTEMBER, OCTOBER..... ANNUAL RYE
NOVEMBER THROUGH FEBRUARY..... WINTER RYE

*** IF FLATPEA IS USED, INCREASE TO 30 LBS./ACRE. ALL LEGUME SEED MUST BE PROPERLY INOCULATED. WEEPING LOVEGRASS MAY ALSO BE INCLUDED IN ANY SLOPE OR LOW-MAINTENANCE MIXTURE DURING WARMER SEEDING PERIODS; ADD 10-20 LBS./ACRE IN MIXES.

PS PERMANENT SEEDING
APPALACHIAN REGION
SCALE: NOT TO SCALE

TABLE 3.31-B
ACCEPTABLE TEMPORARY SEEDING PLANT MATERIALS
"QUICK REFERENCE FOR ALL REGIONS"

PLANTING DATES	SPECIES	RATE (LBS./ACRE)
SEPT. 1 - FEB. 15	50/50 MIX OF ANNUAL RYEGRASS (LOLIUM MULTI-FLORUM) & CEREAL (WINTER) RYE (SECALE CEREALE)	50-100
FEB. 16 - APR. 30	ANNUAL RYEGRASS (LOLIUM MULTI-FLORUM)	60-100
MAY 1 - AUG. 31	GERMAN MILLET (SETARIA ITALICA)	50

TS TEMPORARY SEEDING
SCALE: NOT TO SCALE

ORGANIC MULCH MATERIALS AND APPLICATION RATES

MULCH	MULCHING RATES		NOTES
	PER ACRE	PER 1000 SQ FT	
STRAW AND HAY	1.5 - 2 TONS (MIN 2 TONS FOR WINTER COVER)	70-90 LBS	FREE FROM WEEDS AND COARSE MATTER. MUST BE ANCHORED. SPREAD WITH MULCH BLOWER OR BY HAND.

MU MULCHING
SCALE: NOT TO SCALE

COMMONWEALTH OF VIRGINIA
BRUCE W. STRICKLAND JR.
Lic. No. 056612
11/17/2023
PROFESSIONAL ENGINEER

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CHECKED BY B. STRICKLAND
SCALE AS SHOWN

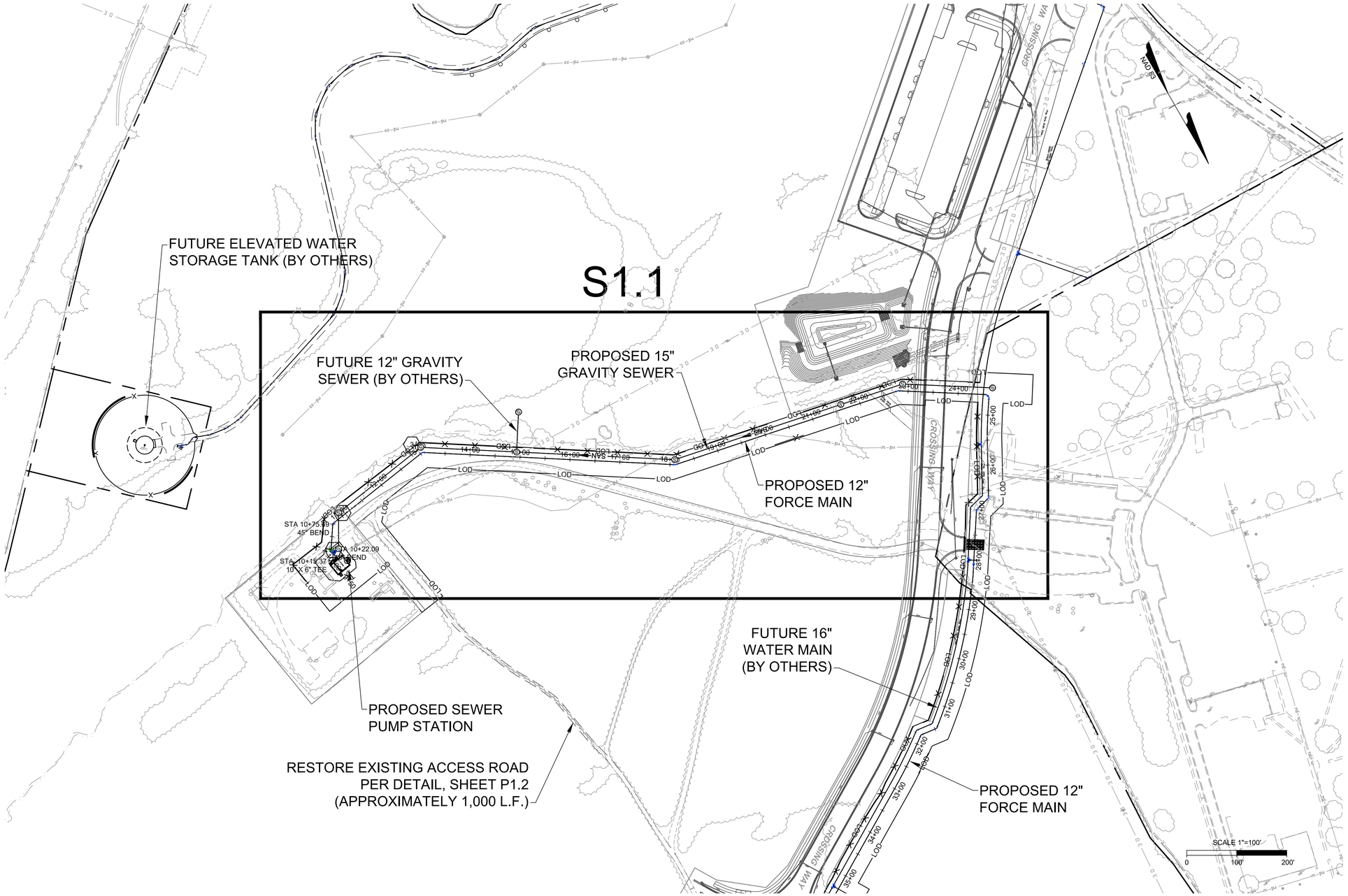
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STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER
CITY OF STAUNTON, VIRGINIA
EROSION AND SEDIMENT CONTROL DETAILS

JOB NO. 49408
SHEET NO. C1.1

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DESIGNED BY: J. CARTER
CHECKED BY: B. STRICKLAND
SCALE: 1" = 100'

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STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER

CITY OF STAUNTON, VIRGINIA

SANITARY SEWER SHEET INDEX

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ROADWAY PAVEMENT RESTORATION NOTE:
SAW CUT AND REPLACE EXISTING PAVEMENT AND CURB AND GUTTER. MATCH EXISTING PAVEMENT THICKNESS WITH RESPECT TO BASE AND SURFACE MATERIALS. CONCRETE REPLACEMENT SHALL EXTEND TO NEAREST CONTROL JOINT. (SEE "CROSSING WAY PAVEMENT RESTORATION DETAIL", SHEET U1.1)

SCALE 1"=50'
0 50' 100'

**NOTE:
AT THE TIME OF UTILITY DESIGN, CROSSING WAY WAS UNDER CONSTRUCTION. THE PROPOSED GRADES SHOWN WERE TAKEN FROM THE ROADWAY PLANS AND HAVE NOT BEEN CONFIRMED.

NOTE:

PROPOSED GRADES AND FUTURE ROAD LOCATIONS SHOWN PER VDOT PROJECT "U000-132-350, P101, C501".

FUTURE ROAD GRADES SHOWN ARE EXTRAPOLATED FROM THE VDOT PLANS AND ARE APPROXIMATE AND SUBJECT TO CHANGE BASED ON FUTURE ROAD IMPROVEMENT PROJECTS.

PROFILE SCALE
0 50
10
0

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CHECKED BY: B. STRICKLAND
SCALE: H: 1" = 50' V: 1" = 10'

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STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER

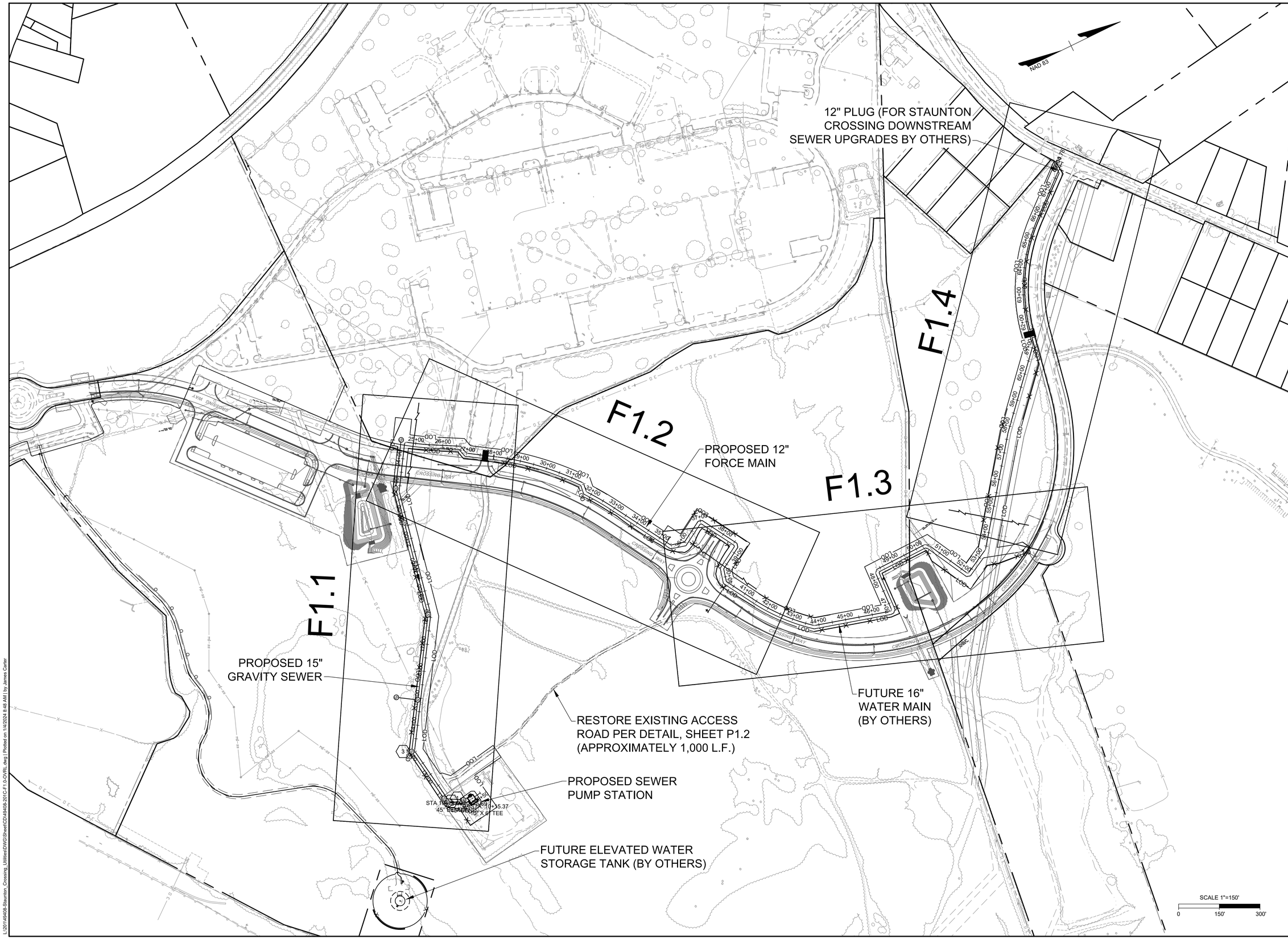
CITY OF STAUNTON, VIRGINIA

SANITARY SEWER PLAN AND PROFILE

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DESIGNED BY: J. CARTER
CHECKED BY: B. STRICKLAND
SCALE: 1" = 150'

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STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER

CITY OF STAUNTON, VIRGINIA

FORCEMAIN SHEET INDEX

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SAW CUT AND REPLACE EXISTING PAVEMENT AND CURB AND GUTTER. MATCH EXISTING PAVEMENT THICKNESS WITH RESPECT TO BASE AND SURFACE MATERIALS. CONCRETE REPLACEMENT SHALL EXTEND TO NEAREST CONTROL JOINT. (SEE "CROSSING WAY PAVEMENT RESTORATION DETAIL", SHEET U1.1)

NAD 83

EXISTING SAN. M.H. (ABANDONED) PER RECORD DRAWING

EXISTING SEWER LINE PER RECORD DRAWING

WHERE EXISTING ABANDONED UTILITIES CONFLICT WITH PROPOSED UTILITIES, THE ABANDONED UTILITIES SHALL BE REMOVED (TYPICAL)

PROPOSED 20' UTILITY EASEMENT

FUTURE SANITARY SEWER (BY OTHERS)

PROPOSED 10' TEMPORARY CONSTRUCTION EASEMENT

PROPOSED 15" PVC GRAVITY SEWER

PROPOSED 30' UTILITY EASEMENT

PROPOSED 20' TEMPORARY CONSTRUCTION EASEMENT

PROPOSED 12" CL. 350 D.I. SEWER FORCE MAIN WITH PROTECTO 401 LINING

STA. 13+04.59 45° BEND

STA. 18+10.79 22.50° BEND

STA. 22+79.56 22.50° BEND

STA. 24+57.04 45° BEND

STA. 24+63.87 45° BEND

PROPOSED 16" WATER MAIN (BY OTHERS)

SEE "ROADWAY PAVEMENT RESTORATION NOTE", THIS SHEET

MATCH LINE SHEET F1.2

CROSSING WAY

EXISTING PUMP STATION ACCESS ROAD

EXISTING SAN. M.H. (ABANDONED) RIM = 1388.13 SE INV.= 1378.59 12" PVC NE INV.= 1378.57 12" PVC

STA. 10+75.69 45° BEND

STA. 10+22.09 45° BEND

STA. 10+15.37

STA. 10+05 CONNECT TO PUMP STATION EFFLUENT LINE

PUMP STATION WET WELL

EXISTING PUMP STATION ACCESS ROAD TO BE UTILIZED

WHERE EXISTING ABANDONED UTILITIES CONFLICT WITH PROPOSED UTILITIES, THE ABANDONED UTILITIES SHALL BE REMOVED (TYPICAL)

EMERGENCY PUMP CONNECTION (SEE SHEET P1.2 FOR DETAILS)

SEE PUMP STATION SITE PLAN

SCALE 1"=50'
0 50' 100'

EASEMENT

RESTRAINED PIPE JOINT NOTE:
SEE NOTES AND RESTRAINT LENGTH TABLE, SHEET G1.1 FOR PIPE RESTRAINT LENGTHS NOT SHOWN HERE.

**NOTE:
AT THE TIME OF UTILITY DESIGN, CROSSING WAY WAS UNDER CONSTRUCTION. THE PROPOSED GRADES SHOWN WERE TAKEN FROM THE ROADWAY PLANS AND HAVE NOT BEEN CONFIRMED.

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STA. 10+15.37 10" X 10" TEE
3-10" PLUG VALVE (SEE SHEET P1.2 FOR EFFLUENT PUMP CONNECTION DETAILS)
STA. 10+22.09 45° BEND
STA. 10+05 CONNECT TO PUMP STATION EFFLUENT MAIN
STA. 10+19.69 12" x 10" REDUCER
STA. 10+75.69 45° BEND
PROPOSED 15" GRAVITY SEWER
STA. 13+04.59 45° BEND
STA. 18+10.79 22.50° BEND
STA. 22+79.56 22.50° BEND
PROPOSED 18" RCP STORM PIPE (6)**
CROSSING WAY
VDOT R/W
R/W
PROPOSED 16" WATER MAIN (BY OTHERS)
STA. 24+57.04 45° BEND
STA. 24+63.87 45° BEND
PROPOSED GRADE**
EXISTING GRADE
MAINTAIN 3.0' MINIMUM COVER OVER FORCE MAIN
MAINTAIN 18" MINIMUM CLEARANCE
MAINTAIN 18" MIN. CLEARANCE
PROPOSED 12" CL. 350 D.I. SEWER FORCE MAIN WITH PROTECTO 401 LINING
PROPOSED 10" CL. 350 D.I. SEWER FORCE MAIN WITH PROTECTO 401 LINING
18'
RESTRAIN ALL PIPES, FITTINGS AND APPURTENANCES
SHEET F1.2
MATCH LINE
PROFILE SCALE 10 0 0 50

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DESIGNED BY J. CARTER
CHECKED BY B. STRICKLAND
SCALE H: 1" = 50' V: 1" = 10'

TIMMONS GROUP

STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER

CITY OF STAUNTON, VIRGINIA

FORCE MAIN PLAN AND PROFILE

JOB NO. 49408
SHEET NO. F1.1

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WHERE EXISTING ABANDONED UTILITIES CONFLICT WITH PROPOSED UTILITIES, THE ABANDONED UTILITIES SHALL BE REMOVED (TYPICAL)

ABANDONED EXISTING WATER MAIN PER RECORD DRAWINGS

STA. 26+65.75 45° BEND

STA. 26+99.48 45° BEND

STA. 28+10.97 22.50° VERTICAL BEND

STA. 28+08.38 12" PLUG VALVE

PROPOSED 12" CL. 350 D.I. SEWER FORCE MAIN WITH PROTECTO 401 LINING

PROPOSED 30' UTILITY EASEMENT

PROPOSED 20' TEMPORARY CONSTRUCTION EASEMENT

STA. 31+46.19 45° BEND

STA. 31+80.36 45° BEND

PROPOSED 16" WATER MAIN (BY OTHERS)

PROPOSED 12" CL. 350 D.I. SEWER FORCE MAIN WITH PROTECTO 401 LINING

STA. 35+99.42 45° BEND

STA. 35+47.99 45° BEND

STA. 36+50.00 2" AIR RELEASE VALVE

STA. 36+91.59 45° BEND

STA. 37+06.48 45° BEND

STA. 37+22.40 22.50° VERTICAL BEND

PROPOSED 45' TEMPORARY CONSTRUCTION EASEMENT

PROPOSED 30' UTILITY EASEMENT

STA. 37+61.39 22.50° VERTICAL BEND

STA. 38+05.64 22.50° VERTICAL BEND

STA. 38+39.50 22.50° VERTICAL BEND

STA. 38+60.44 45° BEND

STA. 38+75.33 45° BEND

STA 39+24.99 2" AIR RELEASE VALVE

STA. 39+79.29 45° BEND

STA. 40+17.77 45° BEND

STA. 22+79.56 22.50° BEND

MATCH LINE SHEET F1.1

MATCH LINE SHEET F1.3

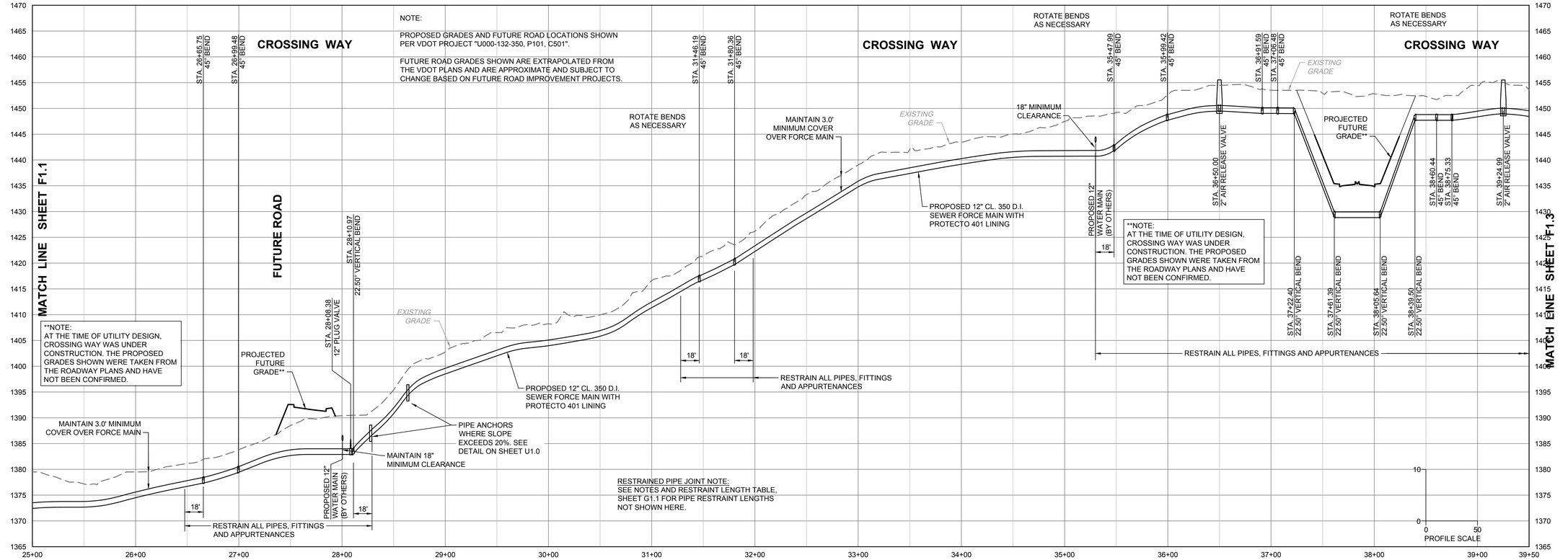
CROSSING WAY

ABANDONED EX. SANITARY MANHOLE
R/M = 1385.13'
SE INV.=1378.59' 12" PVC
NE INV.=1378.57' 12" PVC

EX. VALVE (ABAND.)

NAD 83

SCALE 1"=50'
0 50' 100'



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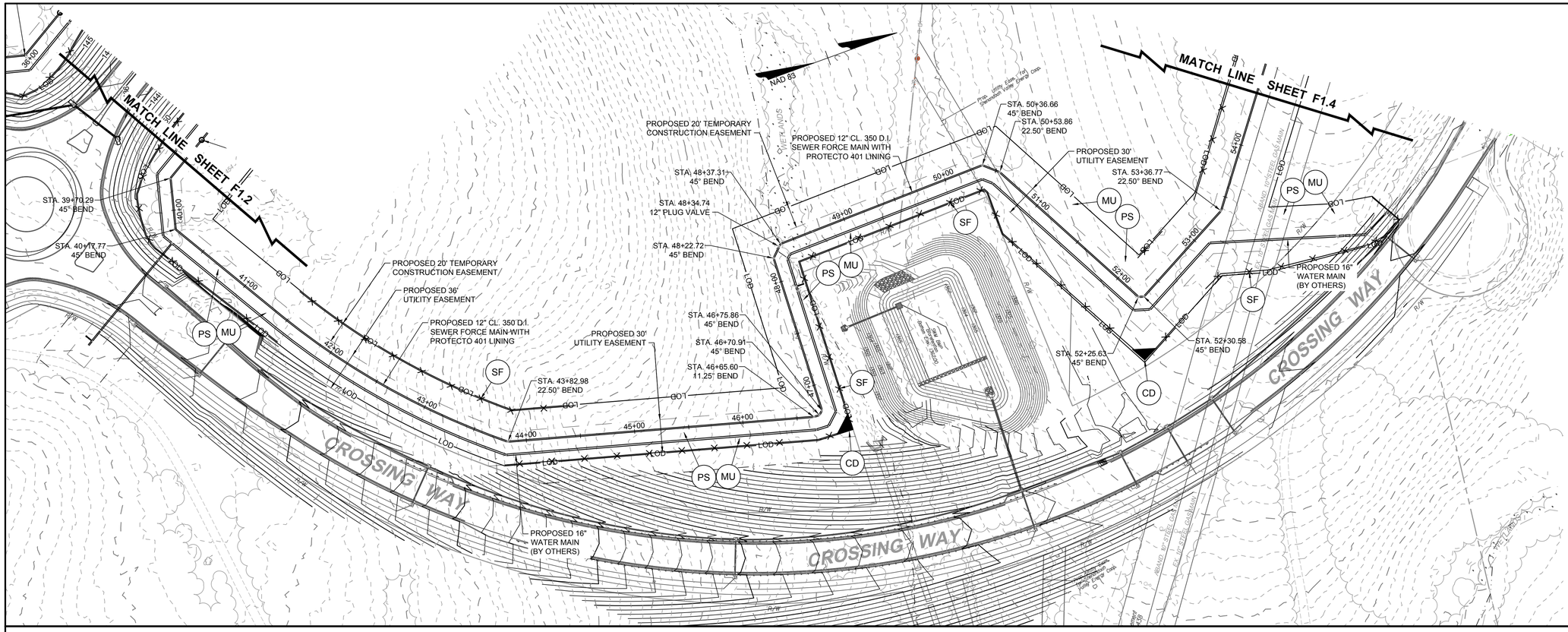
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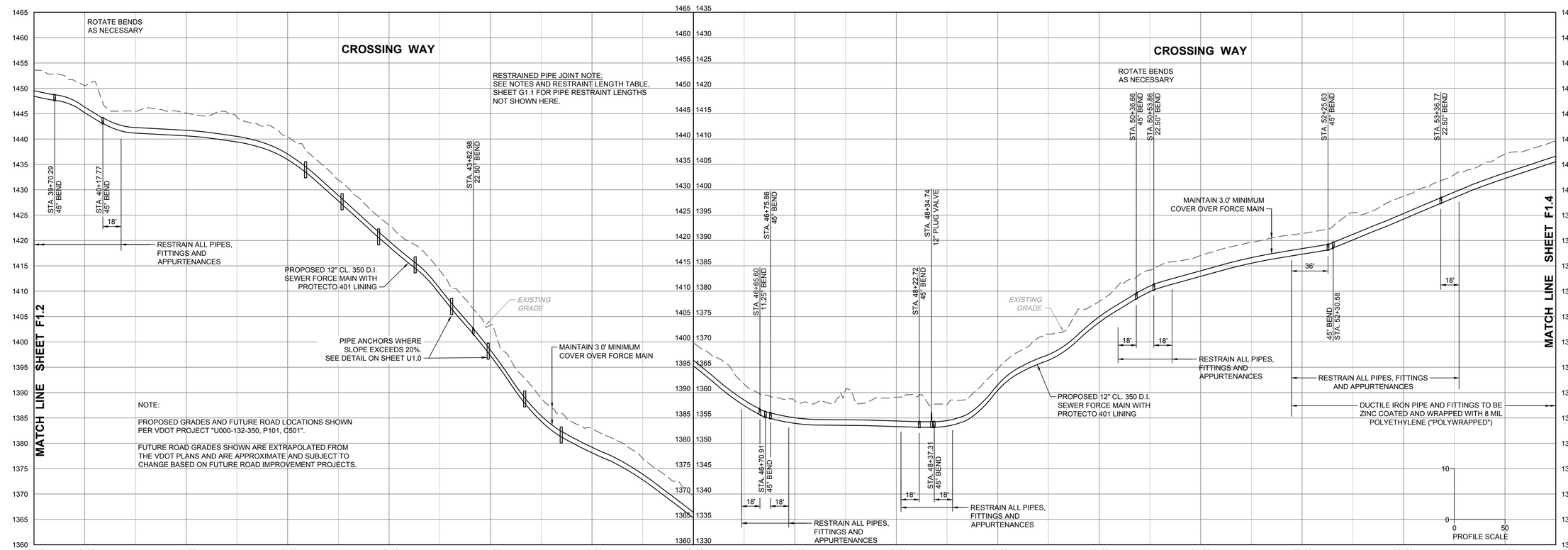
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CITY OF STAUNTON, VIRGINIA
FORCE MAIN PLAN AND PROFILE

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SHEET NO. F1.2

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DATE
3/31/2023

DRAWN BY
J. CARTER

DESIGNED BY
J. CARTER

CHECKED BY
B. STRICKLAND

SCALE
H: 1" = 50'
V: 1" = 10'

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STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER

CITY OF STAUNTON, VIRGINIA

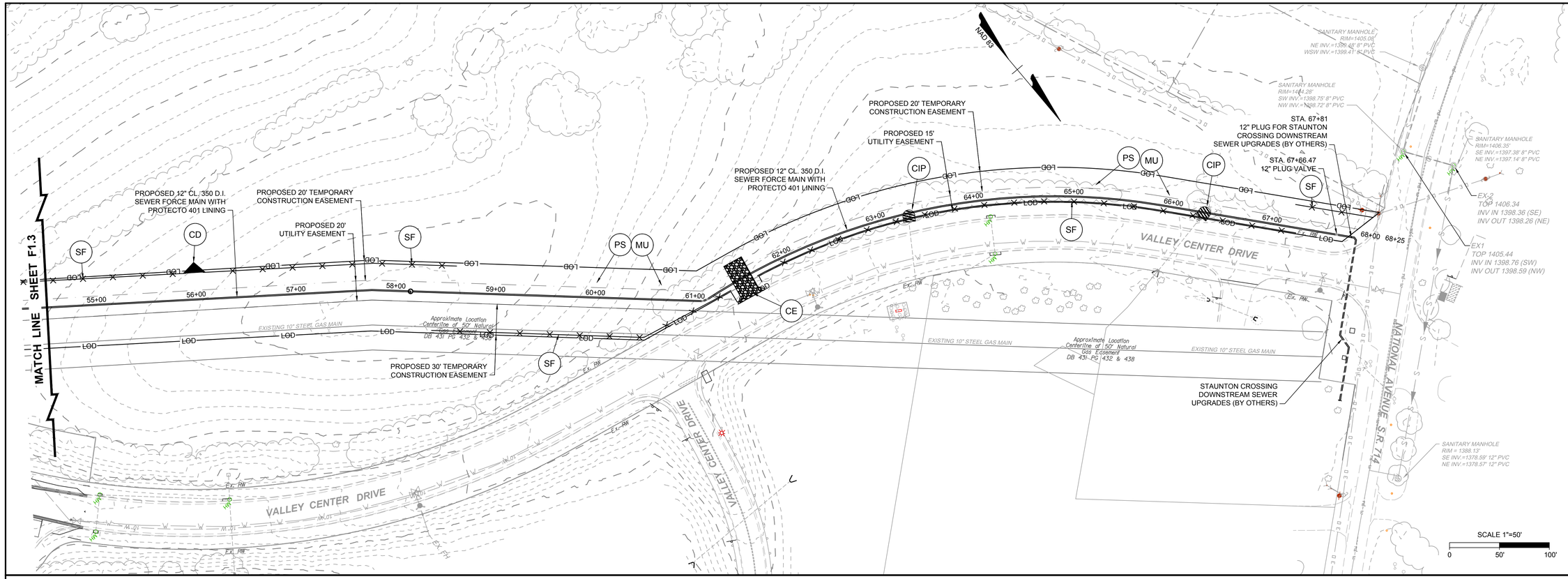
FORCE MAIN PLAN AND PROFILE

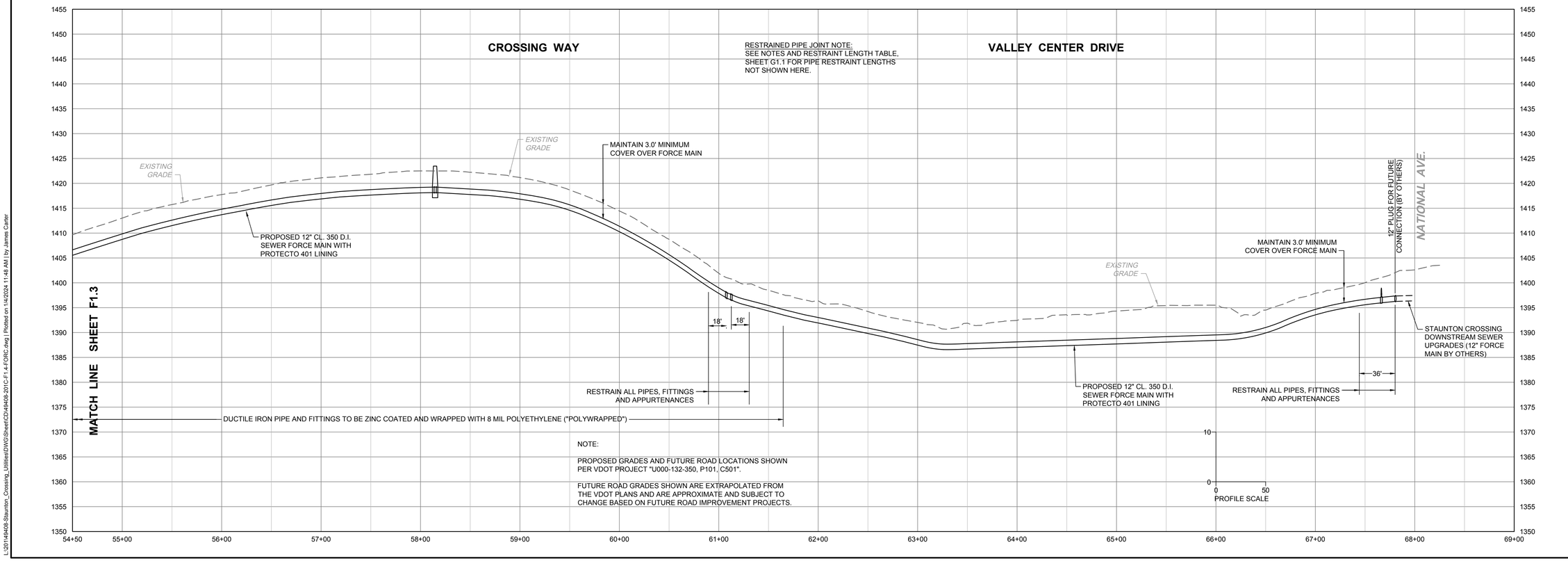
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CHECKED BY B. STRICKLAND
SCALE H: 50 V: 1" = 10'

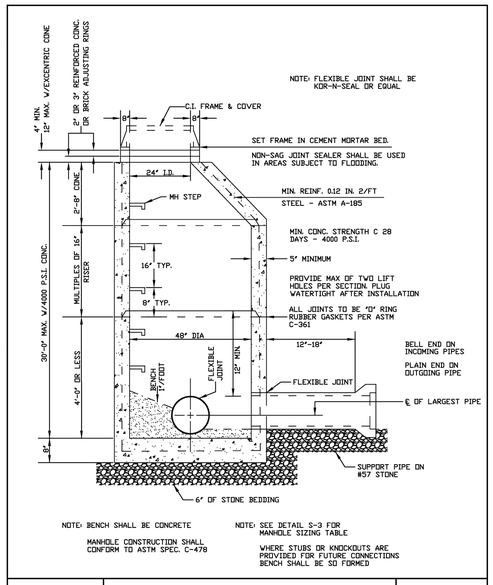
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STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER
CITY OF STAUNTON, VIRGINIA
FORCE MAIN PLAN AND PROFILE

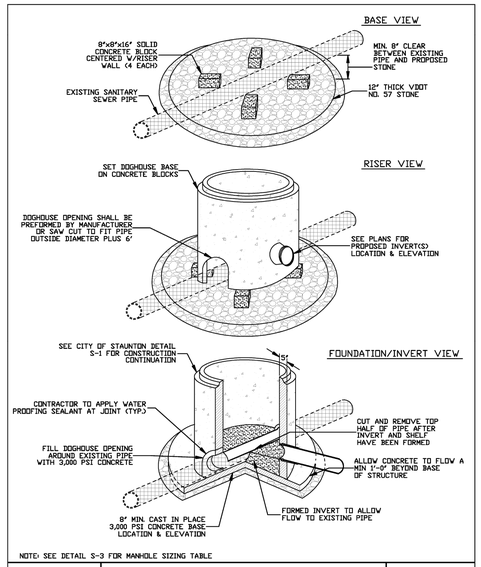
JOB NO. 49408
SHEET NO. F1.4

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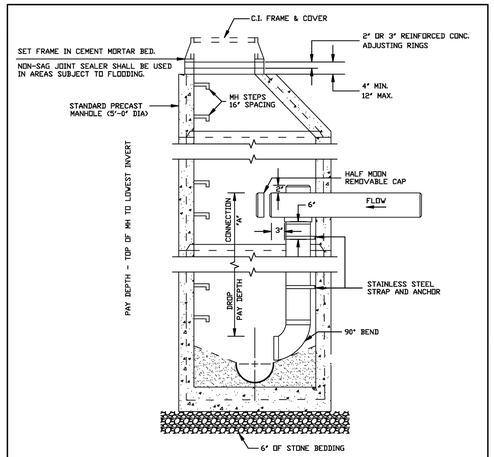
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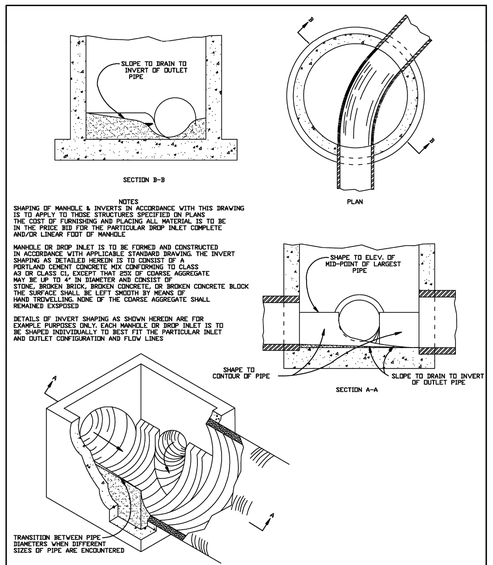
CITY OF STAUNTON, VA	STANDARD PRECAST CONCRETE MANHOLE	Draw No. S-1



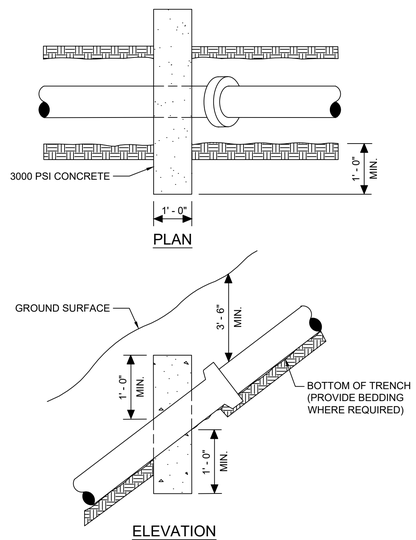
CITY OF STAUNTON, VA	STANDARD PRECAST DOGHOUSE MANHOLE	Draw No. S-1A



CITY OF STAUNTON, VA	DROP CONNECTION 8" MAIN AND SMALLER	Draw No. S-2



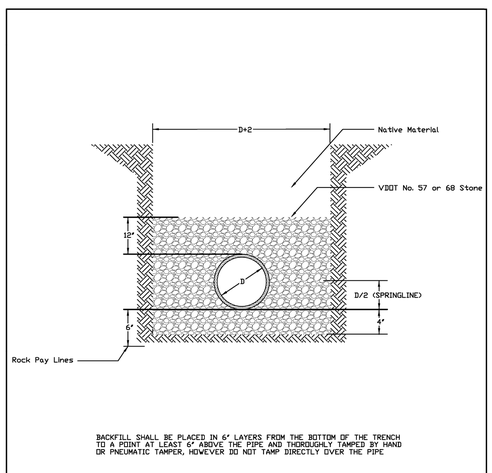
CITY OF STAUNTON, VA	STANDARD METHOD OF SHAPING MANHOLE & INLET INVERTS	Draw No. S-4



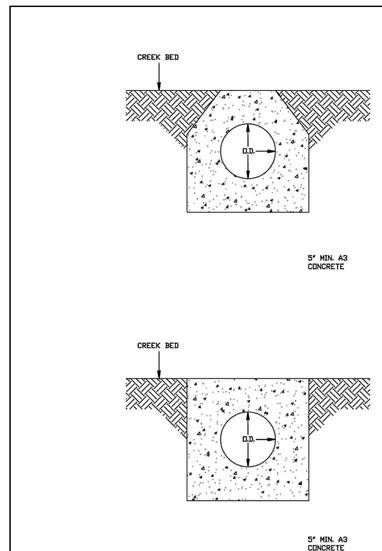
NOTES:

1. CONCRETE TO BE POURED AGAINST UNDISTURBED EARTH
2. SPACING OF ANCHORS:
   SLOPES: 20%-30% - EVERY 2 LENGTHS OF PIPE
   30%-50% - EVERY 1 1/2 LENGTHS OF PIPE
   OVER 50% - EVERY LENGTH OF PIPE

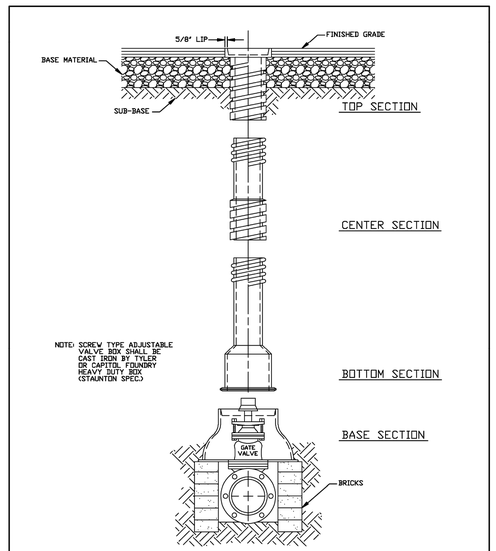
PIPE ANCHORAGE IN SLOPES GREATER THAN OR EQUAL TO 20%



CITY OF STAUNTON, VA	SEWER PIPE INSTALLATION	Draw No. S-8



CITY OF STAUNTON, VA	CONCRETE ENCASEMENTS	Draw No. S-9



CITY OF STAUNTON, VA	SCREW - TYPE ADJUSTABLE VALVE BOX	Draw No. W-11

COMMONWEALTH OF VIRGINIA
BRUCE W. STRICKLAND JR.
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DESIGNED BY J. CARTER
CHECKED BY B. STRICKLAND
SCALE AS SHOWN

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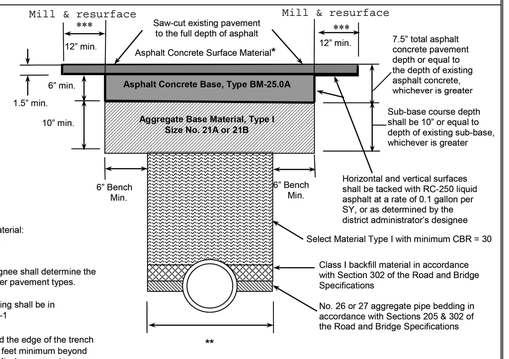
STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER
CITY OF STAUNTON, VIRGINIA
UTILITY DETAILS

JOB NO. 49408
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Asphalt Pavement Restoration Detail for Open Cut Utility Installations



NOTES:

* Asphalt Concrete Surface Material:
SM-9.5A for ADT < 10,000
SM-9.5D for ADT > 10,000

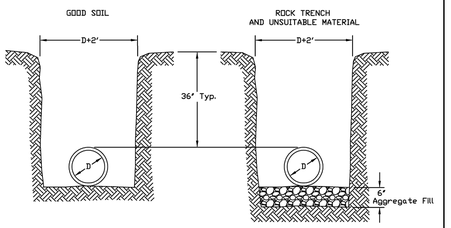
The district administrator's designee shall determine the restoration requirements for other pavement types.

** Trench width and pipe bedding shall be in accordance with VDOT Std. PB-1

*** 12 inches minimum beyond the edge of the trench on longitudinal open cuts, or 25 feet minimum beyond the trench centerline on perpendicular open cuts, or as determined by the district administrator's designee.

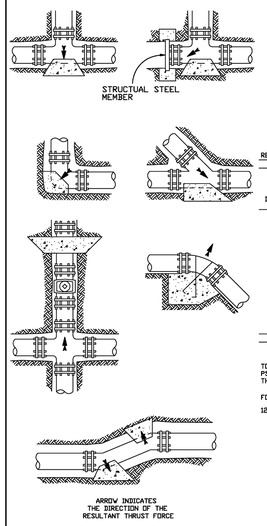
Date: August 27, 2014

CROSSING WAY
PAVEMENT RESTORATION DETAIL



NOTE:
1. ALL BEDDING SHALL BE CONTINUOUS AND UNIFORM
2. EXCAVATION IS REQUIRED TO ENSURE THERE IS NO ROCK WITHIN 6' OF THE BOTTOM OF THE PIPE

CITY OF STAUNTON, VA	SEWER FORCEMAIN AND **WATER PIPE INSTALLATION**	Draw No. **W-12**



UTILIZE TO DETERMINE THE THRUST TO BE RESTRAINED BY A THRUST BLOCK

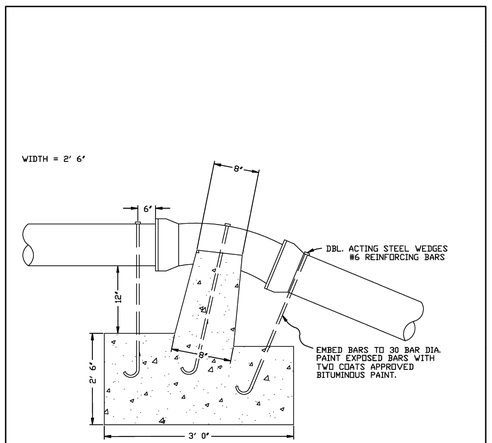
RESULTANT THRUST AT FITTINGS AT 100 PSI WATER PRESSURE

NOM. PIPE DIA IN.	TOTAL POUNDS DEAD END	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND
4	1,810	2,559	1,385	706	355
6	3,739	5,288	2,862	1,459	733
8	6,433	9,097	4,923	2,510	1,261
10	9,677	13,685	7,406	3,776	1,897
12	13,685	19,353	10,474	5,340	2,683
14	18,385	26,001	14,072	7,174	3,604
16	23,779	33,628	18,199	9,278	4,661
18	29,865	42,235	22,858	11,653	5,855
20	36,644	51,822	28,046	14,298	7,183
24	52,579	73,934	40,013	20,398	10,249
30	80,425	113,738	61,554	31,380	15,766
36	115,209	162,931	88,177	44,952	22,585
42	155,529	219,950	119,036	60,684	30,489
48	202,683	286,627	155,127	79,083	39,733
54	256,072	362,140	195,989	99,914	50,199

TO DETERMINE THRUST AT PRESSURES OTHER THAN 100 PSI, MULTIPLY THE THRUST OBTAINED IN THE TABLE BY THE RATIO OF THE PRESSURE TO 100

FOR EXAMPLE, THE THRUST ON A 12 INCH, 90° BEND AT 125 PSI IS 19,353 X $\frac{125}{100}$ = 24,191 POUNDS

CITY OF STAUNTON, VA	**THRUST BLOCK TABLES XXV,XXIV**	Draw No. **W-13**

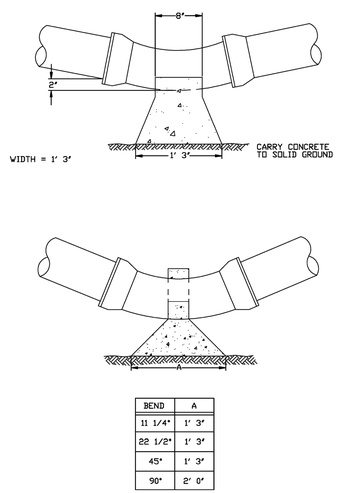


MEGA-LUG ALTERNATIVE FOR BENDS 22 1/2° AND LESS

CITY OF STAUNTON, VA	**THRUST BLOCK DETAILS**	Draw No. **W-14**

MEGA-LUG ALTERNATIVE FOR BENDS 22 1/2° OR LESS

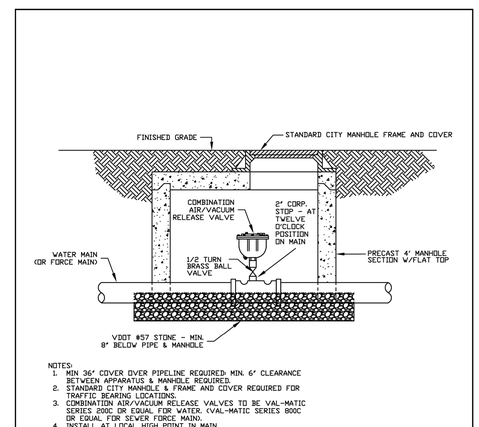
CITY OF STAUNTON, VA	**THRUST BLOCK VERTICAL BEND**	Draw No. **W-15**



BEND	A
11 1/4°	1' 3"
22 1/2°	1' 3"
45°	1' 3"
90°	2' 0"

MEGA-LUG ALTERNATIVE FOR BENDS 22 1/2° OR LESS

CITY OF STAUNTON, VA	**THRUST BLOCK HORIZONTAL & VERTICAL BENDS**	Draw No. **W-16**



NOTES:
1. MIN 36" COVER OVER PIPELINE REQUIRED. MIN. 6" CLEARANCE BETWEEN APPARATUS & MANHOLE REQUIRED.
2. STANDARD CITY MANHOLE & FRAME AND COVER REQUIRED FOR TRAFFIC BEARING LOCATIONS.
3. COMBINATION AIR/VACUUM RELEASE VALVES TO BE VAL-MATIC SERIES 200C OR EQUAL FOR WATER. (VAL-MATIC SERIES 800C OR EQUAL FOR SEWER FORCE MAIN.
4. INSTALL AT LOCAL HIGH POINT IN MAIN.

REVISED: 2023-10-20

CITY OF STAUNTON, VA	COMBINATION AIR/VACUUM RELEASE VALVE	Drawing No. W-18

COMMONWEALTH OF VIRGINIA
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CHECKED BY: B. STRICKLAND
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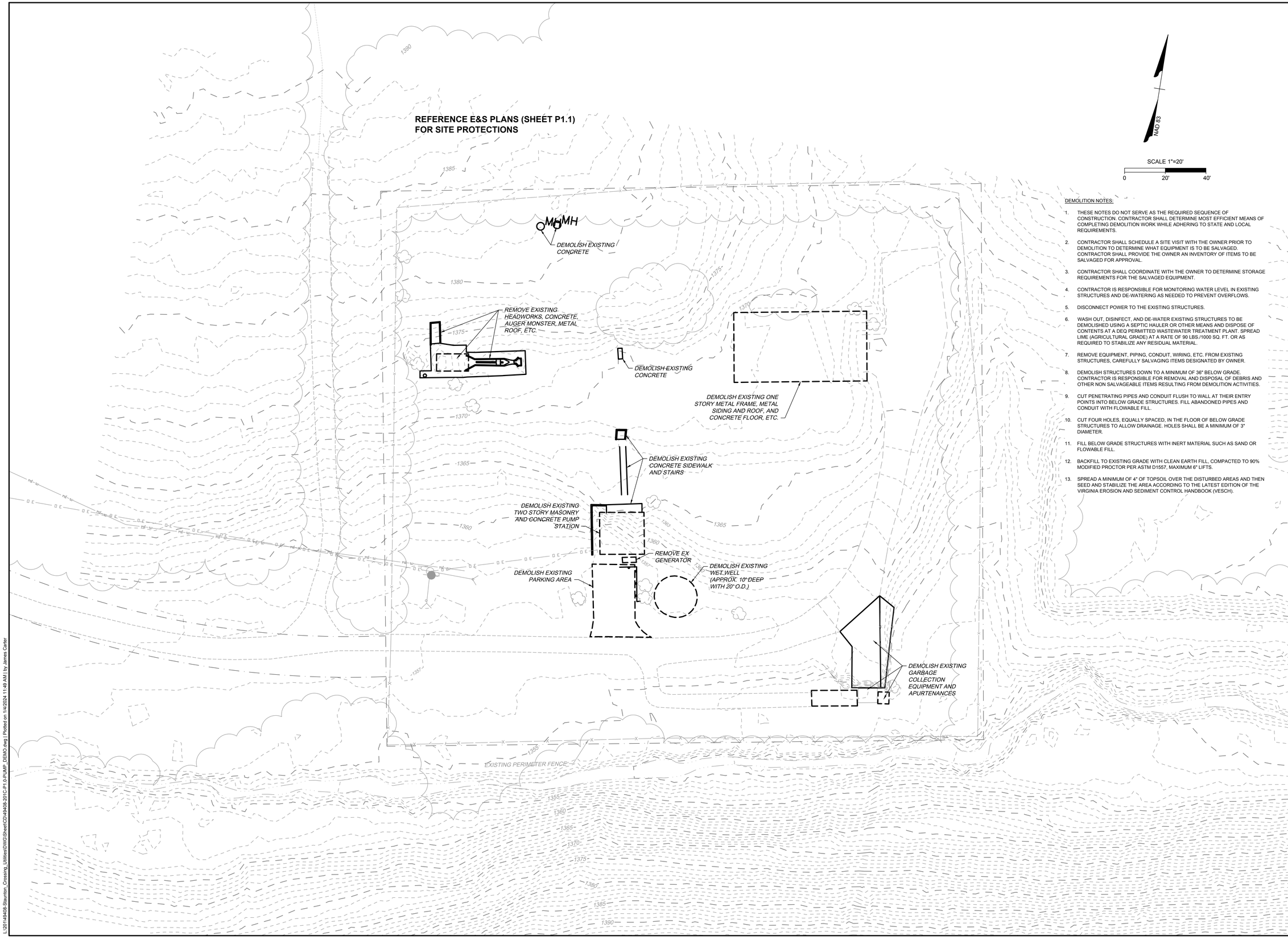
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CITY OF STAUNTON, VIRGINIA
UTILITY DETAILS

JOB NO. 49408
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REFERENCE E&S PLANS (SHEET P1.1)
FOR SITE PROTECTIONS



DEMOLITION NOTES:

1. THESE NOTES DO NOT SERVE AS THE REQUIRED SEQUENCE OF CONSTRUCTION. CONTRACTOR SHALL DETERMINE MOST EFFICIENT MEANS OF COMPLETING DEMOLITION WORK WHILE ADHERING TO STATE AND LOCAL REQUIREMENTS.
2. CONTRACTOR SHALL SCHEDULE A SITE VISIT WITH THE OWNER PRIOR TO DEMOLITION TO DETERMINE WHAT EQUIPMENT IS TO BE SALVAGED. CONTRACTOR SHALL PROVIDE THE OWNER AN INVENTORY OF ITEMS TO BE SALVAGED FOR APPROVAL.
3. CONTRACTOR SHALL COORDINATE WITH THE OWNER TO DETERMINE STORAGE REQUIREMENTS FOR THE SALVAGED EQUIPMENT.
4. CONTRACTOR IS RESPONSIBLE FOR MONITORING WATER LEVEL IN EXISTING STRUCTURES AND DE-WATERING AS NEEDED TO PREVENT OVERFLOWS.
5. DISCONNECT POWER TO THE EXISTING STRUCTURES.
6. WASH OUT, DISINFECT, AND DE-WATER EXISTING STRUCTURES TO BE DEMOLISHED USING A SEPTIC HAULER OR OTHER MEANS AND DISPOSE OF CONTENTS AT A DEQ PERMITTED WASTEWATER TREATMENT PLANT. SPREAD LIME (AGRICULTURAL GRADE) AT A RATE OF 90 LBS./1000 SQ. FT. OR AS REQUIRED TO STABILIZE ANY RESIDUAL MATERIAL.
7. REMOVE EQUIPMENT, PIPING, CONDUIT, WIRING, ETC. FROM EXISTING STRUCTURES, CAREFULLY SALVAGING ITEMS DESIGNATED BY OWNER.
8. DEMOLISH STRUCTURES DOWN TO A MINIMUM OF 36" BELOW GRADE. CONTRACTOR IS RESPONSIBLE FOR REMOVAL AND DISPOSAL OF DEBRIS AND OTHER NON SALVAGEABLE ITEMS RESULTING FROM DEMOLITION ACTIVITIES.
9. CUT PENETRATING PIPES AND CONDUIT FLUSH TO WALL AT THEIR ENTRY POINTS INTO BELOW GRADE STRUCTURES. FILL ABANDONED PIPES AND CONDUIT WITH FLOWABLE FILL.
10. CUT FOUR HOLES, EQUALLY SPACED, IN THE FLOOR OF BELOW GRADE STRUCTURES TO ALLOW DRAINAGE. HOLES SHALL BE A MINIMUM OF 3" DIAMETER.
11. FILL BELOW GRADE STRUCTURES WITH INERT MATERIAL SUCH AS SAND OR FLOWABLE FILL.
12. BACKFILL TO EXISTING GRADE WITH CLEAN EARTH FILL, COMPACTED TO 90% MODIFIED PROCTOR PER ASTM D1557, MAXIMUM 6" LIFTS.
13. SPREAD A MINIMUM OF 4" OF TOPSOIL OVER THE DISTURBED AREAS AND THEN SEED AND STABILIZE THE AREA ACCORDING TO THE LATEST EDITION OF THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK (VESCH).

COMMONWEALTH OF VIRGINIA
BRUCE W. STRICKLAND JR.
Lic. No. 056612
11/17/2023
PROFESSIONAL ENGINEER

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DESIGNED BY: J. CARTER
CHECKED BY: B. STRICKLAND
SCALE:

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STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER
CITY OF STAUNTON, VIRGINIA
PUMP STATION SITE DEMOLITION PLAN

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NAD 83

SCALE 1"=10'
0 10' 20'

RESTORE EXISTING GRAVEL ACCESS ROAD (SEE DETAIL SHEET P1.2)

EXISTING POWER POLE STABILIZE OR RELOCATE AS REQUIRED**

12' ID PRECAST CONCRETE WETWELL

30'x24' PRECAST CONCRETE BUILDING

FFE = 1358.00

SWALE

MINI-SPLIT PAD DIMENSIONS PER MANUFACTURER

GENERATOR PAD DIMENSIONS PER MANUFACTURER

MANHOLE SEE SEWER PLANS

15" PVC GRAVITY SEWER

CONCRETE PAD STA. 10+15.37 10" X 10" TEE

BOLLARD (TYP.)

NEW 12' WIDE GRAVEL DRIVE

NEW FENCE (SEE DETAIL SHEET P1.2)

STA. 10+22.09 45° BEND

R10'

NEW 16' DOUBLE SWING GATE

RESTORE EXISTING ACCESS ROAD

STA. 10+75.69 45° BEND

**NOTE:
DOMINION VIRGINIA POWER WILL BE RELOCATING THE EXISTING POWER POLE TO THE VICINITY OF THE SW CORNER OF THE SITE. CONTRACTOR SHALL COORDINATE WITH THE OWNER PRIOR TO ANY WORK IN THE VICINITY OF THE EXISTING POWER POLE AND/OR GUY WIRES.

INSET
1" = 5'

10" PLUG VALVE
EMERGENCY PUMP CONNECTION (SEE DETAIL, SHEET P1.2
CONCRETE PAD
10" PLUG VALVE
10" X 10" TEE
10" PLUG VALVE
12"x10" REDUCER
12" 45° BEND
10"x4" REDUCER
4" PLUG VALVE

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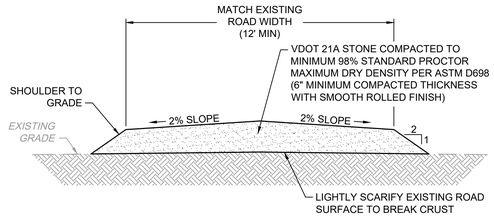
STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER

CITY OF STAUNTON, VIRGINIA

PUMP STATION SITE LAYOUT

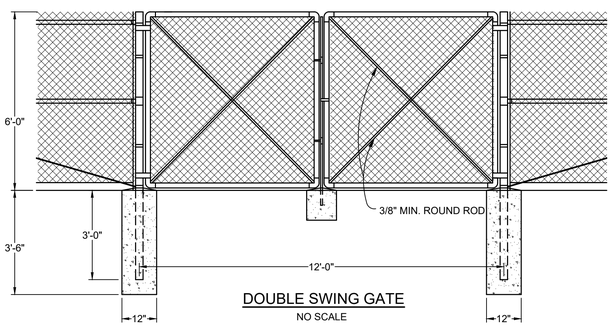
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GRAVEL ROAD RESTORATION

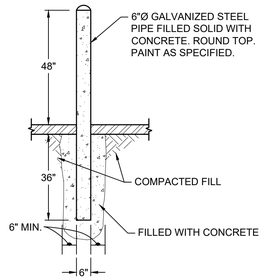
NO SCALE



DOUBLE SWING GATE

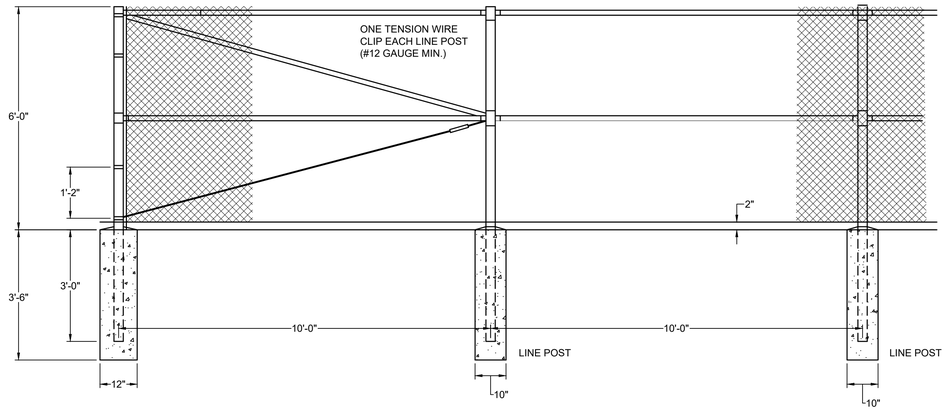
NO SCALE

NOTE:
FENCE POSTS, SUPPORTS, AND FABRIC SHALL BE BLACK PVC CLAD



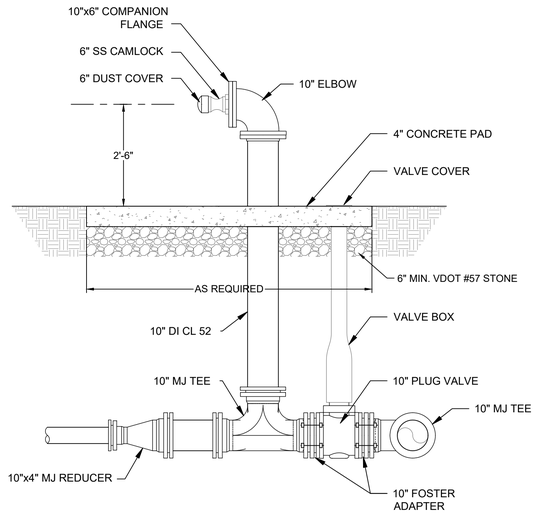
SITE BOLLARD

NO SCALE



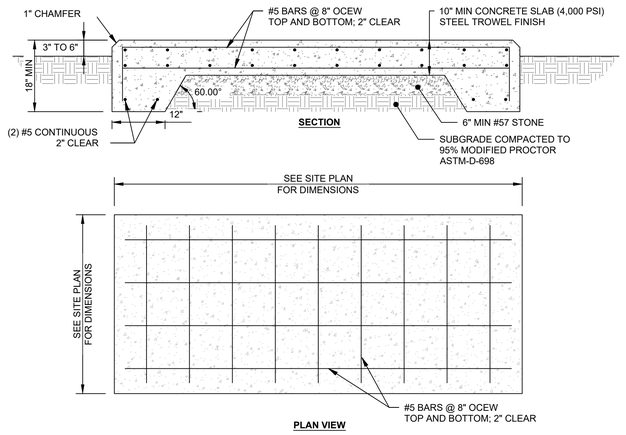
SITE FENCE AND GATE

NO SCALE



EMERGENCY PUMP CONNECTION

NO SCALE



CONCRETE GENERATOR PAD

NO SCALE

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CHECKED BY: B. STRICKLAND
SCALE:

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STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER

CITY OF STAUNTON, VIRGINIA

PUMP STATION SITE DETAILS

JOB NO. 49408

SHEET NO. P1.2

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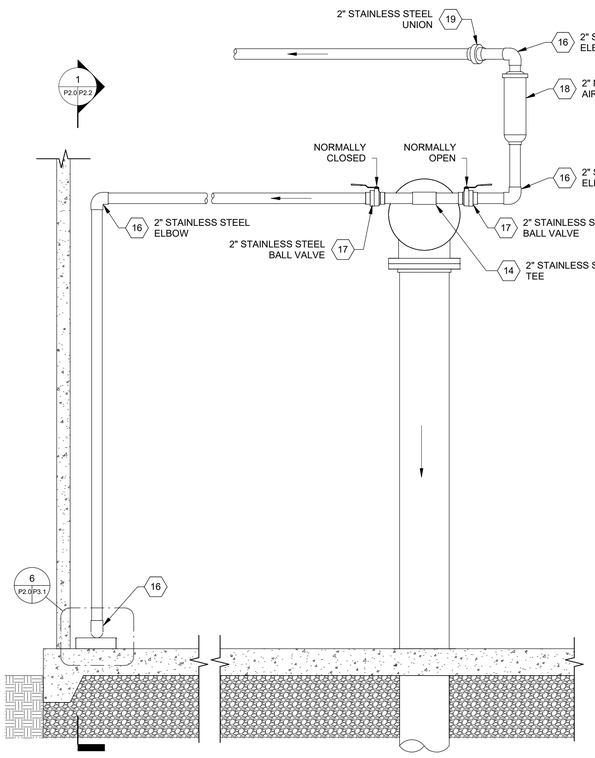
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GENERAL NOTES

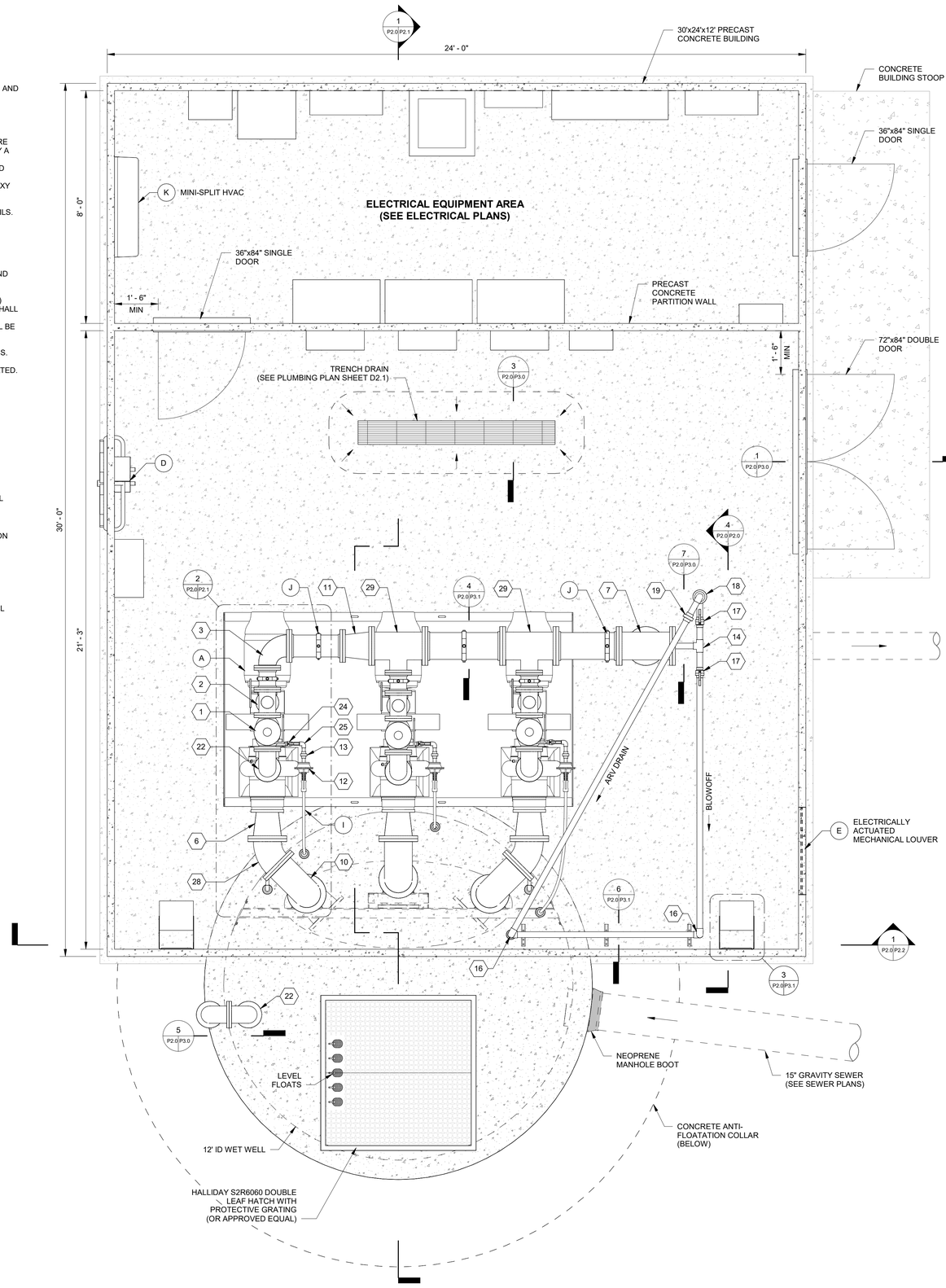
1. SECTIONS ARE INTENDED TO REPRESENT THE APPROXIMATE LOCATION FOR PIPING AND APPURTENANCES. SOME ITEMS MAY BE ROTATED OR OMITTED FOR CLARITY.
2. REFER TO ELECTRICAL DRAWINGS FOR PANEL DETAILS, LOAD REQUIREMENTS, WIRE SIZES AND CONDUITS, ETC.
3. ALL SAFETY EQUIPMENT TO BE OSHA COMPLIANT.
4. PIPE SUPPORTS AND HANGERS REMOVED FOR CLARITY, SUPPORTS NOT SHOWN WILL BE NECESSARY. PIPING SHALL BE SUPPORTED AND BRACED TO HOLD THE PIPE OR APPURTENANCE IN A FIRM, SUBSTANTIAL MANNER.
5. ALL UNISTRUT SUPPORTS SHALL BE STAINLESS STEEL.

WASTEWATER PUMP STATION NOTES

1. THE WET WELL AND BUILDING SHALL BE CONSTRUCTED OF PRECAST CONCRETE. THE PRECAST SUPPLIER SHALL SIZE THE STRUCTURE WALLS, TOP AND BASE TO ACCOUNT FOR THE ANTICIPATED LOADS, DEPTH AND FLOATATION AND PROVIDE CALCULATIONS SIGNED BY A VIRGINIA LICENSED PROFESSIONAL ENGINEER WITH THE SUBMITTALS.
2. PRECAST STRUCTURES SHALL HAVE A MONOLITHIC BASE SECTION. THE JOINTS BETWEEN PRECAST SECTIONS SHALL BE TONGUE AND GROOVE WITH AN O-RING RUBBER GASKET. A FLEXIBLE JOINT SEALANT IS REQUIRED BETWEEN PRECAST STRUCTURE SECTIONS.
3. THE ENTIRE EXTERIOR SURFACE OF ALL BELOW GRADE PRECAST CONCRETE STRUCTURES SHALL BE COATED WITH A COAL-TAR EPOXY TYPE BITUMINOUS COATING TO A MINIMUM 23 MIL THICKNESS. AN EXTERNAL WRAP SHALL BE USED AT ALL JOINTS WHERE PRECAST CONCRETE SECTIONS JOIN TOGETHER. THE WRAP SHALL MEET OR EXCEED THE REQUIREMENTS OF ASTM C877 TYPE III AND C990.
4. THE PRECAST CONCRETE WET WELL INTERIOR SHALL BE COATED WITH RAVEN 405 EPOXY LINING TO A MINIMUM THICKNESS OF 120 MILS.
5. ALL MISCELLANEOUS METAL IN THE WET WELL SHALL BE STAINLESS STEEL ALLOY DESIGNED FOR USE IN SEWAGE STRUCTURES. ALL BOLTS, NUTS AND OTHER FASTENERS IN WET WELLS SHALL BE 316 OR 304 STAINLESS STEEL.
6. CONTRACTOR SHALL SUPPLY ALL EQUIPMENT REQUIRED TO PROVIDE A COMPLETE OPERATING SYSTEM.
7. PUMPS SHALL BE EXPLOSION PROOF.
8. FLOATS AND TRANSDUCER SHALL BE INTRINSICALLY SAFE.
9. CONTRACTOR SHALL CONFIRM PENETRATION SIZES AND LOCATIONS PRIOR TO ORDERING PRECAST STRUCTURES.
10. ALL PACKAGED PUMP STATION COMPONENTS SHALL BE SUPPLIED BY A UNITARY SOURCE INCLUDING PUMPS, MOTORS, CONTROLS AND CONTROL PANEL.
11. FLOATS SHALL BE POSITIONED TO PREVENT INFLUENT FLOW FROM AFFECTING PROPER OPERATION OF THE PUMP STATION.
12. CONTRACTOR SHALL PROVIDE ALL LABOR AND MATERIALS (INCLUDING ADEQUATE WATER SUPPLIES FOR SEVERAL PUMPING CYCLES) NECESSARY TO CONDUCT MANUFACTURER'S STARTUP PROCEDURE, TRAINING, AND PUMP PERFORMANCE TESTING. CONTRACTOR SHALL SUBMIT MANUFACTURER'S CERTIFIED STARTUP DOCUMENTATION TO THE ENGINEER FOR REVIEW.
13. ALL EXPOSED PIPE 4" AND GREATER SHALL BE FLANGED CLASS 53 DUCTILE IRON AND ALL BELOW GRADE PIPE 4" AND GREATER SHALL BE MECHANICAL JOINT CLASS 52 DUCTILE IRON UNLESS OTHERWISE STATED. ALL DUCTILE IRON PIPING SHALL INCLUDE PROTECTO 401 INTERNAL LINING. RESTRAIN ALL JOINTS.
14. ALL DUCTILE IRON PIPE SUBMERGED IN RAW WASTEWATER SHALL HAVE A COAL TAR EPOXY COATING TO A MINIMUM 16 MIL THICKNESS.
15. ENSURE ACCESS TO AND OPERABILITY OF ALL VALVES.
16. ALL PIPES, VALVES, AND FITTINGS LESS THAN 4" DIAMETER SHALL BE STAINLESS STEEL, BRASS, OR COPPER UNLESS OTHERWISE STATED.



4 PUMP STATION SECTION
3/4" = 1'-0"



1 PUMP STATION LAYOUT
1/2" = 1'-0"

FITTING AND EQUIPMENT SCHEDULE

LABEL	DESCRIPTION
1	6" FLG CHECK VALVE (GORMAN RUPP)
2	6" FLG PLUG VALVE (GORMAN RUPP)
3	8"x6" FLG REDUCING ELBOW
6	10"x8" FLG ECCENTRIC REDUCER
7	10" FLG TEE
10	10" FLG LONG RADIUS ELBOW
11	10"x8" FLG CONCENTRIC REDUCER
12	ARV (GORMAN RUPP)
13	1" STAINLESS STEEL UNION
14	2" STAINLESS STEEL TEE
16	2" STAINLESS STEEL ELBOW
17	2" STAINLESS STEEL BALL VALVE
18	2" NPT COMBINATION AIR VALVE
19	2" STAINLESS STEEL UNION
22	6" FLG 90 DEGREE ELBOW
24	1" STAINLESS STEEL BALL VALVE
25	1" STAINLESS STEEL ELBOW
28	10" FLG 45 DEGREE BEND
29	10"x6" FLG REDUCING TEE
A	TRIPLEX GORMAN RUPP PUMP SKID
D	EXHAUST FAN
E	ELECTRICALLY ACTUATED MECHANICAL LOUVER
I	FLEXIBLE HOSE WITH CAMLOCK FITTINGS
J	CLEVIS HANGER
K	MINI-SPLIT HVAC

MECHANICAL ABBREVIATIONS

APPROX	APPROXIMATE
ARV	AIR RELEASE VALVE
AVG	AVERAGE
CHEM	CHEMICAL
ELEV	ELEVATION
EX	EXISTING
FE	FLANGED END
GE	GROOVED END
GPM	GALLONS PER MINUTE
HP	HORSE POWER
ID	INSIDE DIAMETER
LF	LINEAR FOOT (FEET)
MAX	MAXIMUM
MIN	MINIMUM
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
No	NUMBER
NPT	NATIONAL PIPE THREAD
OC	ON CENTER
OCEW	ON CENTER EACH WAY
PE	PLAIN END
PNL	PANEL
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
RQD	REQUIRED
SCH	SCHEDULE
SIM	SIMILAR (TO)
SS	STAINLESS STEEL
TYP	TYPICAL

PLAN LEGEND

SYMBOL	DESCRIPTION
1	SCHEDULED FITTING
1	SCHEDULED EQUIPMENT
1 / M1.0/M1.1	BUILDING SECTION
2 / M2.0/M2.1	DETAIL SECTION
3 / M3.0/M3.1	DETAIL REFERENCE
	ELEVATION MARKER
ELEV	LIQUID ELEVATION

0 1' 2' 3' 4' 5'
1/2" = 1'-0"

0 1' 2' 3' 4' 5'
3/4" = 1'-0"

COMMONWEALTH OF VIRGINIA
BRUCE W. STRICKLAND JR.
Lic. No. 056612
11/17/2023
PROFESSIONAL ENGINEER

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CHECKED BY B. STRICKLAND
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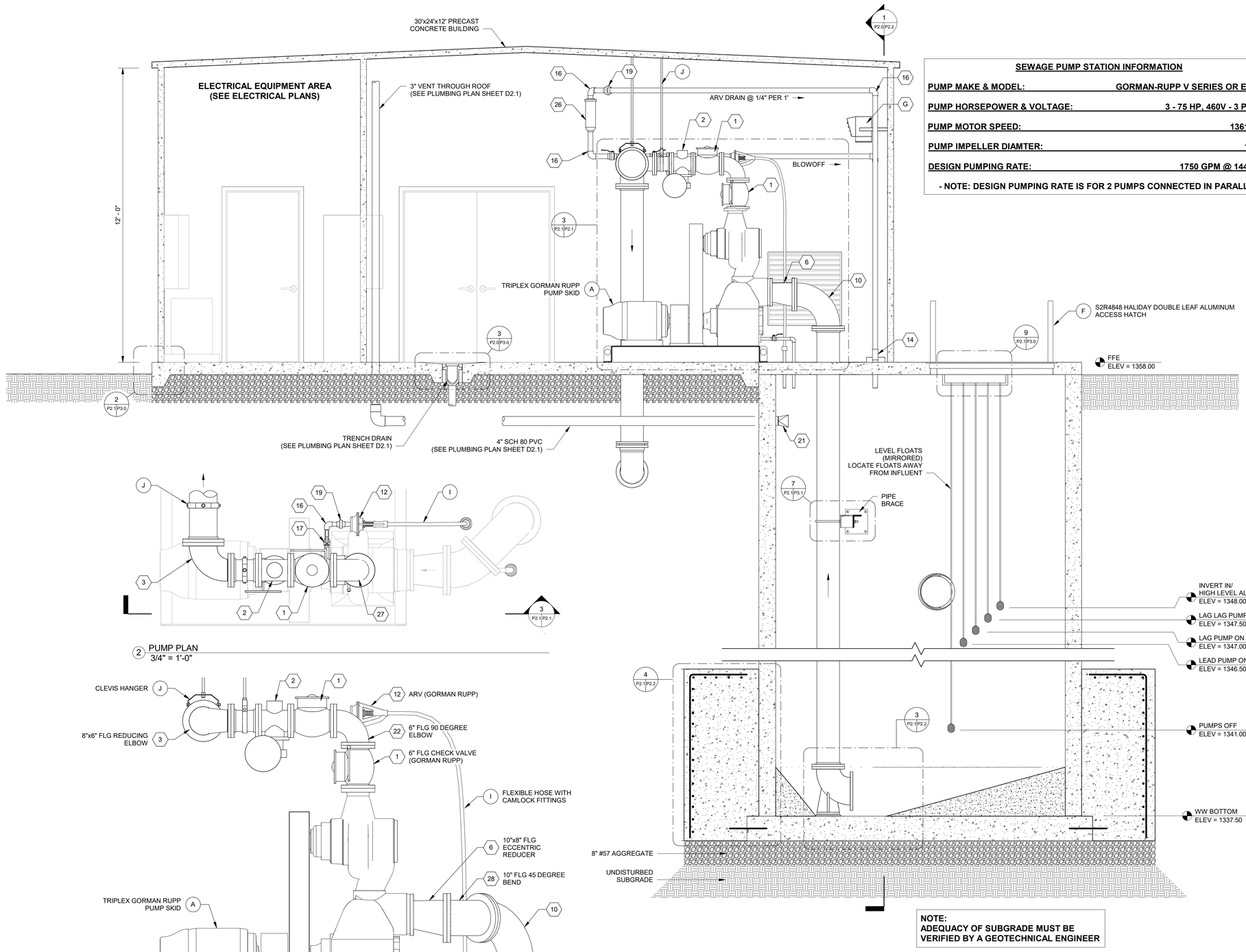
TIMMONS GROUP

STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER
CITY OF STAUNTON - VIRGINIA
PUMP STATION LAYOUT

JOB NO. 49408.003
SHEET NO. P2.0

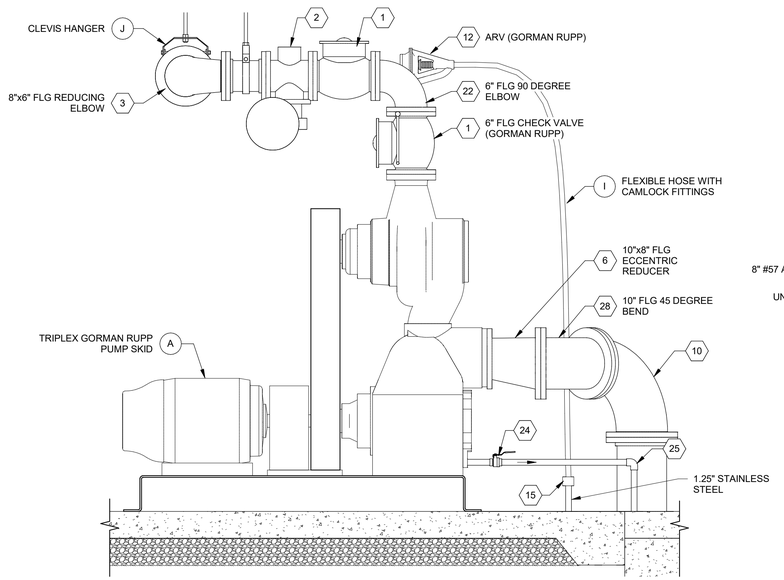
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1 PUMP STATION SECTION
1/2" = 1'-0"

2 PUMP PLAN
3/4" = 1'-0"



3 PUMP SECTION
3/4" = 1'-0"

SEWAGE PUMP STATION INFORMATION

PUMP MAKE & MODEL:	**GORMAN-RUPP V SERIES OR EQUAL**
PUMP HORSEPOWER & VOLTAGE:	**3 - 75 HP, 460V - 3 PHASE**
PUMP MOTOR SPEED:	**1361 RPM**
PUMP IMPELLER DIAMTER:	**12.38"**
DESIGN PUMPING RATE:	**1750 GPM @ 144' TDH**

- NOTE: DESIGN PUMPING RATE IS FOR 2 PUMPS CONNECTED IN PARALLEL

FITTING AND EQUIPMENT SCHEDULE

LABEL	DESCRIPTION
1	6" FLG CHECK VALVE (GORMAN RUPP)
2	6" FLG PLUG VALVE (GORMAN RUPP)
3	8"x6" FLG REDUCING ELBOW
6	10"x8" FLG ECCENTRIC REDUCER
10	10" FLG LONG RADIUS ELBOW
12	ARV (GORMAN RUPP)
14	2" STAINLESS STEEL TEE
15	1 1/4" CAMLOCK COUPLING
16	2" STAINLESS STEEL ELBOW
17	2" STAINLESS STEEL BALL VALVE
19	2" STAINLESS STEEL UNION
21	4" TIDEFLEX CHECK VALVE
22	6" FLG 90 DEGREE ELBOW
24	1" STAINLESS STEEL BALL VALVE
25	1" STAINLESS STEEL ELBOW
26	10" MJ 90 DEGREE ELBOW
27	6" FLG 90 DEGREE ELBOW
28	10" FLG 45 DEGREE BEND
A	TRIPLEX GORMAN RUPP PUMP SKID
F	S2R4848 HALIDAY DOUBLE LEAF ALUMINUM ACCESS HATCH
G	UNIT HEATER
I	FLEXIBLE HOSE WITH CAMLOCK FITTINGS
J	CLEVIS HANGER

PLAN LEGEND

SYMBOL	DESCRIPTION
1	SCHEDULED FITTING
1	SCHEDULED EQUIPMENT
1 (M1.0/M1.1)	BUILDING SECTION
2 (M2.0/M2.1)	DETAIL SECTION
3 (M3.0/M3.1)	DETAIL REFERENCE
	ELEVATION MARKER
ELEV	LIQUID ELEVATION

0 1' 2' 3' 4' 5'
1/2" = 1'-0"

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BRUCE W. STRICKLAND JR.
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PROFESSIONAL ENGINEER

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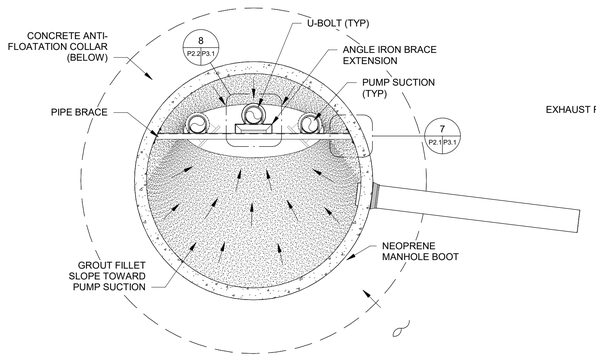
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STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER
CITY OF STAUNTON - VIRGINIA
PUMP STATION SECTIONS

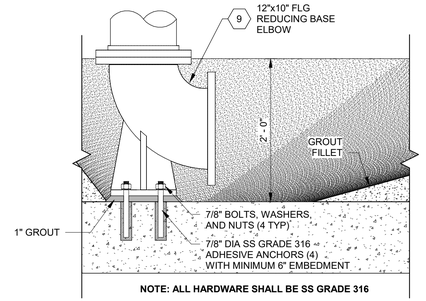
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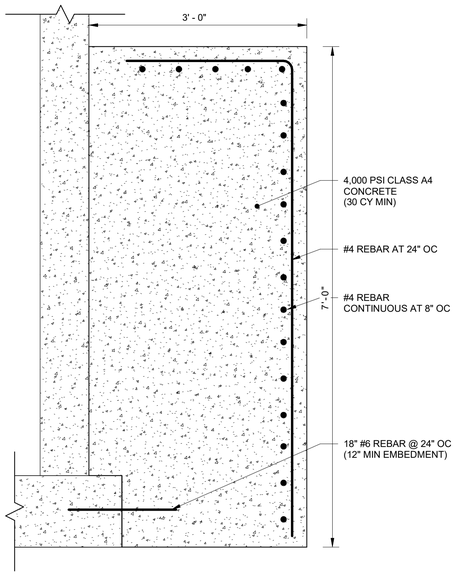
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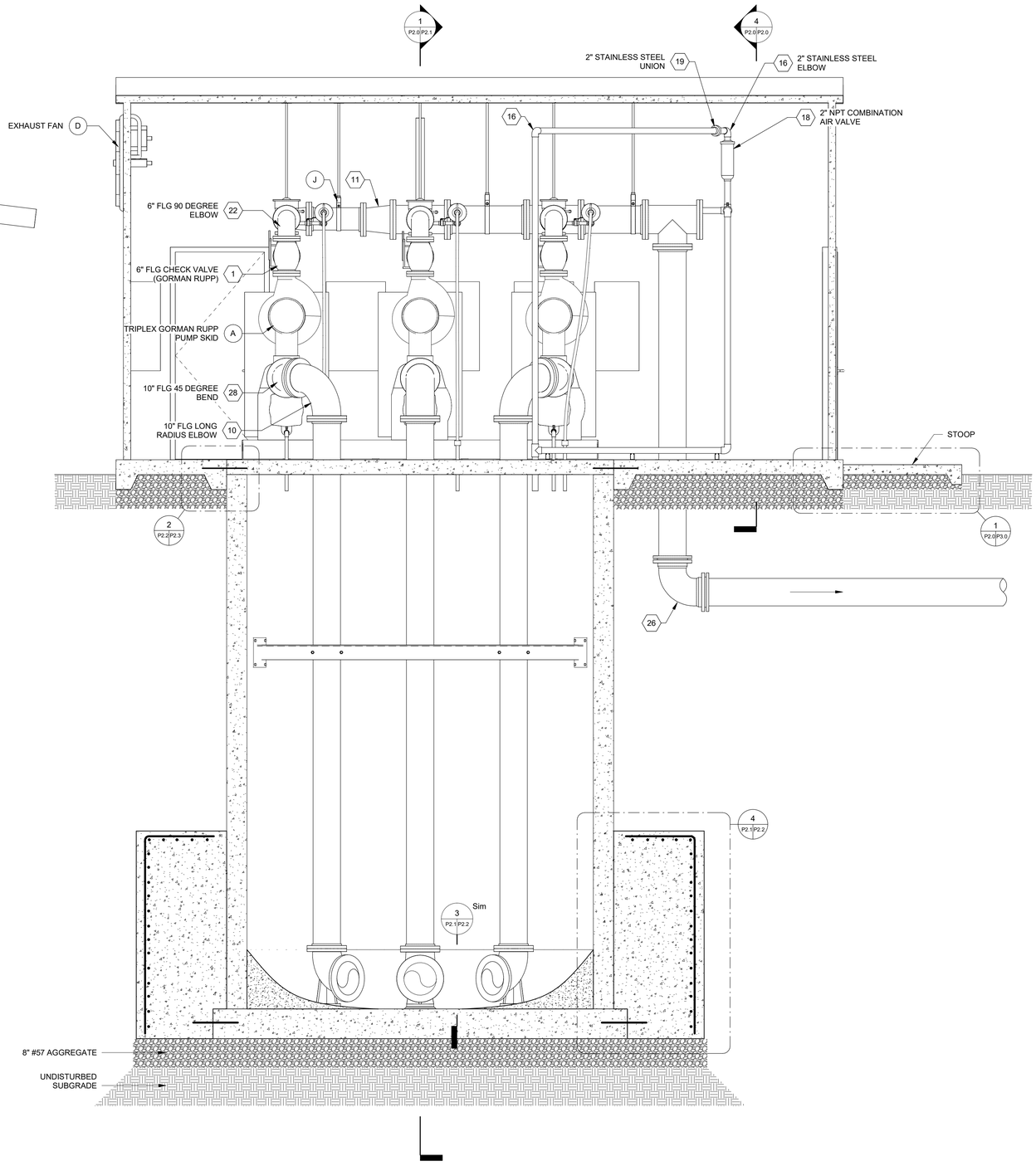
2 WET WELL FILLET PLAN
1/4" = 1'-0"



3 BASE ELBOW SUCTION
1" = 1'-0"



4 ANTI-FLOTATION COLLAR
1" = 1'-0"



1 PUMP STATION SECTION
1/2" = 1'-0"

FITTING AND EQUIPMENT SCHEDULE	
LABEL	DESCRIPTION
1	6" FLG CHECK VALVE (GORMAN RUPP)
9	12"x10" FLG REDUCING BASE ELBOW
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11	10"x8" FLG CONCENTRIC REDUCER
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J	CLEVIS HANGER

PLAN LEGEND

SYMBOL	DESCRIPTION
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1	SCHEDULED EQUIPMENT
1 M1.0|M1.1	BUILDING SECTION
2 M2.0|M2.1	DETAIL SECTION
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	ELEVATION MARKER
ELEV	LIQUID ELEVATION

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1/2" = 1'-0"

0 1' 2' 3'
1" = 1'-0"

0 5' 10' 15'
1/4" = 1'-0"

COMMONWEALTH OF VIRGINIA
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CHECKED BY
B. STRICKLAND
SCALE
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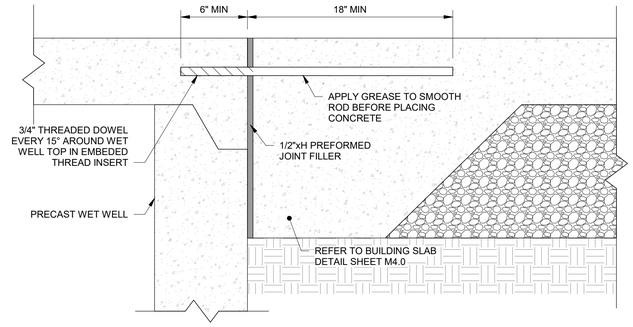
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STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER
CITY OF STAUNTON - VIRGINIA
PUMP STATION SECTIONS

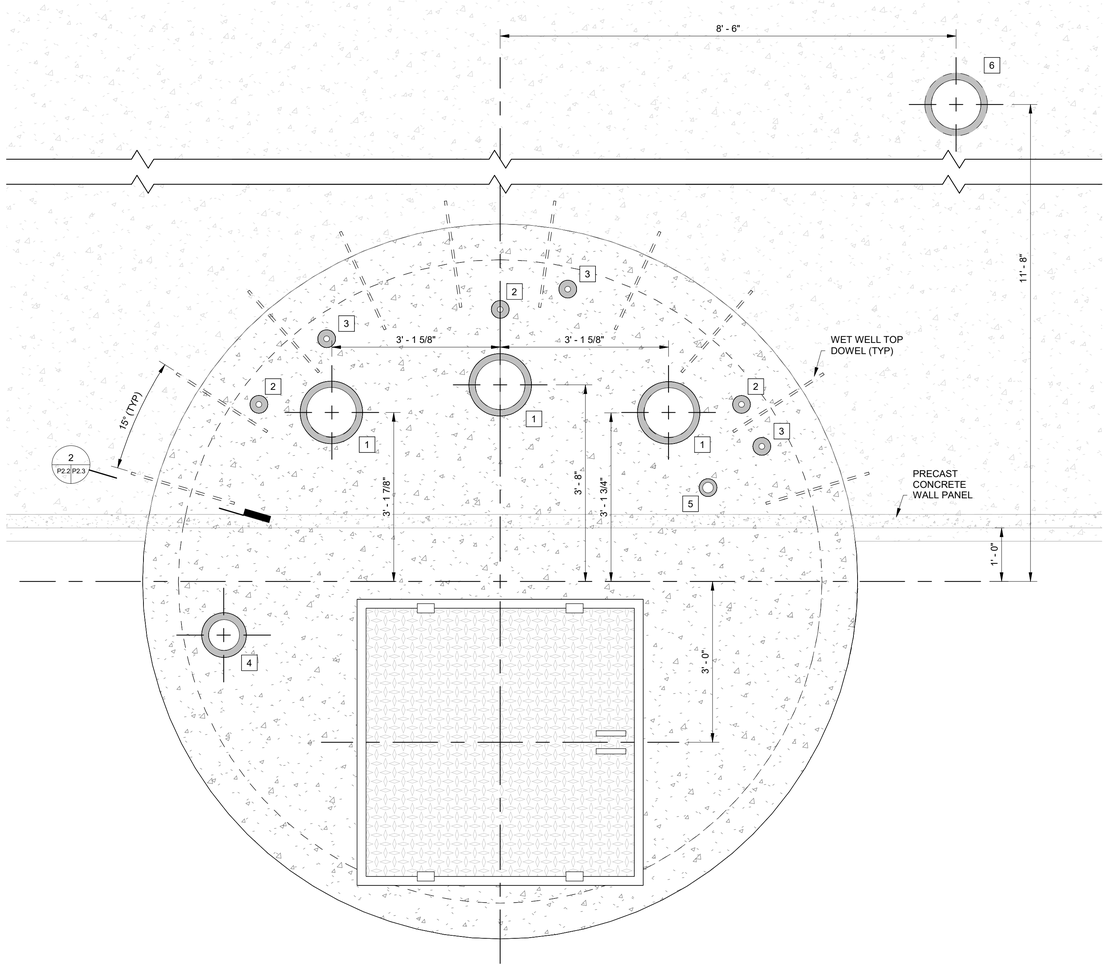
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2 WET WELL TOP DOWELS
NOT TO SCALE



PENETRATION SCHEDULE				
PENETRATION	PIPE MATERIAL	PIPE NOMINAL DIAMETER	PENETRATION DIAMETER	DESCRIPTION
1	DUCTILE IRON	10"	14"	PUMP SUCTION
2	STAINLESS STEEL	1"	4"	PUMP DRAIN
3	STAINLESS STEEL	1.25"	4"	GORMAN RUPP ARV DRAIN
4	DUCTILE IRON	6"	10"	WET WELL VENT
5	STAINLESS STEEL	2"	4"	ARV DRAIN
6	DUCTILE IRON	10"	14"	PUMP DISCHARGE

1 PIPE PENETRATION DETAIL
3/4" = 1'-0"

PLAN LEGEND

SYMBOL	DESCRIPTION
1	SCHEDULED FITTING
1	SCHEDULED EQUIPMENT
1 M1.0/M1.1	BUILDING SECTION
2 M2.0/M2.1	DETAIL SECTION
3 M3.0/M3.1	DETAIL REFERENCE
	ELEVATION MARKER
ELEV	LIQUID ELEVATION

0 1' 2' 3'
1" = 1'-0"

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STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER
CITY OF STAUNTON - VIRGINIA

WET WELL PENETRATION DETAIL

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Wastewater Pump Station Calculations

Project: Staunton Crossing
Project No: 49408

Prepared by: B. Strickland / Z. Mountjoy
Prepared on:
Date Revised: 11/15/2023

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Pump Station Capacity

Description	Value	Units	Notes
Average Daily Flowrate	700	gpm	*Assume 1 MGD*
Peak Factor Used	2.50		
Design Peak Influent Rate	1,750	gpm	
Design Pumping Rate	1,750	gpm	*Must be greater than Design Influent Rate*
			Update based on pump / system curves

Wet Well Sizing

Description	Value	Units	Notes
Wetwell Diameter	12.0	feet	
Minimum Pump Cycle Time	10	min	
Unit Volume	845.97	gal/ft	
Wet Well Drawdown Volume	4375.00	gal	Based on $V = \frac{TP}{4}$
Average Pump Run Time	4.43	min	*Based on control settings below*
Average Pump Cycle Time	11.08	min	*Time between pump starts*
Peak Pump Run Time	#DIV/0!	min	
Peak Pump Cycle Time	#DIV/0!	min	
Minimum Operating Depth	5.17	ft	

Control Settings

Description	Value	Units	Notes
100-year Flood Plain Elevation	0.00	ft AMSL	*N/A*
Top of Wet Well Elevation	1358.00	ft AMSL	*From drawings*
Lowest Invert In Elevation	1348.00	ft AMSL	
High Level Alarm Elevation	1347.50	ft AMSL	**0.50' Below Influent Line**
Lag Pump On Elevation	1347.00	ft AMSL	**0.50' Below High Level Alarm**
Lead Pump On Elevation	1346.50	ft AMSL	**0.50' Below Lag Pump On**
Both Pumps Off Elevation	1341.00	ft AMSL	**5.50' Below Lead Pump On**
Pump entrance diameter	12.46	inches	
Minimum Submergence	2.94	ft	H.I. Stds: S=(1+2.3*F*)D where $F = v/(gD)^{0.5}$
Suction Entrance Elevation	1338.00	ft AMSL	**3.00' Below Both Pump Off**
Wetwell Floor Elevation	1337.50	ft AMSL	**6" Below Suction Entrance**
Depth of Wet Well	20.50	ft	

Pump Station Head Loss - Discharge Side

Description	Value	Units	Notes
Pump Station Pipe Diameter 1	6.22	inch	*From drawings*
Pump Station Pipe Velocity	9.24	fps	
Pump Station Pipe "c" value	120		*(Hazen-Williams)*
Equivalent Length of Fittings	120.00	ft	*From Fitting Friction Loss Table Below*
Straight Pipe Quantity	5.00	ft	*From drawings*
Total Equivalent Length	125.00	ft	
Pump Station Head Loss 1	7.07	ft	
Pump Station Pipe Diameter 2	8.33	inch	*From drawings*

Wastewater Pump Station Calculations

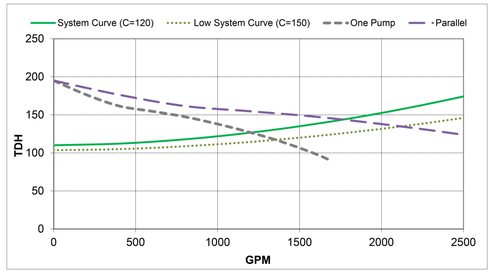
Project: Staunton Crossing
Project No: 49408

Prepared by: B. Strickland / Z. Mountjoy
Prepared on:
Date Revised: 11/15/2023

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Force Main Head Loss

Description	Value	Units	Notes
Force Main "c" Value	120		*(Hazen Williams)*
Force Main Nominal Diameter	12	in	
Force Main Material	DI - Class 52		
Force Main Inside Diameter	12.46	in	*From Pipe Properties Table*
Flowrate	1750	gpm	
Velocity	4.60	fps	
Force Main Length	2925	ft	*Measured From Drawings*
Equivalent Length of Fittings	405.3	ft	*From Fitting Friction Loss Table*
Total Equivalent Length	3330.3	ft	
Force Main Friction Loss	23.12	ft	
Force Main High Point Elev.	1451.00	ft AMSL	*Check FM / HGL plot for special design*
Manifold Condition?	No		*considerations*
~~Manifold Elevation~~	~~0.0~~	~~ft AMSL~~	
~~Peak Residual Pressure Head~~	~~0.0~~	~~ft~~	~~*At manifold connection*~~
~~Minimum Residual Pressure Head~~	~~0.0~~	~~ft~~	~~*At manifold connection*~~
Pump Station LWL	1341	ft AMSL	
System Static Head	110	ft	
Total Dynamic Head	143.2	ft	



Pump Station Buoyancy Calculations

Project: Staunton Crossing
Project No: 49408

Prepared by: B. Strickland / Z. Mountjoy
Prepared on:
Date Revised: 11/15/2023

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Wet Well Buoyancy

Description	Value	Units	Notes
Inner Diameter	12.0	ft	
Outer Diameter	13.3	ft	**8-inch wall thickness**
Depth	20.5	ft	
Concrete Volume	543.84	ft^3	
Wetwell Weight	78,857	lb	**Based on 145-lb/ft3 for concrete**
Displaced Volume	2,862	ft^3	
Buoyancy Force	-178,610	lb	**Based on 62.4-lb/ft3 for water**
Buoyant Weight of Wetwell	-99,753	lbs	**Structure is buoyant without base**

Base Buoyancy Credit

Description	Value	Units	Notes
Base Diameter	15.3	ft	**12 inches beyond WW outer diameter**
Base Thickness	12.0	in	*Base Thickness should be no greater than 12"*
Concrete / Displaced Volume	184.66	ft^3	
Base Weight	26,775	lb	*Based on 145-lb/ft3 for concrete*
Buoyancy Force	-11,523	lb	*Based on 62.4-lb/ft3 for water*
Buoyant Weight of Base	15,253	lb	
Buoyant Weight of Structure	-84,500	lb	**Structure is buoyant without AF collar**

(Optional) Anti-Flotation Collar Credit

Description	Value	Units	Notes
Collar Inner Diameter	13.3	ft	
Collar Thickness	3.00	ft	*If no collar used, set thickness to "0"*
Collar Height	7.0	ft	
Concrete / Displaced Volume	1,077.57	ft^3	
Base Weight	156,247	lb	*Based on 145-lb/ft3 for concrete*
Buoyancy Force	-67,240	lb	*Based on 62.4-lb/ft3 for water*
Buoyant Weight of Collar	89,007	lb	
Buoyant Weight of Structure	4,507	lb	Structure is not buoyant without soil

Note: The buoyancy calculations above reflect the worst case scenario during construction with the wet well empty, the excavation pit flooded and the absence of overbearing soil. Minimum concrete thicknesses were used for the wall and base sections to ensure a conservative approach. Actual wall and base thicknesses may increase per the manufacturer shop drawings which would reduce the size of the anti-flotation collar. Consideration would also be given to reducing the size of the anti-flotation collar if positive drainage away from the excavation could be maintained during construction.

Net Positive Suction Head Calculations

Project: Staunton Crossing
Project No: 49408

Prepared by: B. Strickland / Z. Mountjoy
Prepared on:
Date Revised: 11/15/2023

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Suction Lift

Description	Value	Units	Notes
LWL	1341.00	ft	From PS Calcs
Pump Suction C/L	1360.50	ft	From Plans
Static (LWL to Pump)	19.50	ft	
Suction Pipe Diameter	10.4	in	
"c" Factor	120		
Length of Suction Pipe	25.00	ft	**From Plans - Enter zero if Submersible**
Equivalent Length of Fittings	78.32	ft	From Fitting Friction Loss Table Below
Total Equivalent Length	103.32	ft	
Suction Line Friction	0.48	ft	Q/2 for parallel pumps
SUCTION LIFT	19.98	ft	

NPSH Verification

Description	Value	Units	Notes
Site Elevation	1358.00	ft AMSL	From Site Plan - Grade Adjacent to Wet well
NPSHa at Site Elevation	32.41	ft	Interpolated From Air Properties Table
Total Suction Lift	19.98	ft	
Vapor Pressure 74° Liquid	1.00	ft	By Gorman-Rupp
Safety Factor	2.00	ft	By Gorman-Rupp
NPSHa for Design	9.43	ft	
NPSHr for Design	8.69	ft	From Pump Curve
NPSH EXCESS	0.74	ft	Okay

Reprime Lift

Description	Value	Units	Notes
Reprime Lift Available	20.00	ft	From Manufacturer's Information
Reprime Lift Required	14.00	ft	Okay

Wastewater Pump Station Calculations

Project: Staunton Crossing
Project No: 49408

Prepared by: B. Strickland / Z. Mountjoy
Prepared on:
Date Revised: 11/15/2023

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Force Main Retention Time

Description	Value	Units	Notes
Daily Flowrate	1,008,000	gpd	
Force Main Volume	18,526.40	gals	
Force Main Retention Time	0.44	hours	
Pump Cycles Req'd to Flush FM	0.96	cycles	
Pump Cycles per Day	130	cycles	*Based on Average Daily Flow Rate*

Pump Station Buoyancy Calculations

Project: Staunton Crossing
Project No: 49408

Prepared by: B. Strickland / Z. Mountjoy
Prepared on:
Date Revised: 11/15/2023

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Soil Impact

Description	Value	Units	Notes
Angle of Influence	15.0	degrees	
Angle of Influence	0.262	radians	
Top of Triangle	5	ft	
Top Diameter	26	ft	
Bottom Diameter	15	ft	
Saturated Soil Density	110.0	lb/ft^3	*From Geotechnical Report or Estimate*
Depth of Soil above Base	20.5	ft	
Volume of Soil	4,283	ft^3	*Volume of Soil (frustrum of cone, less wetwell)*
Buoyant Weight of Soil	203,871	lb	

Buoyancy Float Check

Description	Value	Units	Notes
Total Difference After Backfill	208,378	lb	*Structure is not buoyant after backfill*

COMMONWEALTH OF VIRGINIA
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11/17/2023
PROFESSIONAL ENGINEER

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REVISION DESCRIPTION	DATE

DATE
3/31/23

DRAWN BY
J. MARSHALL

DESIGNED BY
B. STRICKLAND

CHECKED BY
B. STRICKLAND

SCALE
AS NOTED

TIMMONS GROUP

STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER
CITY OF STAUNTON - VIRGINIA

PUMP DATA

JOB NO.
49408.003

SHEET NO.
P2.4

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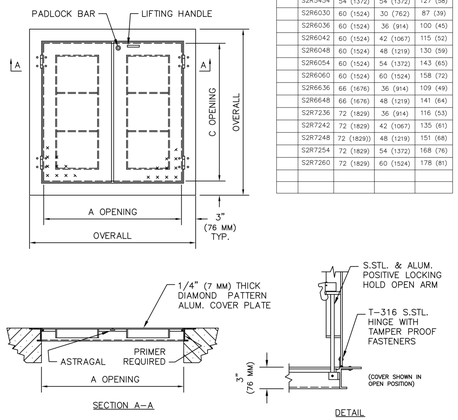
SERIES S2R ACCESS DOOR

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STANDARD FEATURES:

- AUTO-LOCK T-316 STAINLESS STEEL HOLD OPEN ARM WITH RELEASE HANDLE
- T-316 STAINLESS STEEL HINGES AND ATTACHING HARDWARE
- NON-CORROSIVE PADLOCK BAR
- DOUBLE LEAF CONSTRUCTION
- 300 LBS. PER SQ. FT. LOAD RATING (1464 KG. PER SQ. METER LOAD RATING)
- EXTRUDED ALUMINUM FRAME
- RECESSED LIFTING HANDLE
- LIFETIME GUARANTEE

STANDARD SIZES				
QTY.	MODEL NO.	A DIM. INCHES (MM)	C DIM. INCHES (MM)	UNIT WT. LBS. (KG.)
	S2R4242	42 (1067)	42 (1067)	93 (42)
	S2R4842	48 (1219)	42 (1067)	99 (45)
	S2R4848	48 (1219)	48 (1219)	110 (50)
	S2R5442	54 (1372)	42 (1067)	108 (49)
	S2R5448	54 (1372)	48 (1219)	119 (54)
	S2R5454	54 (1372)	54 (1372)	127 (58)
	S2R6030	60 (1524)	30 (762)	87 (39)
	S2R6036	60 (1524)	36 (914)	100 (45)
	S2R6042	60 (1524)	42 (1067)	115 (52)
	S2R6048	60 (1524)	48 (1219)	130 (59)
	S2R6054	60 (1524)	54 (1372)	143 (65)
	S2R6060	60 (1524)	60 (1524)	158 (72)
	S2R6636	66 (1676)	36 (914)	109 (49)
	S2R6648	66 (1676)	48 (1219)	141 (64)
	S2R7236	72 (1829)	36 (914)	116 (53)
	S2R7242	72 (1829)	42 (1067)	135 (61)
	S2R7248	72 (1829)	48 (1219)	151 (68)
	S2R7254	72 (1829)	54 (1372)	168 (76)
	S2R7260	72 (1829)	60 (1524)	178 (81)



10 ACCESS HATCH
NOT TO SCALE

SERIES J CABLE HOLDER

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STANDARD FEATURES:

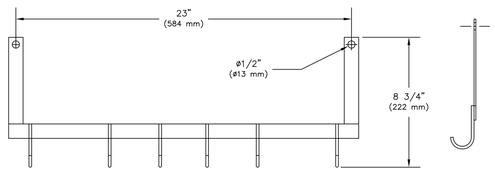
- STAINLESS STEEL CONSTRUCTION
- 6 HOOKS STANDARD - FOR FLOAT SWITCHES
- AVAILABLE STANDARD DUTY OR HEAVY DUTY

MODEL	CABLE HOLDER
J6A	STD., 1/8" (3 mm) BODY, ø3/16" (4 mm) HOOK (T-316 S.STL. ONLY)
J4J	H.D., 3/16" (4 mm) BODY, ø1/4" (7 mm) HOOKS (T-304 S.STL)
J6J	H.D., 3/16" (4 mm) BODY, ø1/4" (7 mm) HOOKS (T-316 S.STL)

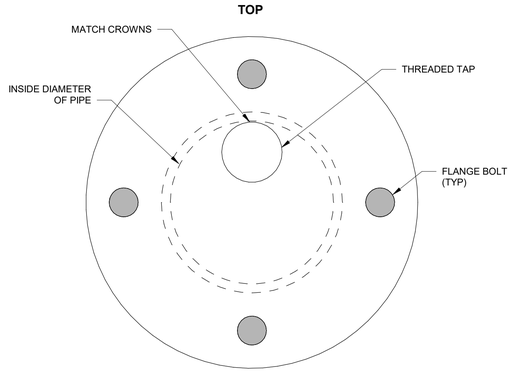
QUANITITY J6A

QUANITITY J4J

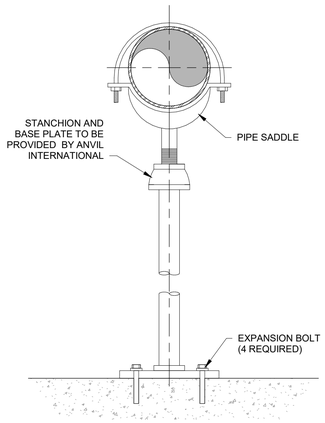
QUANITITY J6J



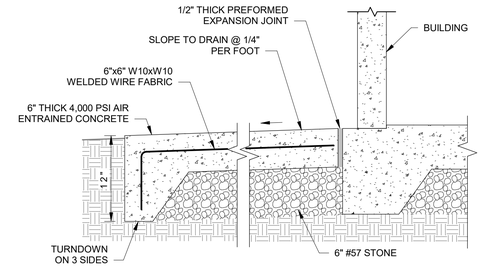
11 CABLE HOLDER
NOT TO SCALE



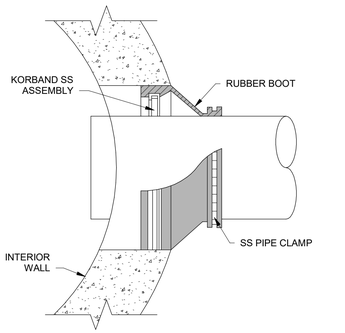
7 TAPPED BLIND FLANGE FOR COMBINATION AIR VALVE
NOT TO SCALE



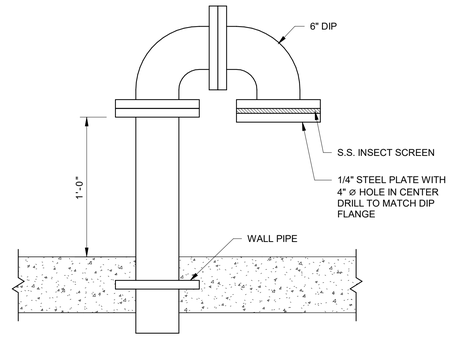
4 ADJUSTABLE PIPE SUPPORT
NOT TO SCALE



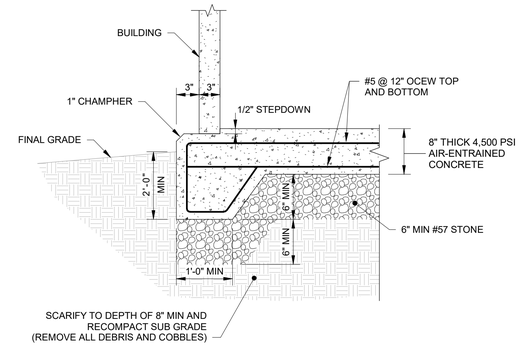
1 BUILDING STOOP
NOT TO SCALE



8 MANHOLE BOOT
NOT TO SCALE

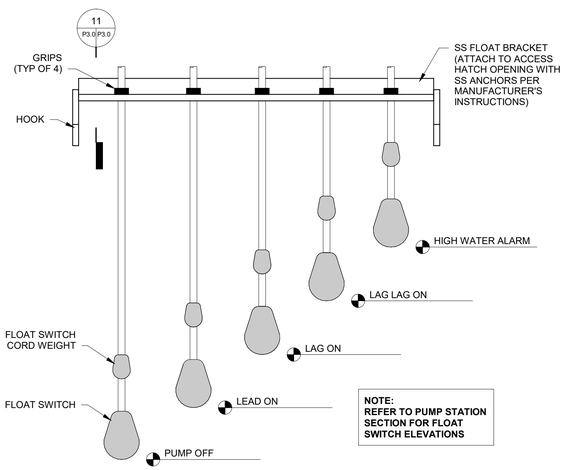


5 WET WELL VENT
NOT TO SCALE



NOTE:
SLOPE FINAL GRADE AWAY FROM STRUCTURES AS SHOWN ON GRADING PLANS.

2 BUILDING SLAB ON GRADE
NOT TO SCALE

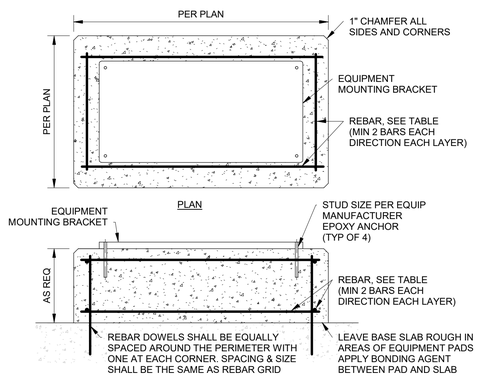


NOTE:
REFER TO PUMP STATION SECTION FOR FLOAT SWITCH ELEVATIONS

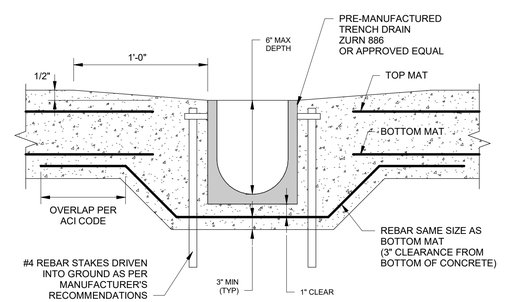
9 LEVEL FLOAT AND CABLE HOLDER
NOT TO SCALE

PAD THICKNESS	REBAR SIZE	MAX SPACING	TOP CLEARANCE	SIDE CLEARANCE
4"	3	13"	2"	2"
6"	4	16"	2"	2"
8"	4	12"	2"	2"
10"	5	15"	2"	2"
12"	5	12"	2"	2"

NOTES:
1. EMBEDMENT SHALL BE 3" OR 1/2 THE SLAB THICKNESS, WHICHEVER IS GREATER.
2. EDGE OF PAD SHALL EXTEND A MINIMUM OF 6" FROM THE EQUIPMENT BASE.



6 CONCRETE HOUSEKEEPING PAD
NOT TO SCALE



3 TRENCH DRAIN
NOT TO SCALE

COMMONWEALTH OF VIRGINIA
BRUCE W. STRICKLAND JR.
Lic. No. 056612
11/17/2023
PROFESSIONAL ENGINEER

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DESIGNED BY B. STRICKLAND
CHECKED BY B. STRICKLAND
SCALE AS NOTED

TIMMONS GROUP

STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER
CITY OF STAUNTON - VIRGINIA
PUMP STATION MECHANICAL DETAILS

JOB NO. 49408.003
SHEET NO. P3.0

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OPTIONAL PROTECTIVE GRATING PANEL

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STANDARD FEATURES:

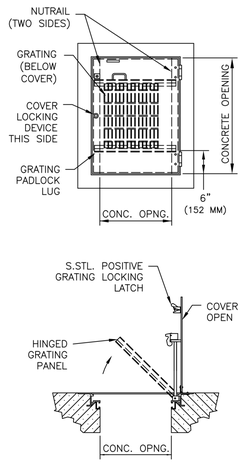
- ALUMINUM "I" BAR CONSTRUCTION
- ALL T-316 STAINLESS STEEL HARDWARE
- LOCKABLE WITH OWNER-SUPPLIED PADLOCK
- HINGED WITH POSITIVE LATCH TO MAINTAIN UPRIGHT POSITION
- LOAD RATED CONSISTENT WITH ACCESS COVER
- VIEW AREA FOR OBSERVATION AND LIMITED MAINTENANCE
- SAFETY ORANGE POWDER-COATED FINISH
- NUTRAIL W/S.STL. SPRING NUTS (300 LBS. PSF [1464 KG. PER METER] LOADED DOORS ONLY)
- LIFETIME GUARANTEE

APPLICATIONS:

THE OPTIONAL PROTECTIVE GRATING PANEL SHOULD BE SPECIFIED FOR APPLICATIONS IN AREAS THAT REQUIRE ADDITIONAL PROTECTION SHOULD THE ACCESS COVER BE LEFT IN THE OPEN POSITION. THIS OPTION SHOULD ALSO BE CONSIDERED WHEN A SINGLE PERSON INSPECTION OF WET WELLS IS DESIRABLE. THE GRATING PANEL HAS PROVISIONS FOR AN OWNER-SUPPLIED PADLOCK THAT WOULD PROVIDE SECONDARY PROTECTION AGAINST UNAUTHORIZED PERSONNEL OPENING THE ACCESS COVER. THIS OPTION IS NOT AVAILABLE FOR ALL ACCESS COVERS MODELS. PLEASE CONSULT THE FACTORY.

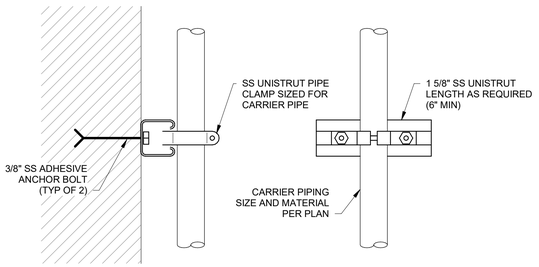
HALLIDAY PRODUCTS OPTIONAL PROTECTIVE GRATING PANEL IS EQUIPPED WITH ALL T-316 STAINLESS STEEL HARDWARE. THIS LOCKABLE GRATING PANEL CAN BE FACTORY INSTALLED ON MOST MODELS IN OUR EXTENSIVE LINE OF QUALITY ACCESS COVERS. EACH GRATING PANEL IS POWDER COAT FINISHED IN SAFETY ORANGE COLOR, AND IS EQUIPPED WITH A T-316 STAINLESS STEEL POSITIVE LATCH WITH RELEASE HANDLE THAT SECURES THE GRATING PANEL IN THE OPEN POSITION. THE GRATING SUPPORT LEDGES FEATURE BUILT-IN NUTRAIL. EACH UNIT IS SUPPLIED WITH FOUR STAINLESS STEEL SPRING NUTS USED TO MOUNT PUMP BRACKETS AND CABLE HOLDERS.

- CONSULT FACTORY FOR ALL PRICING
- FOR ADDITIONAL INFORMATION VISIT US AT: HallidayProducts.com

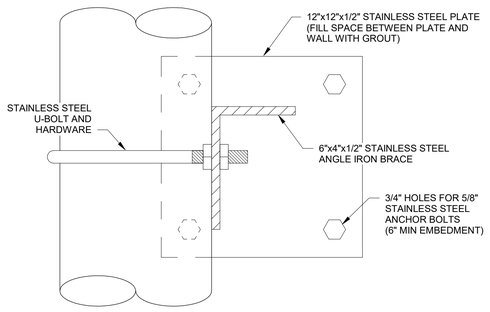


OPT-GRATE-N 07/29/05

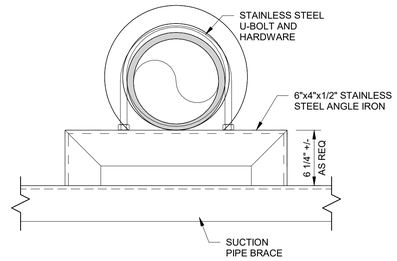
10 SAFETY GRATE
NOT TO SCALE



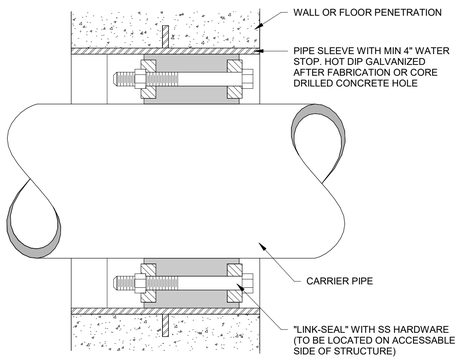
6 UNISTRUT PIPE SUPPORT
NOT TO SCALE



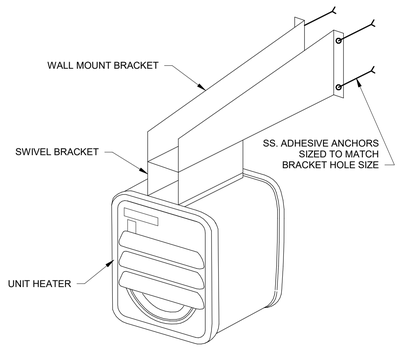
7 SUCTION PIPE BRACE
NOT TO SCALE



8 ANGLE IRON BRACE EXTENSION
NOT TO SCALE

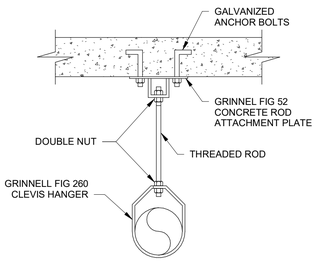


9 LINK SEAL
NOT TO SCALE



NOTES:
1. MINIMUM MOUNTING HEIGHT 7'-0" PREFERRED HEIGHT 8'-0"
2. WALL MOUNT BRACKET TO BE SIZED AND SUPPLIED BY MANUFACTURER AS PART OF HEATER

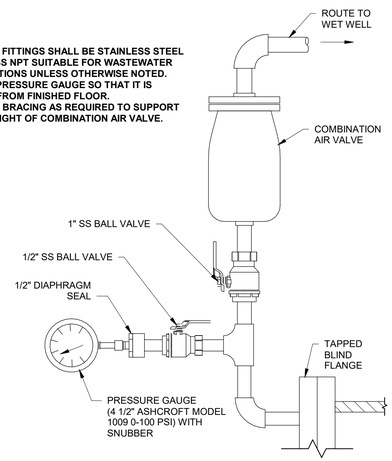
3 UNIT HEATER
NOT TO SCALE



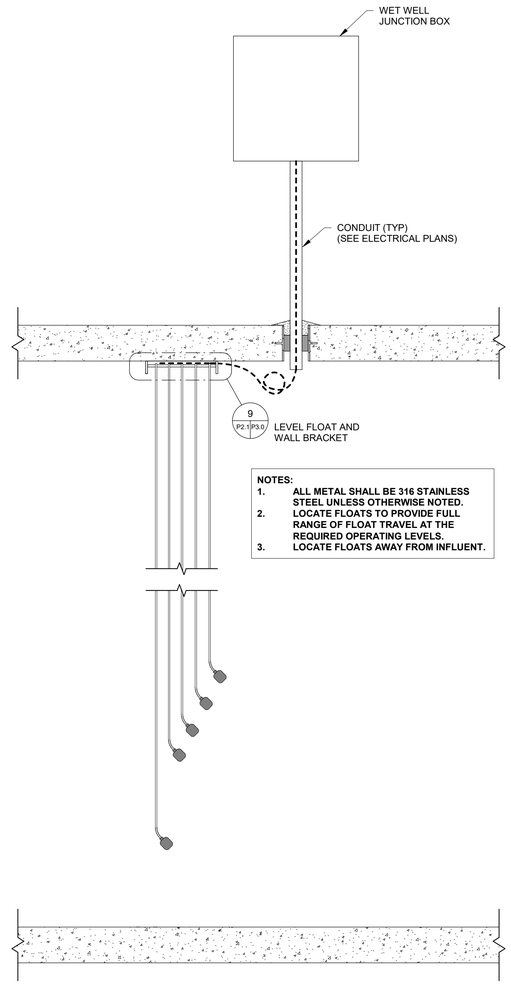
PIPE SIZE	ROD SIZE	ANCHOR BOLT SIZE
12"	7/8"	5/8"
10"	7/8"	5/8"
8"	3/4"	5/8"
6"	3/4"	5/8"
4"	5/8"	1/2"
3"	1/2"	1/2"

4 CLEVIS HANGER IN CONCRETE
NOT TO SCALE

NOTE:
1. **ALL PIPE FITTINGS SHALL BE STAINLESS STEEL OR BRASS NPT SUITABLE FOR WASTEWATER APPLICATIONS UNLESS OTHERWISE NOTED.**
2. **ORIENT PRESSURE GAUGE SO THAT IT IS VISIBLE FROM FINISHED FLOOR.**
3. **PROVIDE BRACING AS REQUIRED TO SUPPORT FULL WEIGHT OF COMBINATION AIR VALVE.**



5 COMBINATION AIR VALVE
NOT TO SCALE



NOTES:
1. **ALL METAL SHALL BE 316 STAINLESS STEEL UNLESS OTHERWISE NOTED.**
2. **LOCATE FLOATS TO PROVIDE FULL RANGE OF FLOAT TRAVEL AT THE REQUIRED OPERATING LEVELS.**
3. **LOCATE FLOATS AWAY FROM INFLUENT.**

1 SSWR_LEVEL FLOATS AND PRESSURE TRANSDUCER ASSEMBLY
NOT TO SCALE

COMMONWEALTH OF VIRGINIA
BRUCE W. STRICKLAND JR.
Lic. No. 056612
11/17/2023
PROFESSIONAL ENGINEER

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REVISION DESCRIPTION	DATE

DATE 3/31/23
DRAWN BY J. MARSHALL
DESIGNED BY B. STRICKLAND
CHECKED BY B. STRICKLAND
SCALE AS NOTED

TIMMONS GROUP

STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER
CITY OF STAUNTON - VIRGINIA

PUMP STATION MECHANICAL DETAILS

JOB NO. 49408.003
SHEET NO. P3.1

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Power Distribution Diagram

480Y/277Vac,3ø,4W,60Hz
U.G. POWER FROM UTILITY

4"C Schedule–40 PVC with Mule Rope extended from the CT Cabinet to the Utility Power Pole @2FT below grade (2 Sets) Reference Civil Site plan for locations and distances.

REFERENCE NOTE 1.2. REFERENCE THE CIVIL SITE PLAN FOR LOCATIONS AND DISTANCES AND COORDINATE WITH THE UTILITY AS REQUIRED.

UTILITY CT & METERBASE

4"C W/4–350MCM (2 Sets)

MBDS 600Amp(LSI)/3P/4W/60Hz

480Y/277Vac,3ø,4W,60Hz,65kAIC SERVICE ENTRANCE RATED MAIN CIRCUIT BREAKER WITH PAD LOCKABLE PROVISIONS IN THE OFF POSITION

SPD Note–3.1 Alarm

¾"C W/4–#14 & 1–#14 GND → To Panel CSP

1/0 CU

TO PANELBOARD PB

250KW Diesel Generator
CAT Model D250GC
480Y/277Vac,3ø,4W,60Hz
Service Rated Main Circuit Breaker

400Amp(LSI) GMB

Generator Running
Generator Fault
Generator Common Alarm

Block Heater

Battery Charger

4"C W/4–350MCM & 1–1/0 GND (2 Sets)

¾"C Spare

ATS
AUTOMATIC TRANSFER SWITCH
Outdoor Rated NEMA–3R Enclosure
480/277Vac,3ø,4W,60Hz/600AMP/3–Pole
Solid Neutral, Open Transfer in both Directions with Adjustable Delay Timers

MBD NORMAL · OFF · GMB EMERGENCY

Generator/ATS Status Signals
- Utility Position
- Utility Power ON
- Emergency Position
- Emergency Power ON
- Generator Start Signal
- Generator Running
- Generator Fault
- Generator Common Alarm

4"C W/4–500MCM & 1–#1 GND

¾"C W/12–#14 & 1–#12 GND

¾"C W/2–#12 & 1–#12 GND → TO PB1

¾"C W/2–#12 & 1–#12 GND → TO PB1

¾"C W/6–#14 & 1–#12 GND

4"C W/4–350MCM & 1–1/0 GND (2 Sets)

¾"C W/12–#18 & 1–#14 GND → To Panel CSP

Pump Station Control Panel PSCP

Panelboard MDP
480Y/277Vac/3ø
60Hz
65kAIC

VFD–1 Shown: Typical for Pump–1, Pump–2 and Pump–3 (Reference the typical VFD Control Panel Schematic)

2"C W/3–1/0 & 1–#2 GND

¾"C W/2–#14 ATS in Generator Position

Panel VFD–1

Line Reactor

75HP VFD

¾"C W/CAT–6 Enet Cable

¾"C W/2–2c/18awg STP Cables

¾"C W/18–#14 & 1–#14 GND

¾"C W/4–#14 & 1–#14 GND → 2"C W/VFD Power Cable → 200A/3P Disc w/2 Aux Contacts

¾"C W/4–#14 & 1–#14 GND → 2"C W/VFD Power Cable → Pump Skid Junction Box

¾"C W/4–#14 & 1–#14 GND → 2"C W/VFD Power Cable → Tstats → 75HP Pump–x

¾"C W/6–#14 & 1–#14 GND → To VFD–2

¾"C W/6–#14 & 1–#14 GND → To VFD–3

Two Pump Operation – Interlock Circuits while on Generator Power

¾"C W/14–#14 & 1–#14 GND → To Panel CSP

Typical for Unit Heater–1 and Unit Heater–2

¾"C W/3–#12 & 1–#12 GND → Disc 30A/3P → ¾"C W/3–#12 & 1–#12 GND → Unit Heater–x 3.3kW/480Vac/3ø with Integral Tstat

1"C W/3–#6 & 1–#8 GND → 30kVA/3ø 480Vac–208Y/120Vac Dry Type Distribution Transformer

Panelboard PB
208Y/120Vac/3ø
60Hz
22kAIC

2"C W/4–#1 & 1–#6 GND

¾"C W/2–#12 & 1–#12 GND

¾"C W/2–#12 & 1–#12 GND → Disc 30A/2P → ¾"C W/2–#12 & 1–#12 GND → ¾"C W/2–#12 & 1–#12 GND → Split System Heat Pump Indoor Unit AHU–1 → ¾"C W/Manuf. Tstat Cable → T3

¾"C W/2–#12 & 1–#12 GND → Disc 30A/2P → ¾"C W/2–#12 & 1–#12 GND → Split System Heat Pump Outdoor Unit CU–1 → ¾"C W/Manuf. Control Cable

¾"C W/2–#12 & 1–#12 GND → Exhaust Fan Control Panel FCP

- ¾"C W/1–#12, 1–#12N & 1–#12 GND → (EF) Exhaust Fan
- ¾"C W/1–#12, 1–#12N & 1–#12 GND → (LM) Louver Motor
- ¾"C W/2–#14 & 1–#14 GND → Louver Open Limit Switch
- ¾"C W/2–#14 & 1–#14 GND → (T4) Exhaust Fan Tstat (Closes on High Temp)
- ¾"C W/4–#14 & 1–#14 GND

¾"C W/2–#12 & 1–#12 GND

¾"C W/2–#12 & 1–#12 GND → Lighting Control Panel LCP

- ¾"C W/1–#12, 1–#12N & 1–#12 GND → (B) Light Fixture–B Typical–3
- ¾"C W/2–#12, 1–#12N & 1–#12 GND → (PC) Photocell

½"C W/2–#12 & 1–#12 GND — Multiple Conduits/Wire as required for building receptacles. All receptacles shall be Weatherproof GFI Duplex type with in–use cover

½"C W/2–#12 & 1–#12 GND — Multiple Conduits/Wire as required for building interior lights.

½"C W/2–#12 & 1–#12 GND — Multiple Conduits/Wire as required for building exterior lights.

½"C W/2–#12 & 1–#12 GND → OUTDOOR RATED 120VAC NEMA–4X RED GLOBE ALARM BEACON AND ALARM HORN

¾"C W/2–#12 & 1–#12 GND

SBR for for each Float.

¾"C W/12–#14 & 1–#14 GND

¾"C W/10–#14 & 1–#14 GND

City SCADA Panel CSP

¾"C W/2–#14 & 1–#14 GND
- → (T1) Electrical Room High Temperature Thermostat (Contact Opens on High Temp)
- → (T2) Electrical Room Low Temperature Thermostat (Contact Opens on Low Temp)
- → (T5) Pump Room High Temperature Thermostat (Contact Opens on High Temp)
- → (T6) Pump Room Low Temperature Thermostat (Contact Opens on Low Temp)
- → (DS1) Electrical Room Building Door Switch (Contact Opens when Door Opens)
- → (DS2) Pump Room Building Door Switch (Contact Opens when Door Opens)

PVC Coated RGS Conduit Extension & Sleeve through the top slab of the wet well under WWJB. Size sleeve as required for associated cables (typ.)

Conduit End Bells (typ.)

Stainless Steel Hook Assembly with a Kellums Mesh Style Cable Grip support for each Sensor Cable.

NEMA–4X CORD GRIP (typ.)

WWJB Nema–4X Float Cable Junction Box

Cable Cage Detail–E

Float Cable
- High Water Level Alarm Float (HWL)
- Lag–Lag Pump Start Float
- Lag Pump Start Float
- Lead Pump Start Float
- Pumps Stop Float

Sensor Cable

Hazardous Location: Class–1 Division–1 Group–D

Reference WWJB, Wet Well and Cable Cage Installation Detail on E–3

Typical VFD Control Panel Schematic

480Vac/3ø Power from MDP

480Vac/3ø Main Breaker

480Vac/3ø Splitter Block

Nema–3R 3ø Line Reactor

480Vac/3ø

L1 · L2 · L3

T1 · T2 · T3 · Gnd

Coordinate VFD operating AMP rating with pump Full Load Amps

VFD Cable → Pump L1 · L2 · L3 · Gnd

Tstat–1 → To VFD External Fault

Tstat–2 → To VFD External Fault

480Vac/3ø Breaker

480Vac/3ø 24Vdc/20Amp Power Supply

24Vdc– · 24Vdc+

24Vdc 5 Amp Breaker

Pump Stop Note–A

VIR · OTR

H O A

XOO → Panel PSCP Common

OOX → PSCP Input HOA in Hand

PSCP Input HOA in Auto

Panel CSP Common

XOO → CSP Input HOA in Hand

OOX → CSP Input HOA in Auto

PSCP Start/Stop

VFD Start

Speed Reference + / – → 4–20mA → Speed Ref. from PSCP

Speed Status + / – → 4–20mA → Speed Status to PSCP

Enet Cable to PSCP

VFD Fault

R–Flt A2 A1 Faulted (A)

Relays Note–B (Typ)

R–Run A2 A1 Running (R)

VFD Running Contact opens when VFD is stopped and output Hz=0

OTR Pump Over–Temp Alarm Relay A2 A1

Motor Tstat–1 · Motor Tstat–2

External Fault

ATS in Generator Position · VFD2 R–Run · VFD3 R–Run · VIR A2 A1

24Vdc 5 Amp Breaker

Enclosure Fan

VFD Interlock Relay (VIR): For operation while on Generator Power, provide and install conduit/wire as required to to extend a run contact from each of the other two VFDs to prevent this VFD from running if the other two are running.

Notes:
A. Provide and install a remote Pump Stop Button located near the pump. The button shall be a maintained button and housed in a Pad–Lockable Nema–4X enclosure.
B. Provide each of the following relays as 4PDT with individual Form–C Dry Contacts for the following:
Relay R–Flt: Panel PSCP, Panel CSP, Spare, Spare
Relay R–Run: Panel PSCP, Panel CSP, VFD–2, VFD–3
Relay OTR: Panel PSCP, Panel CSP, Start Interlock, Spare
Relay VIR: Panel PSCP, Panel CSP, Start Interlock, Spare

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COMMONWEALTH OF VIRGINIA
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YOUR VISION ACHIEVED THROUGH OURS.

REVISION DESCRIPTION

DATE

DATE 11-17-2023

DRAWN BY D. GLASSCOCK

DESIGNED BY D. GLASSCOCK

CHECKED BY D. GLASSCOCK

SCALE AS SHOWN

TIMMONS GROUP

STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER

CITY OF STAUNTON, VIRGINIA

ELECTRICAL POWER DISTRIBUTION AND NOTES

JOB NO. 49408

SHEET NO. E1.0

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C:\DCS Business Files\DCS Backup\Jobfiles\5485 - TIMMONS Staunton WWPS and Tank\Dwg\E1.0 Staunton WWPS Power Distribution 11-17-2023.dwg | Plotted by Douglas Glasscock

ELECTRICAL NOTES:

1. THE CONTRACTOR SHALL PERFORM THE FOLLOWING FOR POWER SERVICE:
   - 1.1. COORDINATE WITH THE LOCAL POWER COMPANY AS REQUIRED FOR THE EXTENSION OF POWER TO THE SITE. INSTALL ALL UTILITY SUPPLIED EQUIPMENT PER THE UTILITY INSTALLATION REQUIREMENTS AND STANDARDS.
   - 1.2. PROVIDE AND INSTALL UNDERGROUND CONDUIT WITH CONDUCTORS FROM THE UTILITY POWER POLE AND/OR TRANSFORMER LOCATION TO THE UTILITY CT CABINET AT THE BUILDING. PROVIDE ONE SPARE CONDUIT AND COORDINATE WITH THE UTILITY FOR THE CONDUIT TYPE/SIZE AND CABLE TYPE/SIZE FOR THE SERVICE EXTENSION. CONDUCTOR SIZE SHOWN IS BASED ON COPPER. COORDINATE INSTALLATION WITH THE UTILITY TO ENSURE COMPLIANCE WITH ALL UTILITY REQUIREMENTS AND STANDARDS.
   - 1.3. COORDINATE WITH THE UTILITY TO ENSURE THAT PANEL MBDS AND PANELBOARD MDP IS FULLY RATED WITH AN AIC RATING WHICH EXCEEDS THAT WHICH IS DELIVERABLE TO THE SITE.
   - 1.4. THE CONTRACTOR SHALL OBTAIN THE SERVICES OF AN ELECTRICAL PROFESSIONAL ENGINEER LICENSED IN THE STATE OF VIRGINIA FOR THE FOLLOWING: GENERATE AND PROVIDE A LOAD LETTER TO THE POWER COMPANY AND OBTAIN A FAULT CURRENT LETTER AND TRANSFORMER IMPEDANCES FOR THE PUMP STATION UTILITY SERVICE. PERFORM A COORDINATION STUDY TO ENSURE PROPER COORDINATION (TO 0.01 SECONDS) OF ALL SHORT CIRCUIT PROTECTION DEVICES AND PROPER AIC/DUTY RATINGS OF ALL DEVICES AND PANELS TO BE INSTALLED FOR THIS PROJECT. PROVIDE AN ARC FLASH STUDY AND INSTALL ARC FLASH LABELS. PROVIDE A SIGNED AND SEALED DETAILED REPORT FOR EACH STUDY.
2. PROVIDE AND INSTALL BONDING BUSHINGS ON ALL SERVICE CONNECTIONS AND GROUNDING LOCKNUTS ON ALL PANEL CONNECTORS.
3. LIGHTNING/SURGE ARRESTOR:
   - 3.1. FOR PANEL MBDS: PROVIDE AND INSTALL THOR SYSTEMS SURGE PROTECTION DEVICE, UL LISTED TSri (OR EQUAL) UL1449 4th EDITION, UL1283–5TH EDITION, PARALLEL, 480/277Vac, 100kAIC, NEMA–4X FIBERGLASS ENCLOSURE, INTEGRAL FUSED DISCONNECT SWITCH, 200kA PER MODE, FIELD REPLACEABLE SURGE TILES, HYBRID 3–TIER, SURGE COUNTER, MULTIFUNCTION ALARM RELAY CONTACT, #6AWG ROPE–LAY CONNECTION CABLE (OR EQUAL).
   - 3.2. PANELBOARD MDP AND PANELBOARD PB: PROVIDE AND INSTALL UL 1449 LIGHTNING/SURGE ARRESTOR AS AN INTEGRAL COMPONENT TO EACH PANELBOARD. COORDINATE INSTALLATION REQUIREMENTS AND CIRCUIT BREAKER SELECTION WITH THE PANELBOARD MANUFACTURER.
4. ALL WIRE INSTALLED UNDER THIS CONTRACT SHALL BE STRANDED COPPER (THHN/THWN) UNLESS OTHER SPECIFIC CABLE TYPES ARE REQUIRED BY EQUIPMENT MANUFACTURERS.
5. ALL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH LOCAL CODES AND REGULATIONS.
6. ALL EQUIPMENT SHALL BE PROVIDED WITH LAMICOID NAMEPLATES (3/16" LETTERING MIN.).
7. ALL PANELBOARD SCHEDULES SHALL BE TYPED AND REFLECT AS–BUILT CONDITIONS.
8. COORDINATE THE TYPE OF ALL ALARM SIGNALS TO ENSURE COMPATIBILITY WITH THE CITY SCADA PANEL (CSP). INSTALL THE CITY SCADA PANEL AND EXTEND ALL CONDUIT/WIRE AS SHOWN ON THE POWER DISTRIBUTION DIAGRAM. TERMINATE ALL WIRING AS DIRECTED BY THE CSP PROVIDER. COORDINATE WITH THE CSP PROVIDER TO ENSURE THAT ALL SIGNALS ARE CONNECTED AND FUNCTIONAL. REFERENCE THE SCADA SPECIFICATION FOR THE ASSOCIATED INPUT/OUTPUT LIST.
9. ALL ENCLOSURES SHALL BE AS FOLLOWS UNLESS SPECIFICALLY NOTED OTHERWISE:
   - 9.1. UL LISTED FOR THE INTENDED PURPOSE. THIS INCLUDES UL508A FOR "ENCLOSED INDUSTRIAL CONTROL PANELS".
   - 9.2. ENCLOSURES MOUNTED INSIDE THE ELECTRICAL ROOM: NEMA–12.
   - 9.3. ENCLOSURES MOUNTED OUTSIDE AND IN THE PUMP ROOM: NEMA–4X.
   - 9.4. ALL ENCLOSURES SHALL BE PROVIDED WITH AMBIENT COMPENSATION AS REQUIRED BY THE INSTALLED EQUIPMENT. (ie. AIR CONDITIONER, HEATER, COOLING FANS, ETC.)
10. NEMA–4X 316 STAINLESS STEEL JUNCTION BOX (WWJB):
    - 10.1. MINIMUM 24" CLEARANCE BETWEEN THE BOTTOM OF THE ENCLOSURE AND THE WET WELL TOP SURFACE. MINIMUM 60" HORIZONTAL CLEARANCE FROM THE VENT PIPE OPENING.
    - 10.2. PROVIDE AND INSTALL A STAINLESS STEEL UNISTRUT MOUNTING FRAME ANCHORED TO THE WALL OF THE PUMP STATION BUILDING WHERE SHOWN AND SIZED AS REQUIRED TO PROPERLY SUPPORT THE ENCLOSURE.
    - 10.3. WHERE REQUIRED BY THE PUMP SKID MANUFACTURER, COORDINATE CABLE ENTRY INTO THE WET WELL TO MAINTAIN THE HAZARDOUS LOCATION SEAL–OFF AND SEPARATION.
    - 10.4. ALL CABLES IN THE WET WELL SHALL BE SUPPORTED ON A STAINLESS STEEL HOOK ASSEMBLY WITH MESH STYLE CABLE STRAIN RELIEF HOLDERS ALLOWING FULL ACCESS FROM THE WET WELL HATCH.
    - 10.5. ALL WIRING IN WWJB SHALL TERMINATE ON DIN RAIL MOUNTED FINGER–SAFE TERMINALS WITH PROPER RATINGS AND MARKED WITH THE TERMINAL MANUFACTURER'S TAGGING SYSTEM. PROVIDE PVC WIREWAY, OR EQUAL, FOR THE ROUTING OF ALL WIRE AND CABLE INSIDE WWJB. TERMINALS AND WIRING SHALL BE SEPARATED BY TYPE. (ie. POWER, CONTROL, SIGNAL). SPLIT BOLTS, WIRENUTS, BUTT–SPLICES AND THE LIKE ARE NOT ACCEPTABLE.
    - 10.6. THE WWJB ENCLOSURE SIZE SHALL BE MINIMUM (20"X20"X8" HxWxD MIN.). CONTRACTOR SHALL INCREASE THE SIZE OF THE JUNCTION BOX ENCLOSURE AS REQUIRED PER NEC AND TO ALLOW FOR ALL CONDUIT AND CABLE PENETRATIONS.
11. REFERENCE THE CIVIL SITE PLAN FOR ALL EQUIPMENT LOCATIONS AND DISTANCES.
12. GROUNDING RING:
    - 12.1. EXTEND 4/0 COPPER FROM THE BUILDING SERVICE/FEEDER MAIN BREAKER, DISCONNECT, OR PANELBOARD TO ASSOCIATED GROUND RING. PROVIDE AND INSTALL A 4/0 GROUND RING W/A GROUND ROD AT EACH CORNER OF THE BUILDING.
    - 12.2. GROUND RING CONDUCTOR SHALL BE MINIMUM 30" BELOW GRADE.
    - 12.3. REFERENCE GROUNDING SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
    - 12.4. EACH GROUND ROD SHALL BE 3/4"DIA X 10FT COPPER CLAD WITH THE TOP LOCATED 24" BELOW GRADE (MIN).
    - 12.5. ALL CONNECTIONS TO GROUND RODS SHALL BE BARE COPPER CAD WELDED.
    - 12.6. PROVIDE A CONCRETE ENCASED ELECTRODE IN A FOOTING OF THE BUILDINGS POURED CONCRETE FOUNDATION PER NEC 250.52(A)(3) AND CONNECT TO GROUNDING SYSTEM AS REQUIRED.
    - 12.7. PROVIDE A GROUND ROD ACCESS CHAMBER AT ONE CORNER OF THE BUILDING.

ABBREVIATIONS:

(A Number Designates the Unit where applicable)

AH – ALARM HORN
AL – ALARM LIGHT
CSP – CITY SCADA PANEL
Disc – DISCONNECT SWITCH
DS – DOOR SWITCH
EF – EXHAUST FAN
FCP – EXHAUST FAN CONTROL PANEL
ISBR – INTRINSICALLY SAFE BARRIER RELAY
J – JUNCTION BOX
JB – PUMP SKID TERMINATION JUNCTION BOX
LS – LIGHT SWITCH
MB – UTILITY METERBASE
MCB – MAIN CIRCUIT BREAKER
MDP – MAIN DISTRIBUTION PANELBOARD
MTS – MANUAL TRANSFER SWITCH
PB – 240/120 DISTRIBUTION PANELBOARD
OCP – ODOR SYSTEM CONTROL PANEL
PCP – PUMP CONTROL PANEL
R – RECEPTACLE
RGS – RIGID GALVANIZED STEEL
T – THERMOSTAT
TX – TRANSFORMER
UG – UNDER GROUND
UH – UNIT HEATER

PANELBOARD: MDP, SERVICE RATED, 65kAIC
MOUNTING: SURFACE
ENCLOSURE: NEMA–12 (30–Ckt min.)
BOLT–ON BREAKERS
MAIN BUSS: 600AMP, COPPER
VOLTAGE: 480Y/277VAC,3ø,4W,60Hz
INTERIOR: 600AMP/LSI/65kAIC MCB

LOAD DESCRIPTION	CB SIZE	# POLE	CKT NO	AMPS/PHASE øA	AMPS/PHASE øB	AMPS/PHASE øC	CKT NO	# POLE	CB SIZE	LOAD DESCRIPTION
PUMP–1 VFD CONTROL PANEL SUPPLY WITH BREAKER LOCKOUT DEVICE	150	3	1	96			2	3	150	PUMP–2 VFD CONTROL PANEL SUPPLY WITH BREAKER LOCKOUT DEVICE
			3		96		4			
			5			96	6			
PUMP–3 VFD CONTROL PANEL SUPPLY WITH BREAKER LOCKOUT DEVICE	150	3	7	96			8	3	60	TRANSFORMER, 30KVA 480–208/120VAC,3ø SUPPLY WITH BREAKER LOCKOUT DEVICE
			9		96		10			
			11			96	12			
UNIT HEATER–1 3.3kW/3ø	20	3	13	4			14	2	20	UNIT HEATER–2 3.3kW/3ø
			15		4		16			
			17			4	18			
LIGHTNING/SURGE ARRESTOR Reference Note–3	–	3	19	--			20	--	--	PREPARED SPACE
			21		--		22			
			23			--	24			
				332	332	332	TOTAL AMPS			

PANELBOARD: PB, SERVICE RATED, 22kAIC
MOUNTING: SURFACE
ENCLOSURE: NEMA–12 (30–Ckt min.)
MAIN BUSS: 200AMP, COPPER
VOLTAGE: 208/120VAC,3ø,4W,60Hz
INTERIOR: 110AMP MAIN CIRCUIT BREAKER

LOAD DESCRIPTION	CB SIZE	# POLE	CKT NO	AMPS/PH øA	AMPS/PH øB	AMPS/PH øC	CKT NO	# POLE	CB SIZE	LOAD DESCRIPTION
INSIDE LIGHTS ELECTRICAL ROOM	20	1	1	5			2	1	20 GFI	RECEPTACLES
			5							
INSIDE LIGHTS PUMP ROOM	20	1	3		8		4	1	20 GFI	RECEPTACLES
			5			8				
GENERATOR GFI RECEPTACLE BATTERY CHARGER	20	1	5			12	6	1	20	GENERATOR GFI RECEPTACLE BLOCK HEATER
COUNTY SCADA PANEL (CSP)	20	1	7	10			8	1	20	BUILDING WALL PACK LIGHTS
PUMP STATION CONTROL PANEL (PSCP)	20	1	9		12		10	1	15	MINI–SPLIT INDOOR UNIT
			11			12				
SPARE BREAKER	20	--				--	12	1	20	SPARE BREAKER
LIGHTNING/SURGE ARRESTOR Reference Note–3	**	3	13	--			14	--	--	PREPARED SPACE
			15		--		16	--	--	PREPARED SPACE
			17			--	18	--	--	PREPARED SPACE
				28	37	32	TOTAL AMPS PER PHASE			

LIGHTING FIXTURE SCHEDULE

FIXTURES SHALL BE AS NOTED OR APPROVED EQUAL

TYPE	MANUF.	CAT. NUMBER	FIXTURE STYLE MOUNTING	FIXTURE STYLE TYPE	FIXTURE STYLE VOLTS
A	Lithonia	CSVT–L48–4000LM–MVOLT–40K–80CRI–STSL–MHCH36SS Wet Location Fittings	Surface/ Pendant	LED	120VAC
AE	Lithonia	CSVT–L48–4000LM–MVOLT–40K–80CRI–STSL–MHCH36SS Wet Location Fittings and Emergency Battery Pack	Surface/ Pendant	LED	120VAC
B	NLS	NV–W–T2–32L–7–40K7–UNV–WM–PC–20KA–EMCP–BRZ Weatherproof, Emergency Battery Pack, Full Cutoff Wallpack	Surface	LED	120VAC
EX	Philips Chloride	ER55LD–3–R–Die Cast Aluminum/Emergency Battery, Universal Mounting Kit	Surface	LED	120VAC

ELECTRICAL LEGEND

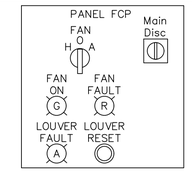
ALL SYMBOLS MAY NOT BE USED ON THIS CONTRACT

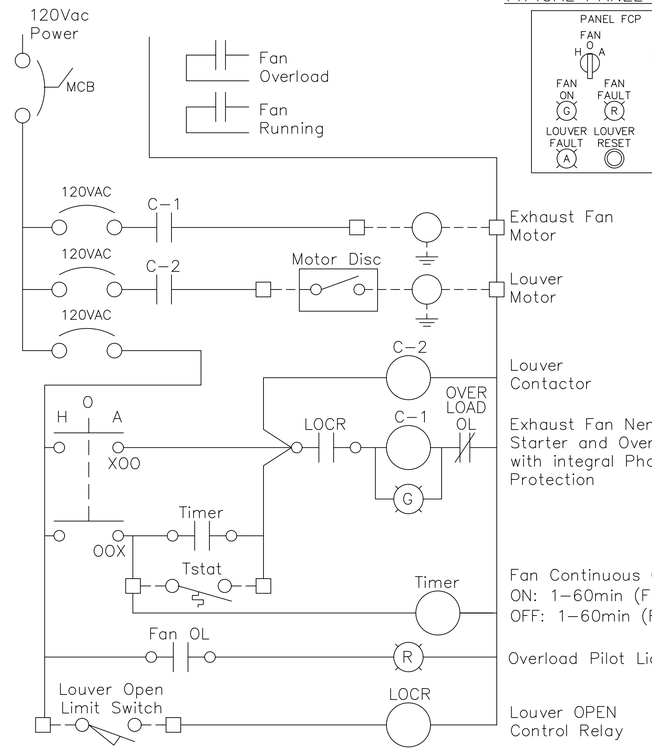
- EXIT 2 — LED EXIT LIGHT – NO. DENOTES FACES
- J — JUNCTION BOX
- OUTSIDE LED WALL PACK LIGHT
- WET LOCATION LED LIGHT
- WET LOCATION LED LIGHT W/EMERG BALLAST AND BATTERY PACK
- EMERG — EMERGENCY LIGHT
- PH — PHOTOCELL
- +44" S — WALL MOUNTED TOGGLE SWITCH – HEIGHT A.F.F.
- S3 — WALL MOUNTED TOGGLE SWITCH – NO. INDICATES 3–WAY, ETC.
- RECEPTACLE
- CONDUIT RUN (— — — ENCASED IN CONCRETE SLAB)
- INDICATES NO. OF WIRES (1–HOT,1–NEUTRAL & 1–GROUND)
- INDICATES A "HOMERUN" (3–HOTS & 1–GROUND)
- GROUND ROD FOR GROUND RING

TYPICAL EXHAUST FAN CONTROL PANEL (FCP) SCHEMATIC

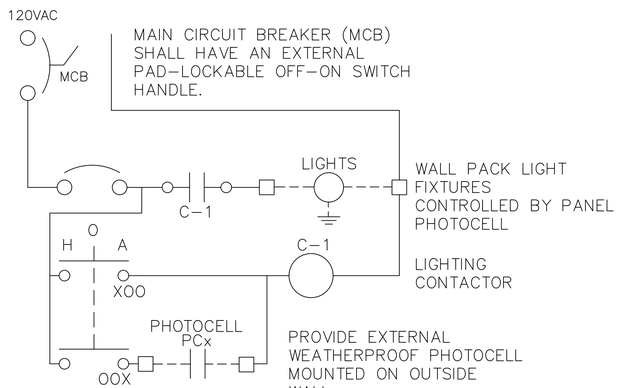
This Diagram shows a 120Vac/1ø powered fan and an Electric Louver with Open Limit Switch. All components shown shall be provided and installed. Provide the Main Circuit Breaker (MCB) with a door mounted pad–lockable operator handle OFF–ON Switch. Reference the HVAC specifications and drawings for Fan/Louver specifications and electrical details. Size all electrical equipment per the NEC and coordinate with the motor horse power or wattage.

TYPICAL PANEL LAYOUT





TYPICAL LIGHTING CONTACTOR CONTROL PANEL (LCP) SCHEMATIC



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REVISION DESCRIPTION

DATE

DATE 11-17-2023
DRAWN BY D. GLASSCOCK
DESIGNED BY D. GLASSCOCK
CHECKED BY D. GLASSCOCK
SCALE AS SHOWN

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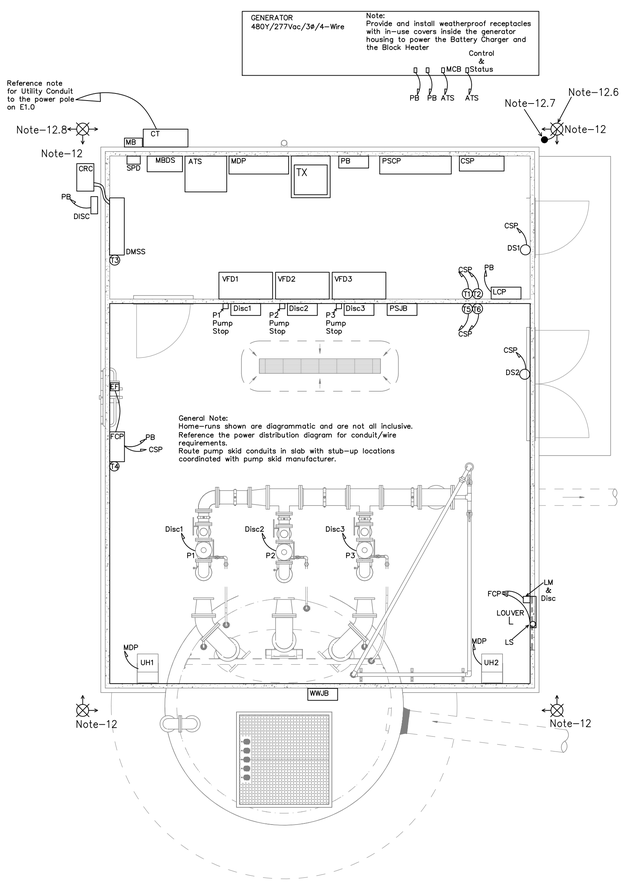
STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER
CITY OF STAUNTON, VIRGINIA
ELECTRICAL SCHEDULES NOTES AND DIAGRAMS

JOB NO. 49408
SHEET NO. E1.1

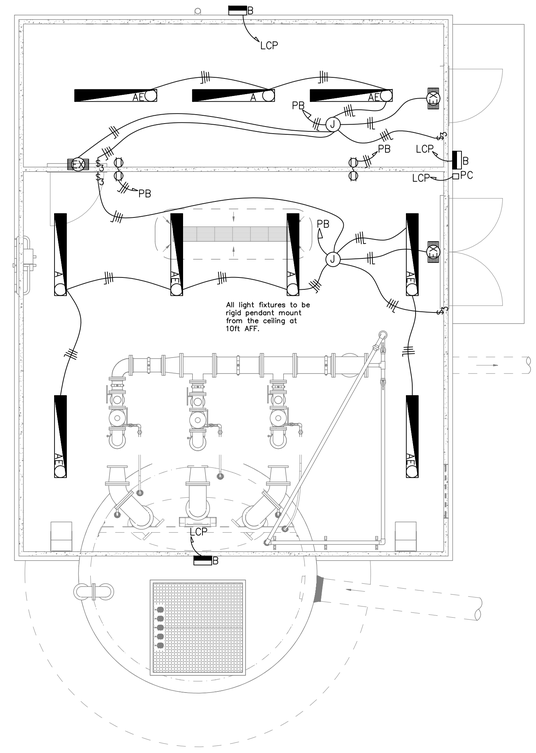
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DominionControls@verizon.net

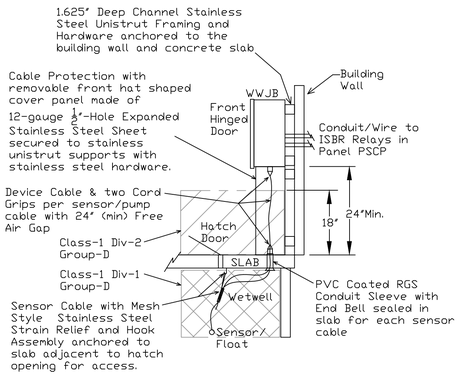
C:\DCS Business Files\DCS Backup\Jobfiles\6485 - TIMMONS Staunton WWPS and Tank\Dwgs\E1.1 Staunton WWPS Schedules Notes and Diagrams 11-17-2023.dwg | Plotted by Douglas Glasscock



POWER DISTRIBUTION PLAN
SCALE: 1/2" = 1'-0"



LIGHTS/RECEPTACLES DISTRIBUTION PLAN
SCALE: 1/2" = 1'-0"



WWJB, Wet Well and Cable Cable Installation Detail

COMMONWEALTH OF VIRGINIA
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SCALE
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TIMMONS GROUP

STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER

CITY OF STAUNTON, VIRGINIA

ELECTRICAL PLAN VIEWS AND DETAILS

JOB NO.
49408

SHEET NO.
E1.2

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HVAC LEGEND

SYMBOL	DESCRIPTION
	PROPELLER FAN
M	MOTOR OPERATED DAMPER
T	THERMOSTAT
A (H-1 | H-2)	A = SECTION LETTER DESIGNATOR H-1 = SHEET WHERE SECTION IS CUT H-2 = SHEET WHERE SECTION APPEARS
	'P' TRAP

ABBREVIATIONS

A	AMPERES
AFF	ABOVE FINISHED FLOOR
AHU	AIR HANDLING UNIT
AMSL	ABOVE MEAN SEA LEVEL
BTU	BRITISH THERMAL UNIT
BTUH	BRITISH THERMAL UNITS PER HOUR
CC	COOLING COIL
CFM	CUBIC FEET PER MINUTE
CU FT	CUBIC FEET
CUH	CABINET UNIT HEATER
CU IN	CUBIC INCHES
D	DRAIN LINE
DB	DRY BULB
DWG	DRAWING
EAT	ENTERING AIR TEMPERATURE
EF	EXHAUST FAN
EL	ELEVATION
ELEC	ELECTRIC
EWB	ENTERING WET BULB TEMPERATURE
EXH	EXHAUST AIR
F	FILTER
°F	DEGREES FAHRENHEIT
FG	FINISHED GRADE
FF	FINISHED FLOOR
FLA	FULL LOAD AMPERES
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FT	FEET
HP	HORSEPOWER
HR	HOUR
HZ	FREQUENCY
IN	INCH OR INCHES
KW	KILOWATT
L	LENGTH
LAT	LEAVING AIR TEMPERATURE
LBS	POUNDS
LDB	LEAVING DRY BULB TEMPERATURE
LWB	LEAVING WET BULB
MAX	MAXIMUM
MBH	BRITISH THERMAL UNITS/HOUR, THOUSANDS
MIN	MINIMUM
NO.	NUMBER
NOM	NOMINAL
NTS	NOT TO SCALE
OA	OUTSIDE AIR
PD	PRESSURE DROP
PH	PHASE
RHG	REFRIGERANT HOT GAS DISCHARGE
RL	REFRIGERANT LIQUID
RM	ROOM
RPM	REVOLUTIONS PER MINUTE
SP	STATIC PRESSURE
SPEC	SPECIFICATION
TEMP	TEMPERATURE
TYP	TYPICAL
UH	UNIT HEATER
W	WIDTH
W/	WITH
W/O	WITHOUT

ELECTRIC UNIT HEATER SCHEDULE: SPECIFICATION SECTIONS 238239.16 AND 238139.19

UNIT NO.	SERVING	UNIT TYPE	TOTAL CAPACITY BTUH	AIR DATA		ELECTRIC DATA				MOTOR DATA			SELECTION BASED ON		REMARKS
				CFM	EAT °F	KW	FLA	VOLT	PH	HP	VOLT	PH	MANUFACTURER	MODEL	
UH-1	PUMP ROOM	HORIZONTAL	11200	400	50	3.3	4	480	3	1/125	480	3	TRANE	UHRA-033DAAT	PROVIDE WITH DISCONNECT AND UNIT MOUNTED THERMOSTAT
UH-2	PUMP ROOM	HORIZONTAL	11200	400	50	3.3	4	480	3	1/125	480	3	TRANE	UHRA-033DAAT	PROVIDE WITH DISCONNECT AND UNIT MOUNTED THERMOSTAT

FAN SCHEDULE: SPECIFICATION SECTION 233423

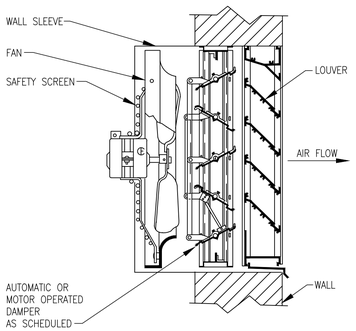
UNIT NO.	SERVING	TYPE	CFM	WHEEL DIA, IN.	DRIVE	BLADE TYPE	TOTAL STATIC, IN. WG.	FAN RPM	MOTOR DATA				SELECTION BASED ON		REMARKS
									HP	RPM	VOLT	PH	MANUFACTURER	MODEL	
EF-1	PUMP ROOM	SIDEWALL	1230	12	DIRECT	PROPELLER	0.25"	1719	1/4	1750	120	1	GREENHECK	SE1-12-432-A	PROVIDE SPEED CONTROLLER & REMOTE THERMOSTAT

SPLIT SYSTEM AIR HANDLING UNIT SCHEDULE: SPECIFICATION SECTION 28126

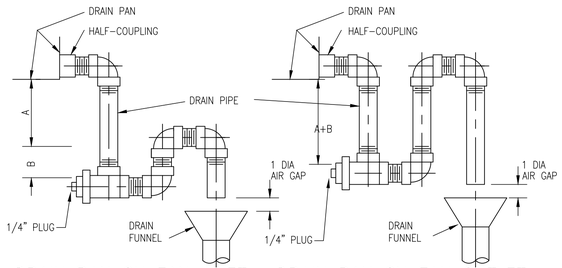
UNIT NO.	SERVING	OA CFM	SUPPLY FAN DATA				COOLING DATA					UNIT ELECTRIC DATA				SELECTION BASED ON		REMARKS
			CFM	ESP In, H2O	FLA	RPM	TOTAL CAPACITY BTUH	SENSIBLE CAPACITY BTUH	EAT °F		SEER @ARI	VOLT	PH	MCA	MOCP	MANUFACTURER	MODEL	
									DB °F	WB °F								
AHU-1	ELECTRIC ROOM	0	738	0	0.76	HIGH	22500	22500	80	67	20.5	230	1	1	20	MITSUBISHI	MSY-GL24NA-U1	MR. SLIM MINI-SPLIT UNIT. POWER FEED FROM CU-1

SPLIT SYSTEM AIR COOLED CONDENSING UNIT SCHEDULE: SPECIFICATION SECTION 238126

UNIT NO.	SERVING	UNIT DATA			FAN MOTOR(S)		COMPRESSOR(S)			UNIT ELECTRIC DATA				SELECTION BASED ON		REMARKS
		CAPACITY BTUH	COND. EAT °F	REFRIG. TYPE	NO.	FLA	NO.	LRA	RLA	MCA	MOCP	VOLT	PH	MANUFACTURER	MODEL	
CU-1	AHU-1	22500	93	410	1	0.93	1	16.1	12.9	17.1	20	230	1	MITSUBISHI	MUY-GL24NA	MR. SLIM MINI SPLIT UNIT

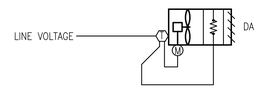


PROPELLER WALL FAN
NO SCALE



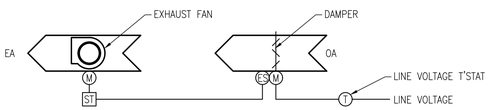
NOTE:
1. DRAIN PIPE TO BE SAME SIZE AS UNIT OUTLET, BUT NOT LESS THAN 1" PIPE SIZE.
2. "A"=SYSTEM STATIC IN INCHES AT DRAIN POINT.
"B"=1/2 SYSTEM STATIC IN INCHES AT DRAIN POINT.

AIR HANDLING UNIT DRAINS
NO SCALE



UNIT HEATER CONTROL DIAGRAM
NO SCALE

UNIT HEATER – (TYPICAL OF 2)
1. ON A CALL FOR HEATING FROM THE UNIT MOUNTED THERMOSTAT, THE UNIT HEATER FAN SHALL START AND THE HEATING COIL SHALL ENERGIZE.
2. WHEN THE UNIT MOUNTED THERMOSTAT IS SATISFIED, THE HEATING COIL SHALL DE-ENERGIZE AND THE FAN SHALL STOP.



EXHAUST FAN (THERMOSTAT) CONTROL DIAGRAM
NO SCALE

EXHAUST FAN – THERMOSTAT (TYPICAL OF 1)
1. ON A CALL FROM THE LINE VOLTAGE SPACE THERMOSTAT (ADJUSTABLE, INITIALLY SET FOR 80°F), THE OA DAMPER SHALL OPEN. WHEN THE OA DAMPER IS PROVEN OPEN VIA END SWITCH, THE EXHAUST FAN SHALL START.
2. WHEN THE LINE VOLTAGE THERMOSTAT IS SATISFIED, THE EXHAUST FAN SHALL STOP AND THE OA DAMPER SHALL CLOSE.
3. ALARMS SHALL BE PROVIDED AS FOLLOWS:
A. HIGH SPACE TEMPERATURE: WHEN SPACE TEMPERATURE EXCEEDS A (ADJUSTABLE) HIGH LIMIT. FOR A (ADJUSTABLE) SPECIFIED TIME PERIOD. INITIAL SETTINGS ARE 100°F AND 30 MINUTES.

COMMONWEALTH OF VIRGINIA
James S. Fuller
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11-17-23
STAUNTON CROSSING
PH. 1
PROFESSIONAL ENGINEER

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SCALE
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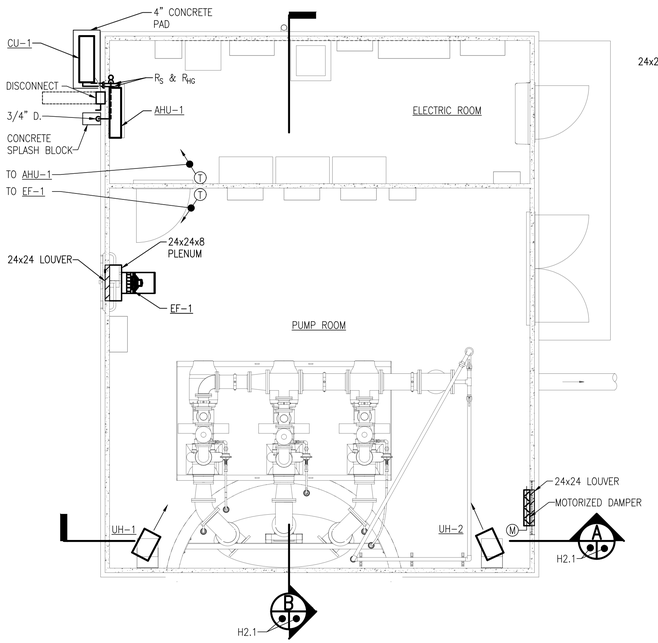
HVAC LEGEND, ABBREVIATIONS, SCHEDULES AND DETAILS

JOB NO.
53153.001

SHEET NO.
M1.1

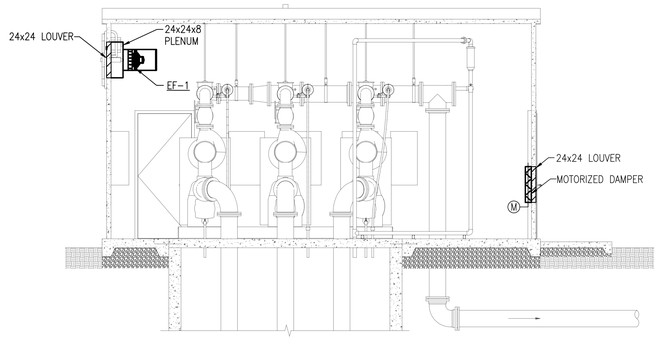
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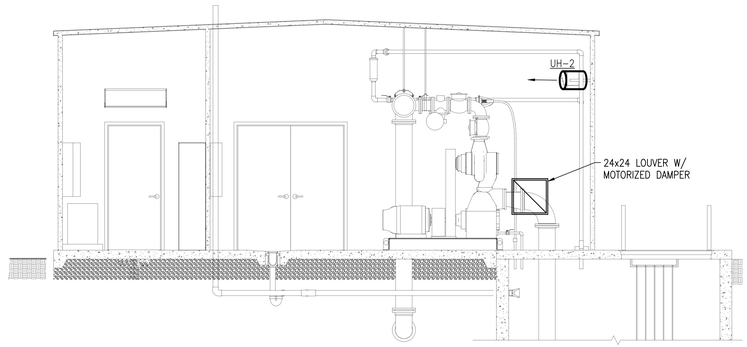


N

1 GROUND LEVEL PLAN – HVAC
SCALE: 1/4"=1'-0"



A SECTION
H2.1 H2.1 SCALE: 1/4" = 1'-0"



B SECTION
H2.1 H2.1 SCALE: 1/4" = 1'-0"

0' 5' 15'
SCALE: 1/4" = 1'-0"

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STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER

CITY OF STAUNTON - VIRGINIA

HVAC PLAN

JOB NO.
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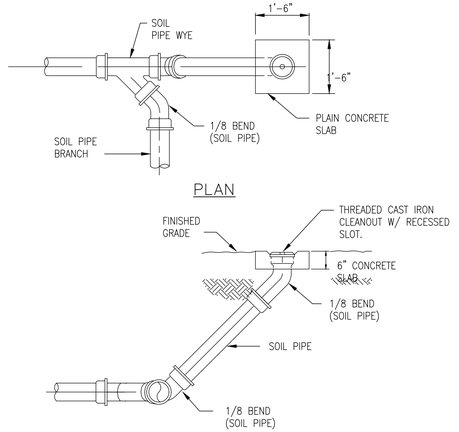
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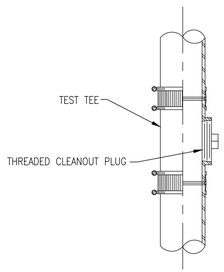
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LEGEND

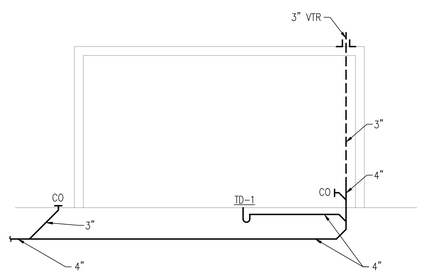
	DEMOLITION OF EXISTING PIPING		GATE VALVE	ADA	AMERICANS WITH DISABILITIES ACT
	EXISTING DOMESTIC COLD WATER PIPING		BALL VALVE	AD	ACCESS DOOR
	EXISTING DOMESTIC HOT WATER PIPING		STRAINER	O.D.	OVERFLOW DRAIN
	EXISTING DOMESTIC HOT WATER RETURN PIPING	C.V.	CHECK VALVE, HORIZONTAL SWING	PDI–	WATER HAMMER ARREST DESIGNATION
	EXISTING SANITARY VENT PIPING		UNION	RPZ	REDUCED PRESSURE ZONE BACK FLOW PREVENTER
SAN	EXISTING SANITARY PIPING		GAS COCK	V.T.R.	VENT THROUGH ROOF
W	EXISTING WASTE PIPING	BC	BALANCING COCK	WCO	WALL CLEAN OUT
ST	EXISTING STORM PIPING		DRAIN VALVE	P–1A	PLUMBING FIXTURE DESIGNATION
	DOMESTIC COLD WATER PIPING	WHA	WATER HAMMER ARRESTOR		
	DOMESTIC HOT WATER PIPING		THERMOMETER	S / 1	WASTE AND VENT RISER DIAGRAM
	DOMESTIC HOT WATER RETURN PIPING		PRESSURE GAUGE	W / 1	WATER RISER DIAGRAM
	SANITARY VENT PIPING		UNION COUPLING		
SAN	SANITARY PIPING	P.G.	PIPE GUIDE		CONNECT NEW TO EXISTING SERVICE
SAN	SANITARY PIPING BELOW	P.A.	PIPE ANCHOR		REMOVE EXISTING TO THIS POINT
W	WASTE PIPING		"P" TRAP		EXISTING SPRINKLER PIPING
W	WASTE PIPING BELOW		PRESSURE RELIEF VALVE		SPRINKLER PIPING
ST	STORM PIPING				PENDENT TYPE SPRINKLER HEAD
PD	PUMP DISCHARGE	WH	WALL HYDRANT		UPRIGHT TYPE SPRINKLER HEAD
G	GAS PIPING	HB	HOSE BIBB		FIRE DEPARTMENT CONNECTION TO WALL
	PIPE TURNING UP		FLOOR CLEAN OUT		OPEN STEM & YOKE VALVE
	PIPE TURNING DOWN	C.O.	CLEAN OUT	FS	FLOW SWITCH
	DIRECTION OF FLOW IN PIPE	A.P.	ACCESS PANEL	TS	TAMPER SWITCH
	SLOPE PIPE IN DIRECTION OF FLOW				



1 TYPICAL CLEANOUT DETAIL
SCALE: NONE



2 NO–HUB CLEAN OUT
SCALE: NONE



3 WASTE & VENT RISER DIAGRAM
NO SCALE

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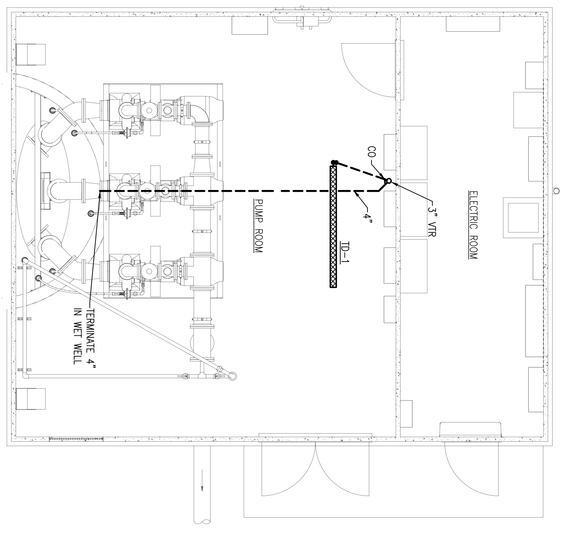
STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER
CITY OF STAUNTON - VIRGINIA
PLUMBING LEGEND, ABBREVIATIONS, SCHEDULES AND DETAILS

JOB NO. 53153.001
SHEET NO. D1.1

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N

1 GROUND LEVEL PLAN – PLUMBING
SCALE: 1/4"=1'-0"

0'
5'
15'
SCALE: 1/4" = 1'-0"

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SHEET NO.	JOB NO.	STAUNTON CROSSING UTILITY IMPROVEMENTS - SEWER	SCALE	CHECKED BY	DESIGNED BY	DRAWN BY	DATE
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		PLUMBING PLAN					

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STAUNTON CROSSING
DOWNSTREAM SEWER UPGRADES

STAUNTON, VIRGINIA
PUBLIC WORKS DEPARTMENT

JANUARY 2024

BEFORE YOU DIG CALL
"MISS UTILITY"
OF VIRGINIA
811

UNDERGROUND UTILITIES

EXISTING UNDERGROUND UTILITY LOCATIONS ARE SHOWN APPROXIMATE. ALL KNOWN UTILITY LOCATIONS HAVE BEEN PROVIDED, BUT MAY NOT BE ALL INCLUSIVE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO HAVE UTILITIES MARKED AND TO PHYSICALLY EXPOSE ALL UTILITIES PRIOR TO CONSTRUCTION.

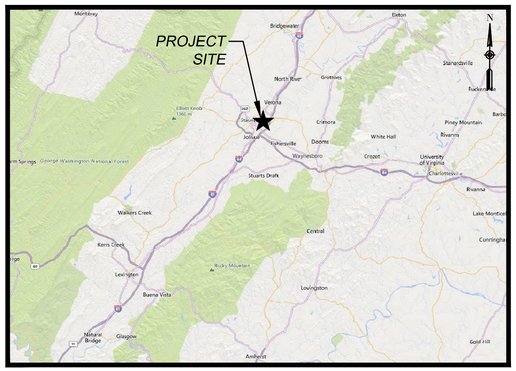
RESPONSIBLE LAND DISTURBER

UNTIL FURTHER NOTICE, THE RESPONSIBLE LAND DISTURBER FOR THIS PROJECT IS:

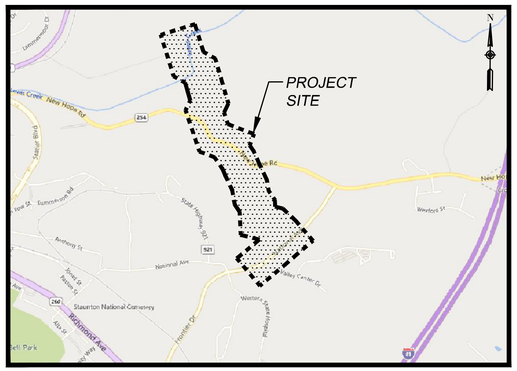
_____

_____

THIS LAND DISTURBER IS DESIGNATED FOR PLAN REVIEW AND APPROVAL ONLY. OWNER OR CONTRACTOR SHALL DESIGNATE RESPONSIBLE LAND DISTURBER WHEN SECURING CONSTRUCTION PERMITS.



VICINITY MAP
SCALE: 1" = 12 Miles



LOCATION MAP
SCALE: 1" = 1,500'

CONTACTS:

POWER, LIGHT, WATER & GAS UTILITIES EMERGENCY:	434-773-8206
WATER & GAS DISPATCH:	434-799-5284 EXT. 2077
WATER & GAS ENGINEERING: HAYDEN RADER	434-857-3366
POWER & LIGHT:	434-799-5268
VERIZON: TIM KAPORNYAI	434-791-9807
COMCAST: JUAN ROSARIO	540-718-3962
CITY ENGINEERS OFFICE:	434-799-5019
PW SEWER MAINTENANCE: DONNIE MCGUIRE	434-489-8423
POLICE DEPARTMENT NON-EMERGENCY:	434-799-5111

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15	D-2	CITY OF STAUNTON SANITARY SEWER DETAILS
16	D-3	CITY OF STAUNTON SANITARY SEWER DETAILS
17	D-4	CITY OF STAUNTON SITE DETAILS

PLAN REVISIONS -

SHEET T-1 1 OF 17

SCALE AS NOTED

STAUNTON CROSSING
DOWNSTREAM SEWER UPGRADES
STAUNTON, VIRGINIA

COVER SHEET

DATE: JANUARY 2024
ENGINEER: AAD
CHECKED: STW
CAD: PCP
JOB#: 22190

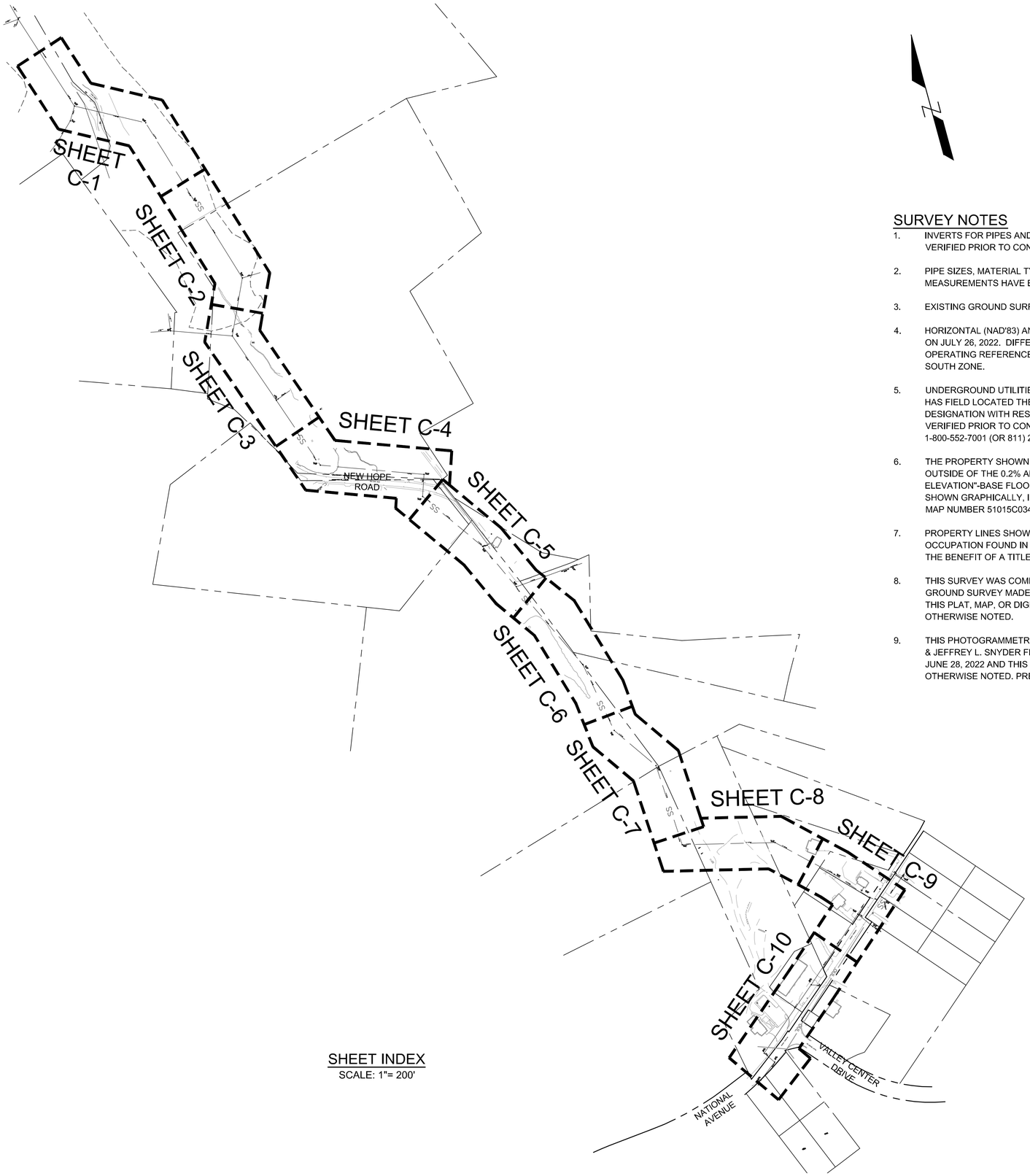
COMMONWEALTH OF VIRGINIA
Stephen Trey Wilkins
Lic. No. 0402059337
PROFESSIONAL ENGINEER
1/12/2024

310 FIRST STREET, SUITE 400
ROANOKE, VIRGINIA 24011
(P) 540 682-7570 (F) 844 890-1689

RK&K
Engineers|Construction Managers|Planners|Scientists

RUMMEL, KLEPPER & KAHL, LLP

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SHEET INDEX
SCALE: 1"= 200'

SURVEY NOTES

1. INVERTS FOR PIPES AND STRUCTURES SHOWN HEREON ARE BASED ON FIELD MEASUREMENTS, HOWEVER THEY SHOULD BE VERIFIED PRIOR TO CONSTRUCTION.

2. PIPE SIZES, MATERIAL TYPE AND INVERT ELEVATIONS AS INDICATED ARE BASED UPON OBSERVATIONS MADE ABOVE GROUND. NO MEASUREMENTS HAVE BEEN PERFORMED BY PERSONNEL IN A CONFINED SPACE SITUATION.

3. EXISTING GROUND SURFACE LOCATION PERFORMED BY CONVENTIONAL INSTRUMENT SURVEY.

4. HORIZONTAL (NAD'83) AND VERTICAL (NAVD'88) DATUM ESTABLISHED THROUGH REAL TIME KINEMATIC (RTK) GPS OBSERVATIONS ON JULY 26, 2022. DIFFERENTIAL CORRECTIONS WERE DERIVED FROM NATIONAL GEODETIC SURVEY (NGS) CONTINUALLY OPERATING REFERENCE STATION (CORS) "VAAD". COORDINATE VALUES, IF SHOWN HEREON, ARE BASED ON VIRGINIA STATE GRID, SOUTH ZONE.

5. UNDERGROUND UTILITIES WERE DESIGNATED (PAINTED) BY ACCUMARK ON AUGUST 11, 2022. H & B SURVEYING AND MAPPING, LLC HAS FIELD LOCATED THE DESIGNATED LINES AS PAINTED AND IS NOT RESPONSIBLE FOR THE ACCURACY OF THE PAINT DESIGNATION WITH RESPECT TO THE EXISTING UTILITY. UTILITY INFORMATION ON THIS DRAWING WILL NEED TO BE FIELD VERIFIED PRIOR TO CONSTRUCTION. INDIVIDUALS ARE REQUIRED BY VIRGINIA LAW TO CONTACT MISS UTILITY OF VIRGINIA AT 1-800-552-7001 (OR 811) 2 BUSINESS DAYS (48 HOURS) PRIOR TO CONSTRUCTION OR EXCAVATION ACTIVITIES.

6. THE PROPERTY SHOWN HEREON FALLS IN THE FOLLOWING FLOOD HAZARD ZONES: "X"(UNSHADED)-AREAS DETERMINED TO BE OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOOD PLAIN, "X"(SHADED)-AREAS IN THE 0.2% ANNUAL CHANCE FLOOD PLAIN, AND "AE ELEVATION"-BASE FLOOD ELEVATIONS DETERMINED (NAVD'88). THE APPROXIMATE BOUNDARY LIMITS OF THESE AREAS ARE SHOWN GRAPHICALLY, IF THEY FALL WITHIN THE LIMITS OF THIS SURVEY, AS SCALED FROM FEMA FLOOD INSURANCE RATE MAP, MAP NUMBER 51015C0343D, EFFECTIVE DATE: 09-28-2007.

7. PROPERTY LINES SHOWN HEREON ARE TAKEN FROM COURT HOUSE RECORDS, EVIDENCE OF MONUMENTATION AND OCCUPATION FOUND IN THE FIELD. THIS SURVEY DOES NOT CONSTITUTE A BOUNDARY SURVEY AND WAS PREPARED WITHOUT THE BENEFIT OF A TITLE COMMITMENT, THEREFORE ALL EASEMENTS MAY NOT BE SHOWN ON THIS SURVEY.

8. THIS SURVEY WAS COMPLETED UNDER THE DIRECT AND RESPONSIBLE CHARGE OF ALISON W. HANSON, LS FROM AN ACTUAL GROUND SURVEY MADE UNDER HER SUPERVISION. THE IMAGERY AND/OR ORIGINAL DATA WAS OBTAINED ON AUGUST 20, 2022. THIS PLAT, MAP, OR DIGITAL GEOSPATIAL DATA INCLUDING METADATA MEETS MINIMUM ACCURACY STANDARDS UNLESS OTHERWISE NOTED.

9. THIS PHOTOGRAMMETRIC SURVEY WAS COMPLETED UNDER THE DIRECT AND RESPONSIBLE CHARGE OF, MALCOLM C. MCKENZIE & JEFFREY L. SNYDER FROM AN ACTUAL AIRBORNE SURVEY MADE UNDER OUR SUPERVISION; THE IMAGERY WAS OBTAINED ON JUNE 28, 2022 AND THIS DIGITAL GEOSPATIAL DATA INCLUDING METADATA MEETS MINIMUM ACCURACY STANDARDS UNLESS OTHERWISE NOTED. PREPARED FOR H&B SURVEYING.

GRAPHIC SCALE
1" = 200'
200' 0 200' 400'

PLAN REVISIONS -

SHEET T-2
2 OF 17

SCALE 1" = 200'

STAUNTON CROSSING
DOWNSTREAM SEWER UPGRADES
STAUNTON, VIRGINIA

SHEET INDEX

DATE: JANUARY 2024
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CAD: PCP
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COMMONWEALTH OF VIRGINIA
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Lic. No. 0402059337
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GENERAL NOTES:

1. CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING THE DEPARTMENT OF PUBLIC WORKS (DPW) TO SCHEDULE A PRE-CONSTRUCTION MEETING AT LEAST 48 HOURS (TWO WORKING DAYS) PRIOR TO STARTING ANY WORK ON THIS PROJECT. THE CONTRACTOR SHALL PAY FOR AND OBTAIN ALL REQUIRED PERMITS AND DELIVER COPIES TO THE OWNER AT THE PRE-CONSTRUCTION MEETING.
2. CONTRACTOR SHALL NOTIFY PROPERTY OWNERS (IN WRITING) OF ANY WORK SCHEDULED ADJACENT TO OR THROUGH THEIR PROPERTY A MINIMUM OF ONE WEEK IN ADVANCE PRIOR TO THE COMMENCEMENT OF ANY STAKING OR CONSTRUCTION ACTIVITY.
3. STAKING FOR CONSTRUCTION, TO ASSURE PROPER LOCATION OF PROJECT COMPONENTS SHALL BE PERFORMED BY A LICENSED LAND SURVEYOR.
4. ALL EXISTING PROPERTY MARKERS ARE TO REMAIN UNDISTURBED. IF DISTURBANCE OCCURS, REPLACEMENT MUST BE PERFORMED BY A LICENSED LAND SURVEYOR AT THE CONTRACTOR'S EXPENSE.
5. PREVIOUSLY ARRANGED ACCESS EASEMENTS, STAGING AREAS, STORAGE AREAS, ETC., IF ANY, ARE SHOWN ON THE DRAWINGS. ADDITIONAL LAND USE RIGHTS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
6. WORK AREAS SHALL BE KEPT, AT ALL TIMES, FREE OF DEBRIS AND HAZARDOUS MATERIAL TO THE SATISFACTION OF THE INSPECTOR.
7. THE CONTRACTOR SHALL COORDINATE STORAGE OF MATERIALS, PARKING OF VEHICLES, AND RESTRICTIONS OF WORK WITH THE INSPECTOR.
8. THE CONTRACTOR IS RESPONSIBLE FOR DAILY AS-BUILT PLANS ON ALL CONSTRUCTION. ALL LATERALS AND APPURTENANCES SHALL BE REFERENCED FROM THE NEAREST MANHOLE.
9. ANY ITEM OF WORK NOT SPECIFICALLY SHOWN OR NOTED BUT NECESSARY FOR THE PROPER CONSTRUCTION, ACCEPTANCE, AND APPROVAL OF THIS PROJECT IS HEREBY IMPLIED.
10. CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF ALL EXISTING FEATURES (EXCEPT TREES), SUCH AS GUARDRAIL, SIDEWALKS, BRICKWORK, CULVERTS, FENCES, SHRUBS, PLANTERS, ETC. TO THEIR ORIGINAL LOCATION AND CONDITION WHICH EXISTED PRIOR TO CONSTRUCTION. TOTAL REPLACEMENT MAY BE NECESSARY.
11. CONTRACTOR SHALL CALL "MISS UTILITY" TOLL FREE AT 811 PRIOR TO START OF CONSTRUCTION.
12. THE CONTRACTOR SHALL INCLUDE IN HIS BID PRICE THE COST OF LOCATING ALL UNDERGROUND LINES AND STRUCTURES AS NECESSARY TO COMPLETE THE WORK. NO CLAIMS FOR DAMAGES OR EXTRA COMPENSATION SHALL ACCRUE TO THE CONTRACTOR DUE TO THE PRESENCE OF EXISTING UTILITIES OR FROM ANY DELAY DUE TO REMOVAL OR REARRANGEMENT OF THE SAME. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE CAUSED TO UNDERGROUND STRUCTURES.
13. THE LOCATION OF EXISTING UTILITIES ACROSS OR ALONG THE ROUTE OF THE PROPOSED WORK IS NOT NECESSARILY SHOWN ON THE PLANS, AND WHEN SHOWN, IS ONLY APPROXIMATELY CORRECT. IN ADDITION TO CONTACTING MISS UTILITY PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR SHALL, ON HIS OWN INITIATIVE, HORIZONTALLY AND VERTICALLY LOCATED ALL EXISTING UNDERGROUND LINES, FACILITIES, AND STRUCTURES. THE CONTRACTOR IS RESPONSIBLE FOR REPAIRING ANY UNDERGROUND LINES, FACILITIES, AND STRUCTURES DAMAGED.
14. CONTRACTOR SHALL VERIFY LOCATION AND ELEVATIONS OF ALL UNDERGROUND UTILITIES SHOWN ON PLANS IN AREAS OF CONSTRUCTION PRIOR TO STARTING WORK.CONTACT ENGINEER IMMEDIATELY IF LOCATION OR ELEVATION IS DIFFERENT FROM THAT SHOWN ON PLAN. IF THERE APPEARS TO BE A CONFLICT, OR UPON DISCOVERY OF ANY UTILITY NOT SHOWN ON THIS PLAN, CALL "MISS UTILITY" AT 811.
15. THE CONTRACTOR SHALL VERIFY THE ELEVATIONS OF ALL POINTS OF CONNECTION OR PROPOSED WORK TO EXISTING CURBS, SANITARY LINES, WATER LINES, ETC., PRIOR TO CONSTRUCTION.
16. CONTRACTOR SHALL COORDINATE WITH THE LOCAL UTILITY COMPANIES PRIOR TO CONSTRUCTING PORTIONS OF WORK IMMEDIATELY ADJACENT TO UTILITY STRUCTURES. THE COSTS OF POLE AND/OR OTHER STRUCTURE STABILIZATION DURING WORK SHALL BE BORNE BY THE CONTRACTOR.
17. ALL WORK SHALL BE SUBJECT TO INSPECTION BY BOTH STATE AND LOCAL INSPECTORS.
18. FINAL ACCEPTANCE BY THE OWNER WILL NOT BE MADE UNTIL ALL WORK SHOWN ON THE APPROVED CONTRACT DOCUMENTS IS COMPLETED, INCLUDING CURB AND GUTTER, PAVING, GRADING, RESTORATION AND ALL ADJUSTMENTS.
19. CONTRACTOR SHALL RESTORE EXISTING DITCH TO ORIGINAL CONDITION AND ENSURE THAT POSITIVE DRAINAGE IS MAINTAINED WITHIN THE DITCH. PAVEMENT AND SHOULDERS MUST ALSO BE RESTORED TO THEIR ORIGINAL CONDITION.
20. CONTRACTOR SHALL ENSURE THAT PUBLIC AND PRIVATE ENTRANCE CULVERTS ARE FREE OF ANY CONSTRUCTION DEBRIS.
21. ALL MATERIALS AND CONSTRUCTION WITHIN THE PUBLIC RIGHT-OF-WAY SHALL BE IN ACCORDANCE WITH THE CURRENT EDITION OF THE VIRGINIA DEPARTMENT OF TRANSPORTATION'S ROAD AND BRIDGE SPECIFICATIONS, ROAD AND BRIDGE STANDARDS AND WORK AREA PROTECTION MANUAL.
22. ANY RIGHT-OF-WAY OR ROADSIDE WORK THAT MAY AFFECT TRAFFIC WILL REQUIRE A TRAFFIC MAINTENANCE PLAN, AND MUST BE SUBMITTED TO AND APPROVED BY DEPARTMENT OF PUBLIC WORKS PRIOR TO ANY WORK THAT MAY AFFECT TRAFFIC.
23. SOIL STABILIZATION IS REQUIRED WITHIN 7 DAYS FOR ALL AREAS WHERE CLEARING, GRADING, EXCAVATION OR OTHER LAND DISTURBING ACTIVITIES HAVE PERMANENTLY CEASED OR WHERE LAND DISTURBANCE ACTIVITIES HAVE BEEN TEMPORARILY SUSPENDED FOR AN ANTICIPATED DURATION OF GREATER THAN 7 DAYS, OR UPON COMPLETION OF GRADING OPERATIONS FOR A SPECIFIED AREA. SOIL STABILIZATION SHALL BEGIN AS SOON AS PRACTICABLE, BUT NOT LATER THAN THE SEVEN DAYS FOLLOWING THE DAY WHEN LAND DISTURBING ACTIVITIES TEMPORARILY OR PERMANENTLY CEASED.

SEWER NOTES:

1. ALL CONSTRUCTION, MATERIALS AND INSTALLATIONS SHALL CONFORM TO THE LATEST EDITION OF STANDARDS AND SPECIFICATIONS, DEPARTMENT OF PUBLIC WORKS (DPW), CITY OF STAUNTON, VIRGINIA.
2. CONTRACTOR SHALL SHALL SUBMIT SHOP DRAWINGS AND SPECIFICATIONS FOR ALL PROPOSED PRODUCTS TO BE USED DURING UTILITY CONSTRUCTION TO DPW FOR REVIEW AND CONCURRENCE PRIOR TO PROCURING ANY MATERIALS. USING MARKINGS, HIGHLIGHTING AND/OR NOTES, SUBMITTAL SHEETS SHALL CLEARLY IDENTIFY THE SPECIFIC PRODUCT TO BE USED, AND THE PURPOSE TO WHICH IT IS TO BE PUT.
3. MINIMUM DESIGN COVER OVER GRAVITY SEWER LINES IS 3 FEET. EXCEPTIONS DUE TO UNUSUAL CIRCUMSTANCES IN THE FIELD MUST BE APPROVED BY DPW. DUCTILE IRON PIPE (DIP) MUST BE USED WHERE COVER IS LESS THAN 3 FEET, AND WHERE COVER IS MORE THAN 15 FEET IN OTHER AREAS.
4. MINIMUM DESIGN COVER OVER SANITARY SEWER FORCE MAINS IS 3.0 FEET. EXCEPTIONS DUE TO UNUSUAL CIRCUMSTANCES IN THE FIELD MUST BE APPROVED BY DPW.
5. A SANITARY SEWER CLEANOUT SHALL BE INSTALLED ON EACH SEWER SERVICE LATERAL AT THE EDGE OF THE RIGHT-OF-WAY/UTILITY EASEMENT, IN ACCORDANCE WITH DPW STANDARDS.
6. DETECTABLE MARKING TAPE IS REQUIRED ON ALL BURIED LINES.
7. COPPER TRACER WIRE AND TRACER WIRE ACCESS BOXES SHALL BE INSTALLED ON ALL WATER MAINS AND ALL SEWAGE FORCE MAINS.
8. SEWAGE FORCE MAINS TRACER WIRE ACCESS BOXES SHALL BE INSTALLED AT THE FOLLOWING LOCATIONS:
   A. ADJACENT TO THE BYPASS CONNECTION RISER ON THE PUMP STATION SITE.
   B. ADJACENT TO THE DISCHARGE MANHOLE FOR THE FORCE MAIN.
   C. OTHER INTERMEDIATE LOCATIONS AS DETERMINED BY DPW AND SHOWN ON THE PLANS.
9. GRAVITY SEWERS WHICH RECEIVE PUMPED FLOW SHALL BE PROTECTED AGAINST SULFIDE ATTACK FOR A DISTANCE OF 2,000 FEET DOWNSTREAM FROM THE POINT OF ENTRY OF THE PUMPED FLOW. THIS SHALL BE ACCOMPLISHED BY THE USE OF ACID-RESISTANT PIPE AND MANHOLES IN ACCORDANCE WITH DPW STANDARDS.
10. EXISTING FRAME AND COVERS SCHEDULED FOR REPLACEMENT SHALL BE DELIVERED TO STAUNTON PUBLIC WORKS FOR SALVAGE.
11. PRIOR TO REQUESTING ANY ACCEPTANCE INSPECTION, CONTRACTOR SHALL FLUSH AND CLEAN OUT GRAVITY SEWER MAINS AS NEEDED, PERFORM CCTV RECORDINGS OF ALL GRAVITY SEWER MAINS AND MANHOLES, AND SUBMIT CCTV RECORDINGS TO DPW FOR REVIEW.

UTILITY NOTES:

1. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PROTECT AND MAINTAIN UNINTERRUPTED SERVICE EXCEPT AS ALLOWED BY THE INSPECTOR.
2. ANY DAMAGE TO EXISTING STRUCTURES SHALL BE REPAIRED IMMEDIATELY TO THE SATISFACTION OF THE INSPECTOR, AT THE CONTRACTOR'S EXPENSE.
3. ALL TIE-IN CONNECTIONS SHALL BE APPROVED BY THE INSPECTOR PRIOR TO BACKFILLING.
4. AFTER BACKFILLING, FINISHED GRADE ABOVE TRENCH SHALL BE RESTORED TO AS GOOD OR BETTER THAN EXISTING CONDITIONS WHICH EXISTED PRIOR TO CONSTRUCTION.
5. BLASTING OF ROCK IS STRICTLY PROHIBITED WITHOUT WRITTEN PRIOR AUTHORIZATION FROM THE OWNER.
6. TRENCHES WITHIN PRIVATE AND PUBLIC PAVED AREAS (GRAVEL, ASPHALT, CONCRETE, ETC.) SUBJECT TO VEHICULAR LOADS SHALL BE FULLY BACKFILLED WITH SELECT AGGREGATE MATERIAL (VDOT 21A OR 21B).

RESTRAINED JOINT NOTES:

THRUST RESTRAINTS SHALL BE PROVIDED ON ALL VALVES, FITTINGS, BENDS, TEES AND DEAD ENDS. THRUST RESTRAINTS SHALL BE PROVIDED AS INDICATED ON THE CONTRACT DRAWINGS. THRUST RESTRAINTS SHALL BE MANUFACTURED BY EBAA IRON OR APPROVED EQUAL AND THE SERIES INDICATED BELOW:

DUCTILE IRON PIPE MECHANICAL JOINTS: SERIES 1100
DUCTILE IRON PIPE PUSH-ON JOINTS: SERIES 1700

BURIED DUCTILE IRON PIPE NOTES:

POLYETHYLENE ENCASEMENT, WHERE REQUIRED, SHALL CONFORM TO AWWA C105 AND ANSI A21.5. THE POLYETHYLENE SHALL HAVE A MINIMUM THICKNESS OF 8 MIL., SHALL BE TUBING TYPE AND SHALL BE MANUFACTURED OF VIRGIN MATERIAL. THE TAPE USED FOR INSTALLATION OF POLYETHYLENE TUBING SHALL BE PLASTIC-BACKED ADHESIVE WITH A THICKNESS OF 12 MILS AND A MINIMUM WIDTH OF 1-1/2". THE TAPE SHALL BE CAPABLE OF BONDING TO METAL, BITUMINOUS COATINGS AND POLYETHYLENE AT A TEMPERATURE RANGE OF 32 TO 120 DEGREES FAHRENHEIT.

LEGEND

EXISTING		PROPOSED
	BUILDING	
	EDGE OF PAVEMENT/CONCRETE	
	EDGE OF GRAVEL	
	PROPERTY/RIGHT-OF-WAY LINE	
	EASEMENT LINE	
FM	SANITARY FORCE MAIN	
8"TC SS	SANITARY GRAVITY MAIN	
S	SANITARY MANHOLE	
SCO	SANITARY LATERAL AND CLEANOUT	
12"DIP PUW	WATER MAIN	
WV	WATER VALVE	
FH	FIRE HYDRANT	
WM	WATER METER & SERVICE LINE	
OHU	OVERHEAD UTILITY LINE	
PP	POWER POLE W/LIGHT & GUY	
PUE	UNDERGROUND ELECTRIC LINE	
6"PL PUG	NATURAL GAS LINE	
GV	GAS VALVE	
TELE. PED.	TELEPHONE PEDESTAL	
D	STORM DRAIN STRUCTURE	
15"CONC	STORM DRAIN LINE	
or	SIGN	
	BOLLARD	
	POST	
	MAILBOX	
	TREE/SHRUB	
	TREE LINE	
	FENCE	
	WETLANDS	
	WATERS OF THE U.S. (WOUS)	
	CONTOUR	
	RESOURCE PROTECTION AREA (RPA)	
	RESOURCE MANAGEMENT AREA (RMA)	
	SOIL BORING	
	TEST HOLE	
	LINE ABANDONMENT	
	PAVEMENT MILL & OVERLAY	
	PAVEMENT TRENCH REPAIR	
	SILT FENCE	SF
	TREE PROTECTION	TP
	TREE REMOVAL	
	SUPER SILT FENCE	SSF
	INLET/CULVERT INLET PROTECTION	CIP, IP
	CONSTRUCTION ENTRANCE	CE
	ROCK CHECK DAM	RCD
	LIMITS OF DISTURBANCE	LOD

PLAN REVISIONS -

SHEET T-3 3 OF 17

SCALE N/A

STAUNTON CROSSING
DOWNSTREAM SEWER UPGRADES
STAUNTON, VIRGINIA

GENERAL NOTES AND LEGEND

DATE: JANUARY 2024
ENGINEER: AAD
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COMMONWEALTH OF VIRGINIA
Stephen Troy Wilkins
Lic. No. 040205937
ENGINEER
PROFESSIONAL
1/12/2024

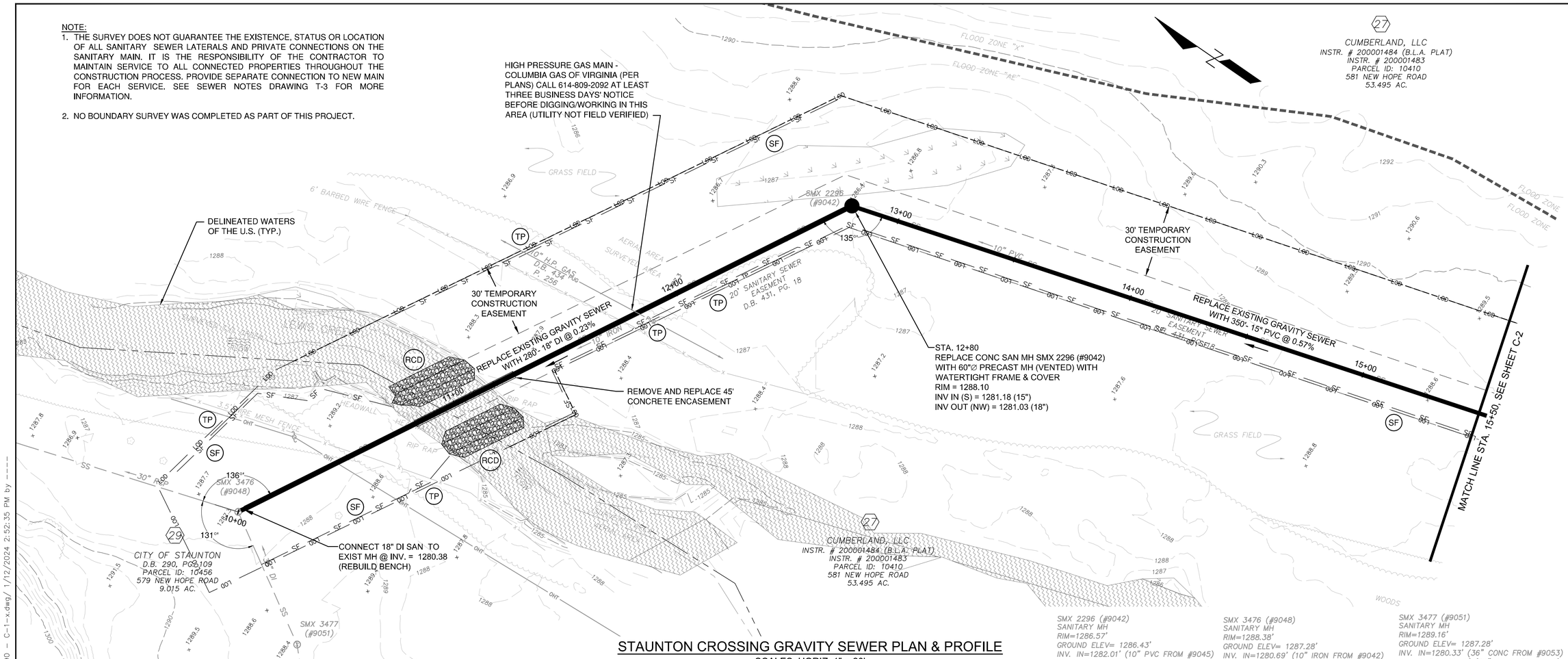
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NOTE:
1. THE SURVEY DOES NOT GUARANTEE THE EXISTENCE, STATUS OR LOCATION OF ALL SANITARY SEWER LATERALS AND PRIVATE CONNECTIONS ON THE SANITARY MAIN. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN SERVICE TO ALL CONNECTED PROPERTIES THROUGHOUT THE CONSTRUCTION PROCESS. PROVIDE SEPARATE CONNECTION TO NEW MAIN FOR EACH SERVICE. SEE SEWER NOTES DRAWING T-3 FOR MORE INFORMATION.
2. NO BOUNDARY SURVEY WAS COMPLETED AS PART OF THIS PROJECT.



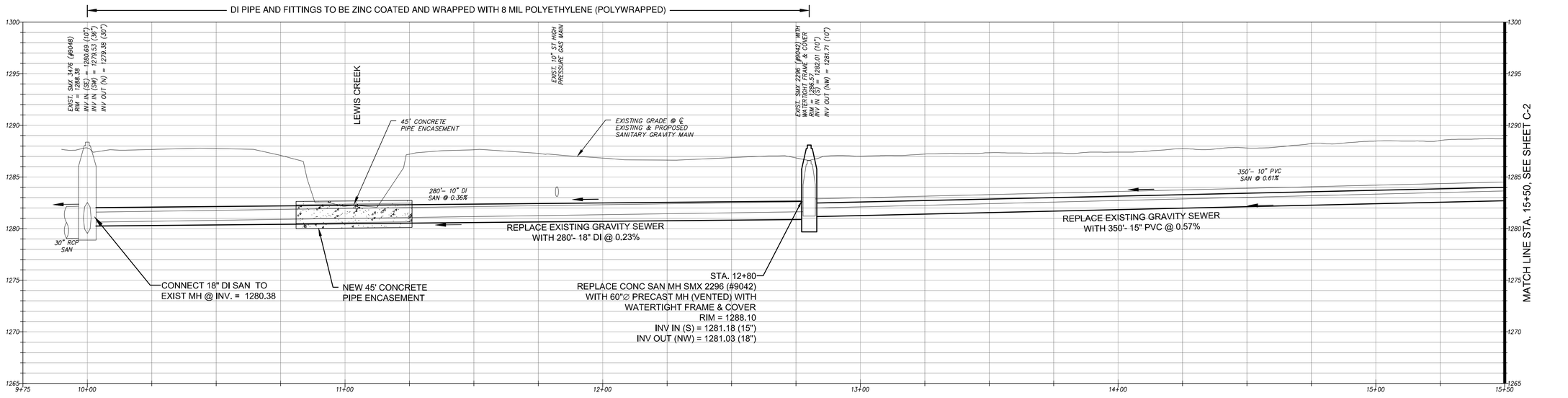
SMX 2296 (#9042)
SANITARY MH
RIM=1286.57'
GROUND ELEV= 1286.43'
INV. IN=1282.01' (10" PVC FROM #9045)
INV. OUT=1281.71' (10" IRON TO #9048)

SMX 3476 (#9048)
SANITARY MH
RIM=1288.38'
GROUND ELEV= 1287.28'
INV. IN=1280.69' (10" IRON FROM #9042)
INV. IN=1279.53' (36" CONC FROM #9051)
INV. OUT=1279.38' (30" CONC TO #9047)

SMX 3477 (#9051)
SANITARY MH
RIM=1289.16'
GROUND ELEV= 1287.28'
INV. IN=1280.33' (36" CONC FROM #9053)
INV. OUT=1280.44' (36" CONC TO #9048)

STAUNTON CROSSING GRAVITY SEWER PLAN & PROFILE

SCALES: HORIZ. 1" = 20'
VERT. 1" = 5'



GRAPHIC SCALES
1" = 20': 20' 0 20' 40'
1" = 5': 5' 0 5' 10'

PLAN REVISIONS -

SHEET C-1
4 OF 17

SCALE
1" = 20'
1" = 5'

STAUNTON CROSSING
DOWNSTREAM SEWER UPGRADES
STAUNTON, VIRGINIA

STAUNTON CROSSING GRAVITY SEWER
- STA. 10+00 TO STA. 15+50

DATE: JANUARY 2024
ENGINEER: AAD
CHECKED: STW
CAD: PCP
JOB#: 22190

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NOTE:
1. THE SURVEY DOES NOT GUARANTEE THE EXISTENCE, STATUS OR LOCATION OF ALL SANITARY SEWER LATERALS AND PRIVATE CONNECTIONS ON THE SANITARY MAIN. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN SERVICE TO ALL CONNECTED PROPERTIES THROUGHOUT THE CONSTRUCTION PROCESS. PROVIDE SEPARATE CONNECTION TO NEW MAIN FOR EACH SERVICE. SEE SEWER NOTES DRAWING T-3 FOR MORE INFORMATION.
2. NO BOUNDARY SURVEY WAS COMPLETED AS PART OF THIS PROJECT.

(27) CUMBERLAND, LLC
INSTR. # 200001484 (B.L.A. PLAT)
INSTR. # 200001483
PARCEL ID: 10410
581 NEW HOPE ROAD
53.495 AC.

(26) PARK W. THOMPSON AND SANDRA H. THOMPSON
D.B. 773, PG. 325
D.B. 471, PG. 389 (PLAT)
D.B. 773, PG. 323 (L&E)
PARCEL ID: 10369
601 NEW HOPE ROAD
23.90 AC.

SMX 2297 (#9045)
SANITARY MH
RIM=1289.09'
GROUND ELEV= 1288.82'
INV. IN=1284.25' (10" PVC FROM #9037)
INV. OUT=1284.15' (10" PVC TO #9042)

SMX 2298 (#9037)
SANITARY MH
RIM=1291.31'
GROUND ELEV= 1290.87'
INV. IN=1287.56' (4" PVC FROM A.D.)
INV. IN=1286.69'(10" IRON FROM #9034)
INV. OUT=1286.51' (10" PVC TO #9045)

MATCH LINE STA. 15+50, SEE SHEET C-1

REPLACE EXISTING GRAVITY SEWER WITH 350'- 15" PVC @ 0.57%

STA. 16+30
REPLACE CONC SMX 2297 (#9045) WITH 48"∅ PRECAST MH WITH WATERTIGHT FRAME & COVER
RIM = 1290.60
INV IN (S) = 1283.32 (15")
INV OUT (N) = 1283.17 (15")

REPLACE EXISTING GRAVITY SEWER WITH 351'- 15" PVC @ 0.57%

30' TEMPORARY CONSTRUCTION EASEMENT

REMOVE AND REPLACE EXISTING FENCE

60' INGRESS / EGRESS & UTILITY EASEMENT D.B. 436, PG. 158 INSTR. # 200001484 (PLAT)

20' PERMANENT SANITARY SEWER EASEMENT D.B. 430, PG. 262

STA. 19+81
REPLACE CONC SMX 2298 (#9037) WITH 48"∅ PRECAST MH WITH WATERTIGHT FRAME & COVER
RIM = 1292.80
INV IN (SW) = 1285.47 (16")
INV IN (E) = 1287.56 (4")
INV OUT (N) = 1285.32 (15")

INSTALL 4" PVC SAN WITH PROPERTY LINE CLEANOUT, SEE NOTE 1

30' TEMPORARY CONSTRUCTION EASEMENT

REPLACE EXISTING GRAVITY SEWER WITH 225'- 16" DI @ 0.57%

HIGH PRESSURE GAS MAIN - COLUMBIA GAS OF VIRGINIA (PER PLANS) CALL 614-809-2092 AT LEAST THREE BUSINESS DAYS' NOTICE BEFORE DIGGING/WORKING IN THIS AREA (UTILITY NOT FIELD VERIFIED)

10" H.P. GAS D.B. 434 P. 256

DELINEATED WETLANDS (TYP.)

DELINEATED WATERS OF THE U.S. (TYP.)

GRASS FIELD

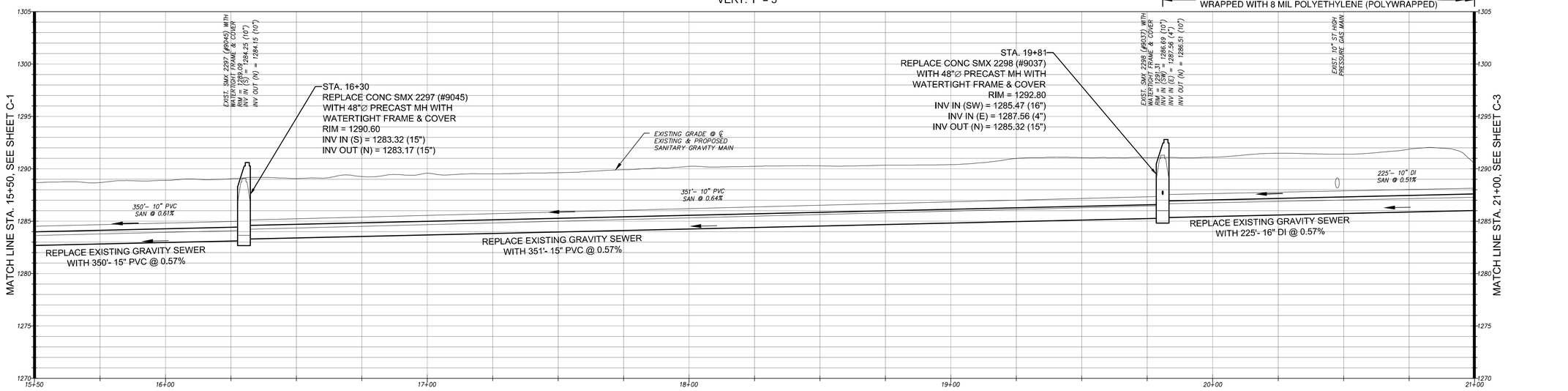
WIRE FENCE

MATCH LINE STA. 21+00, SEE SHEET C-3

NOTE:
1. NO BOUNDARY SURVEY WAS COMPLETED AS PART OF THIS PROJECT.

STAUNTON CROSSING GRAVITY SEWER PLAN & PROFILE

SCALES: HORIZ. 1" = 20'
VERT. 1" = 5'



GRAPHIC SCALES
1" = 20'
20' 0 20' 40'
1" = 5'
5' 0 5' 10'

PLAN REVISIONS -

SHEET C-2
5 OF 17

SCALE
1" = 20'
1" = 5'

STAUNTON CROSSING
DOWNSTREAM SEWER UPGRADES
STAUNTON, VIRGINIA

STAUNTON CROSSING GRAVITY SEWER - STA. 15+50 TO STA. 21+00

DATE: JANUARY 2024
ENGINEER: AAD
CHECKED: STW
CAD: PCP
JOB#: 22190

COMMONWEALTH OF VIRGINIA
Stephen Trey Williams
Lic. No. 0402059357
PROFESSIONAL ENGINEER
1/12/2024

310 FIRST STREET, SUITE 400
ROANOKE, VIRGINIA 24011
(P) 540 682-7570 (F) 844 890-1689

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RUMMEL, KLEPPER & KAHL, LLP

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NOTE:
1. THE SURVEY DOES NOT GUARANTEE THE EXISTENCE, STATUS OR LOCATION OF ALL SANITARY SEWER LATERALS AND PRIVATE CONNECTIONS ON THE SANITARY MAIN. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN SERVICE TO ALL CONNECTED PROPERTIES THROUGHOUT THE CONSTRUCTION PROCESS. PROVIDE SEPARATE CONNECTION TO NEW MAIN FOR EACH SERVICE. SEE SEWER NOTES DRAWING T-3 FOR MORE INFORMATION.
2. NO BOUNDARY SURVEY WAS COMPLETED AS PART OF THIS PROJECT.

SMX 2299 (#9034)
SANITARY MH
RIM=1293.05'
GROUND ELEV= 1292.76'
INV. IN=1288.02' (10" PVC FROM #9031)
INV. IN=1288.14' (8" PVC FROM #9040)
INV. OUT=1287.85' (10" IRON TO #9037)

SMX 2300 (#9040)
SANITARY MH
RIM=1305.68'
GROUND ELEV= 1305.03'
INV. IN=1300.24' (6" PVC FROM A.D.)
INV. IN=1301.00' (4" PVC FROM A.D.)
INV. OUT=1300.15' (8" PVC TO #9034)

SMX 2302 (#9031)
SANITARY MH
RIM=1294.69'
GROUND ELEV= 1294.40'
INV. IN=1290.24' (4" PVC FROM A.D.)
INV. IN=1289.50' (8" PVC FROM #9030)
INV. OUT=1289.22' (10" PVC TO #9034)

26
PARK W. THOMPSON AND SANDRA H. THOMPSON
D.B. 773, PG. 325
D.B. 471, PG. 389 (PLAT)
D.B. 773, PG. 323 (L&E)
PARCEL ID: 10369
601 NEW HOPE ROAD
23.90 AC.

DELINEATED WETLANDS (TYP.)
DELINEATED WATERS OF THE U.S. (TYP.)
10" H.P. GAS D.B. 434 P. 256
REMOVE AND REPLACE 20' CONCRETE ENCASEMENT
MATCH LINE STA. 21+00, SEE SHEET C-2
MATCH LINE STA. 27+00, SEE SHEET C-4
30' TEMPORARY CONSTRUCTION EASEMENT
INSTALL 4" PVC SAN WITH PROPERTY LINE CLEANOUT, SEE NOTE 1
20' PERMANENT SANITARY SEWER EASEMENT D.B. 430, PG. 262
REPLACE EXISTING GRAVITY SEWER WITH 299'- 15" PVC @ 0.57%
REPLACE EXISTING GRAVITY SEWER WITH 301'- 15" PVC @ 0.60%
REPLACE EXISTING GRAVITY SEWER WITH 225'- 16" DI @ 0.57%
STREAM
GRASS FIELD
FENCE
OLD PUT
WATERLINE EASEMENT INSTR. # 120001530
60' INGRESS & EGRESS & UTILITY EASEMENT D.B. 436, PG. 158 INSTR. # 200001484 (PLAT)
137'- 8" PVC SAN @ 5.62%
6" PVC
FROM SMX 2300 (#9040)
DI PIPE AND FITTINGS TO BE ZINC COATED AND WRAPPED WITH 8 MIL POLYETHYLENE (POLYWRAPPED)

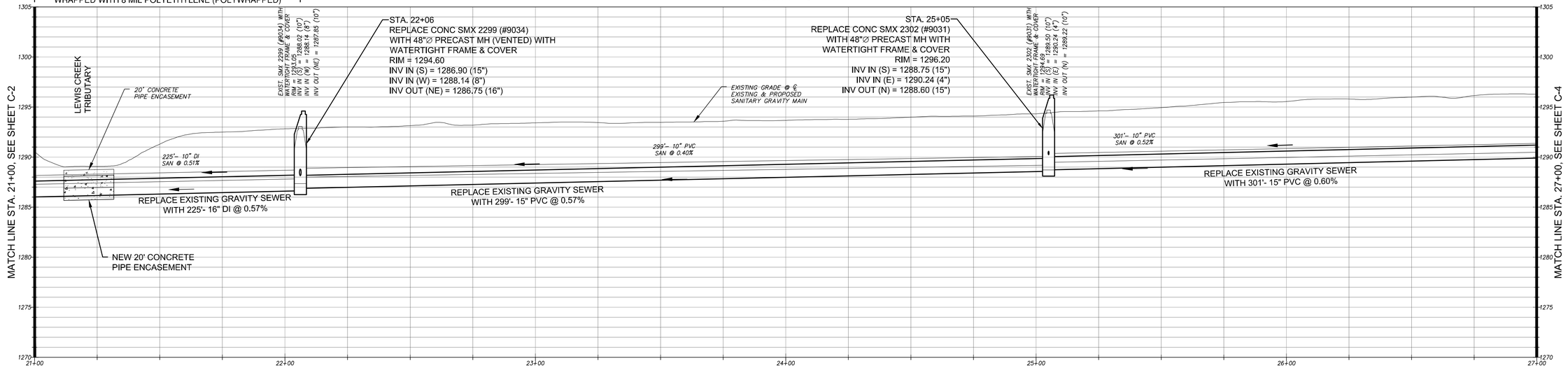
STA. 22+06
REPLACE CONC SMX 2299 (#9034)
WITH 48"∅ PRECAST MH (VENTED) WITH
WATERTIGHT FRAME & COVER
RIM = 1294.60
INV IN (S) = 1286.90 (15")
INV IN (W) = 1288.14 (8")
INV OUT (NE) = 1286.75 (16")
CONNECT 5'- 8" PVC SAN @ INV. = 1288.39±

STA. 25+05
REPLACE CONC SMX 2302 (#9031)
WITH 48"∅ PRECAST MH WITH
WATERTIGHT FRAME & COVER
RIM = 1296.20
INV IN (S) = 1288.75 (15")
INV IN (E) = 1290.24 (4")
INV OUT (N) = 1288.60 (15")

24
ANAMARIA R. DIXON
INSTR. # 000004161
D.B. 387, PG. 43 (PLAT)
PARCEL ID: 10241
610 NEW HOPE ROAD
12.634 AC.

STAUNTON CROSSING GRAVITY SEWER PLAN & PROFILE

SCALES: HORIZ. 1" = 20'
VERT. 1" = 5'



GRAPHIC SCALES
1" = 20'
20' 0 20' 40'
1" = 5'
5' 0 5' 10'

PLAN REVISIONS -

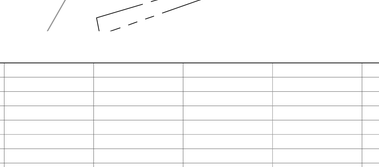
SHEET C-3
6 OF 17

SCALE
1" = 20'
1" = 5'

STAUNTON CROSSING
DOWNSTREAM SEWER UPGRADES
STAUNTON, VIRGINIA

STAUNTON CROSSING GRAVITY SEWER
- STA. 21+00 TO STA. 27+00

DATE: JANUARY 2024
ENGINEER: AAD
CHECKED: STW
CAD: PCP
JOB#: 22190



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NOTE:
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2. NO BOUNDARY SURVEY WAS COMPLETED AS PART OF THIS PROJECT.

MATCH LINE STA. 27+00, SEE SHEET C-3

DELINEATED WATERS OF THE U.S. (TYP.)

DELINEATED WETLANDS (TYP.)

26
PARK W. THOMPSON AND SANDRA H. THOMPSON
D.B. 773, PG. 325
D.B. 471, PG. 389 (PLAT)
D.B. 773, PG. 323 (L&E)
PARCEL ID: 10369
601 NEW HOPE ROAD
23.90 AC.

24
ANAMARIA R. DIXON
INSTR. # 000004161
D.B. 387, PG. 43 (PLAT)
PARCEL ID: 10241
610 NEW HOPE ROAD
12.634 AC.

HIGH PRESSURE GAS MAIN - COLUMBIA GAS OF VIRGINIA (PER PLANS) CALL 614-809-2092 AT LEAST THREE BUSINESS DAYS' NOTICE BEFORE DIGGING/WORKING IN THIS AREA (UTILITY NOT FIELD VERIFIED)

REPLACE EXISTING GRAVITY SEWER WITH 301'- 15" PVC @ 0.60%

30' TEMPORARY CONSTRUCTION EASEMENT

REMOVE AND REPLACE 10' CONCRETE ENCASEMENT

REMOVE AND REPLACE 20' CONCRETE ENCASEMENT

REPLACE EXISTING GRAVITY SEWER WITH 278'- 16" DI @ 1.09%

20' PERMANENT SANITARY SEWER EASEMENT D.B. 430, PG. 262

WATERLINE EASEMENT INSTR. # 120001530

30' PRESCRIPTIVE EASEMENT

VARIABLE WIDTH CONSTRUCTION EASEMENT

20' PERMANENT UTILITY EASEMENT

NEW GRAVITY SEWER 149'- 15" PVC @ 1.64%

STA. 28+06
REPLACE CONC SMX 2303 (#9030)
WITH 48"∅ PRECAST MH WITH
WATERTIGHT FRAME & COVER
RIM = 1298.90
INV IN (E) = 1290.70 (16")
INV OUT (N) = 1290.55 (15")

STA. 30+84
NEW 48"∅ PRECAST MH (VENTED) WITH
WATERTIGHT FRAME & COVER
N: 6738197.79
E: 11328142.00
RIM = 1301.70
INV IN (SE) = 1293.88 (15")
INV OUT (W) = 1293.73 (16")

CUT, CAP AND ABANDON EXISTING 8" PVC SAN WITH FLOWABLE FILL

ABANDON EXISTING MANHOLE IN ACCORDANCE WITH CITY DETAIL S-14, SEE DRAWING D-3

GRAVITY SEWER TO BE INSTALLED USING OPEN CUT ACROSS NEW HOPE ROAD

STA. 32+33
REPLACE CONC SMX 2305 (#9025)
WITH 48"∅ PRECAST MH WITH
WATERTIGHT FRAME & COVER
RIM = 1302.76
INV IN (SE) = 1296.47 (15")
INV OUT (NW) = 1296.32 (15")

REPLACE EXISTING GRAVITY SEWER WITH 301'- 15" PVC @ 2.13%

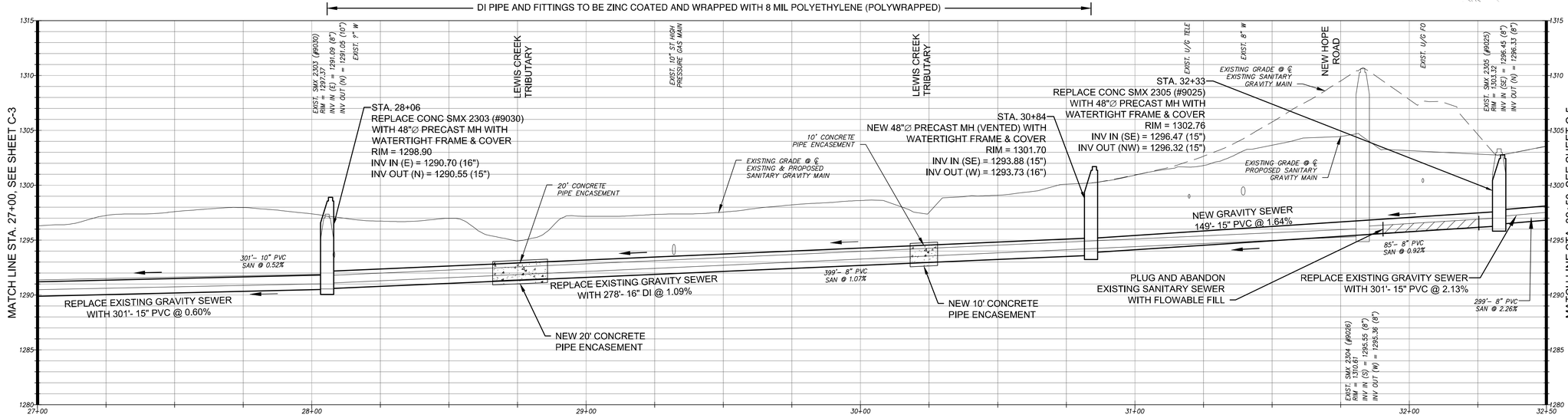
MATCH LINE STA. 32+50, SEE SHEET C-5

SMX 2303 (#9030)
SMX 2304 (#9026)
SMX 2305 (#9025)

STAUNTON CROSSING GRAVITY SEWER PLAN & PROFILE

SCALES: HORIZ. 1" = 20'
VERT. 1" = 5'

DI PIPE AND FITTINGS TO BE ZINC COATED AND WRAPPED WITH 8 MIL POLYETHYLENE (POLYWRAPPED)



GRAPHIC SCALES
1" = 20'
20' 0 20' 40'
1" = 5'
5' 0 5' 10'

PLAN REVISIONS -

SHEET C-4 7 OF 17

SCALE 1" = 20' 1" = 5'

STAUNTON CROSSING DOWNSTREAM SEWER UPGRADES
STAUNTON, VIRGINIA

STAUNTON CROSSING GRAVITY SEWER - STA. 27+00 TO STA. 32+50

DATE: JANUARY 2024
ENGINEER: AAD
CHECKED: STW
CAD: PCP
JOB#: 22190

COMMONWEALTH OF VIRGINIA — Stephen Trey Williams — Lic. No. 0402059357 — PROFESSIONAL ENGINEER — 1/12/2024

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RUMMEL, KLEPPER & KAHL, LLP

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NOTE:
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2. NO BOUNDARY SURVEY WAS COMPLETED AS PART OF THIS PROJECT.

(23) APPOMATTOX LIME COMPANY
D.B. 623, PG. 39
D.B. 608, PG. 502 (PLAT)
PARCEL ID: 10213
620 NEW HOPE ROAD
0.97 AC.

(22) DARRELL WILSON ROWE AND JOANN ROWE
INSTR. # 050005471
PARCEL ID: 10443
690 NEW HOPE ROAD
0.789 AC.

(24) ANAMARIA R. DIXON
INSTR. # 000004161
D.B. 387, PG. 43 (PLAT)
PARCEL ID: 10241
610 NEW HOPE ROAD
12.634 AC.

(19) APPOMATTOX LIME COMPANY
D.B. 623, PG. 39
D.B. 608, PG. 502 (PLAT)
PARCEL ID: 10215
215 NATIONAL AVENUE
25.135 AC.

MATCH LINE STA. 32+50, SEE SHEET C-4

REPLACE EXISTING GRAVITY SEWER WITH 301'- 15" PVC @ 2.13%

30' TEMPORARY CONSTRUCTION EASEMENT

SANITARY SEWER EASEMENT D.B. 30, PG. 269

INSTALL 4" PVC SAN WITH PROPERTY LINE CLEANOUT, SEE NOTE 1

REMOVE AND REPLACE EXISTING FENCE

REPLACE EXISTING GRAVITY SEWER WITH 201'- 15" PVC @ 0.78%

20' TEMPORARY CONSTRUCTION EASEMENT

VARIABLE WIDTH PERMANENT UTILITY EASEMENT

CONNECT 5'- 8" PVC SAN @ INV. = 1306.15±

VARIABLE WIDTH TEMPORARY CONSTRUCTION EASEMENT

NEW GRAVITY SEWER 186'- 15" PVC @ 6.56% 38+00

MATCH LINE STA. 38+00, SEE SHEET C-6

FROM SMX 2308 (#9024)

DELINEATED WATERS OF THE U.S. (TYP.)

DELINEATED WETLANDS (TYP.)

STA. 35+34
REPLACE CONC SMX 2306 (#9021) WITH 48"∅ PRECAST MH WITH STANDARD FRAME & COVER
N: 6737830.26
E: 11328401.97
RIM = 1313.50
INV IN (SE) = 1303.05 (15")
INV IN (E) = 1304.08 (4")
INV OUT (NW) = 1302.90 (15")

STA. 37+36
REPLACE CONC SMX 2307 (#9022) WITH 48"∅ PRECAST MH WITH STANDARD FRAME & COVER
N: 6737646.60
E: 11328484.52
RIM = 1316.05
INV IN (SE) = 1304.78 (15")
INV IN (E) = 1305.81 (8")
INV OUT (NW) = 1304.63 (15")

PLUG AND ABANDON EXISTING SANITARY SEWER WITH FLOWABLE FILL

APPROX. VEPCO TRANSMISSION LINE EASEMENT D.B. 608, PG. 502

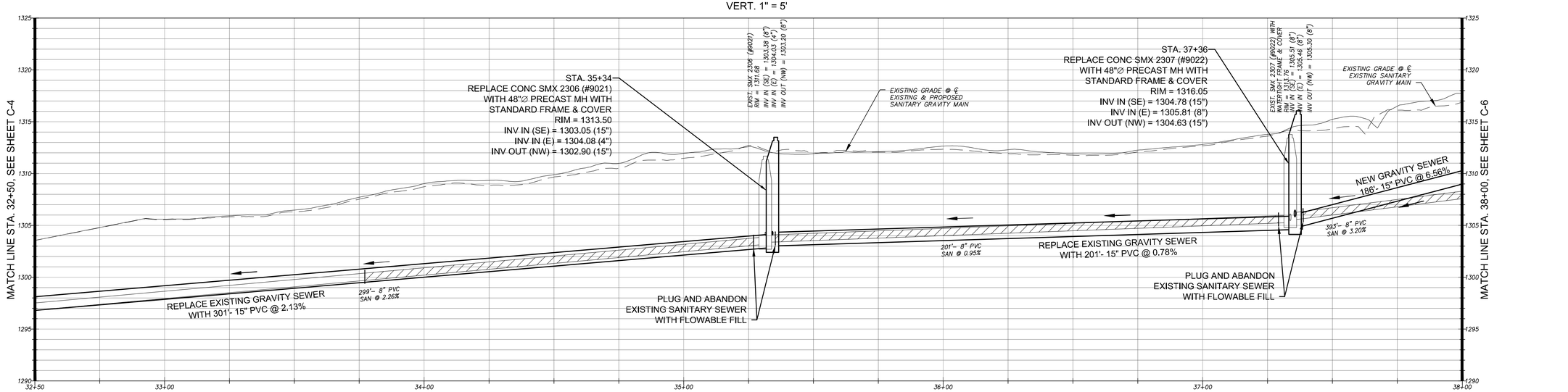
SMX 2307 (#9022)
SANITARY MH
RIM=1313.76'
GROUND ELEV= 1313.60'
INV. IN=1305.51' (8" PVC FROM #9017)
INV. IN=1305.46' (8" PVC FROM #9024)
INV. OUT=1305.30' (8" PVC TO #9021)

SMX 2308 (#9024)
SANITARY MH
RIM=1328.70'
GROUND ELEV= 1328.36'
INV. IN=1322.16' (8" PVC FROM A.D.)
INV. OUT=1320.34' (8" PVC TO #9022)

SMX 2306 (#9021)
SANITARY MH
RIM=1311.68'
GROUND ELEV= 1311.59'
INV. IN=1303.38' (8" PVC FROM #9022)
INV. IN=1304.03' (4" PVC FROM A.D.)
INV. OUT=1303.20' (8" PVC TO #9025)

STAUNTON CROSSING GRAVITY SEWER PLAN & PROFILE

SCALES: HORIZ. 1" = 20'
VERT. 1" = 5'



GRAPHIC SCALES
1" = 20' 20' 0 20' 40'
1" = 5' 5' 0 5' 10'

PLAN REVISIONS -

SHEET C-5
8 OF 17

SCALE 1" = 20' 1" = 5'

STAUNTON CROSSING
DOWNSTREAM SEWER UPGRADES
STAUNTON, VIRGINIA

STAUNTON CROSSING GRAVITY SEWER
- STA. 32+50 TO STA. 38+00

DATE: JANUARY 2024
ENGINEER: AAD
CHECKED: STW
CAD: PCP
JOB#: 22190

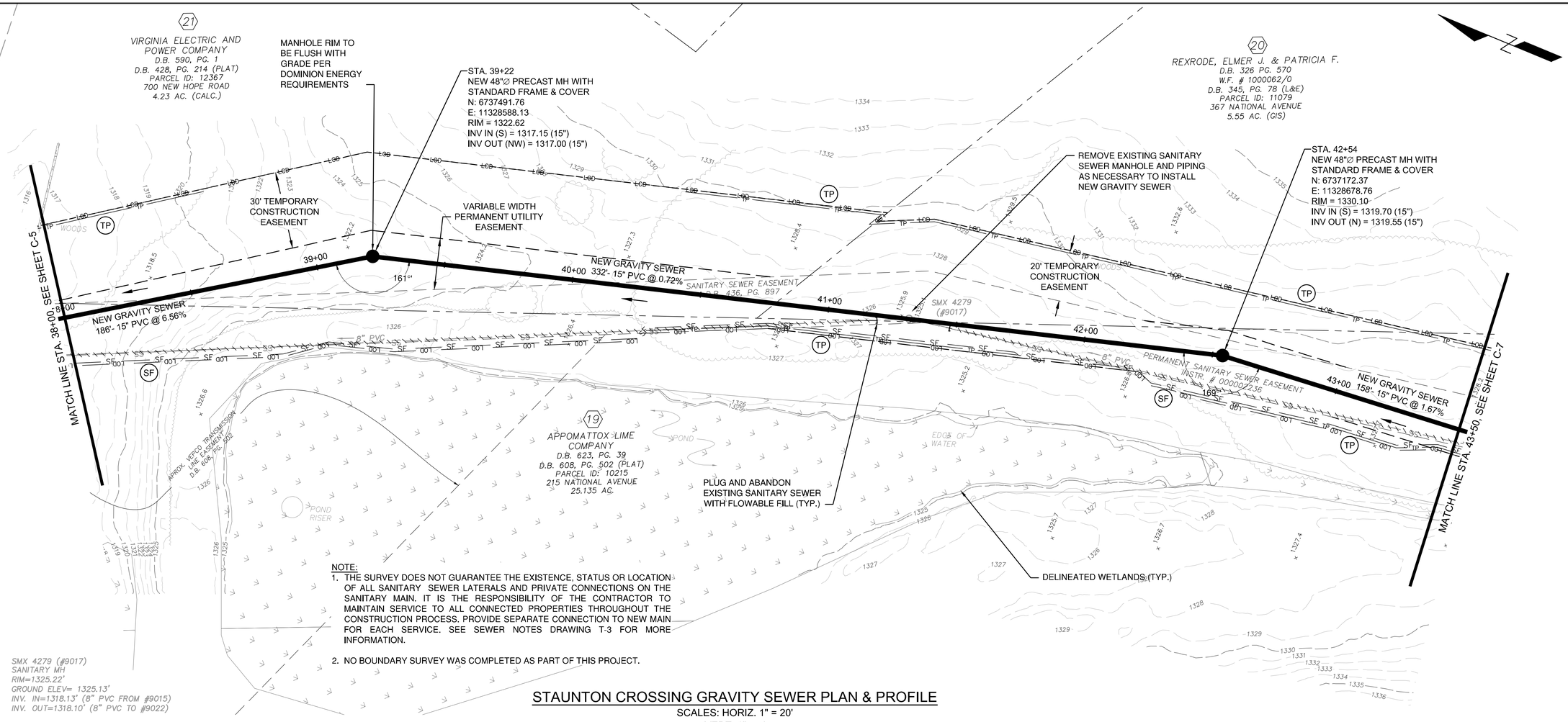
COMMONWEALTH OF VIRGINIA
Stephen Troy Wilkins
Lic. No. 040205937
PROFESSIONAL ENGINEER
1/12/2024

310 FIRST STREET, SUITE 400
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Engineers|Construction Managers|Planners|Scientists

RUMMEL, KLEPPER & KAHL, LLP

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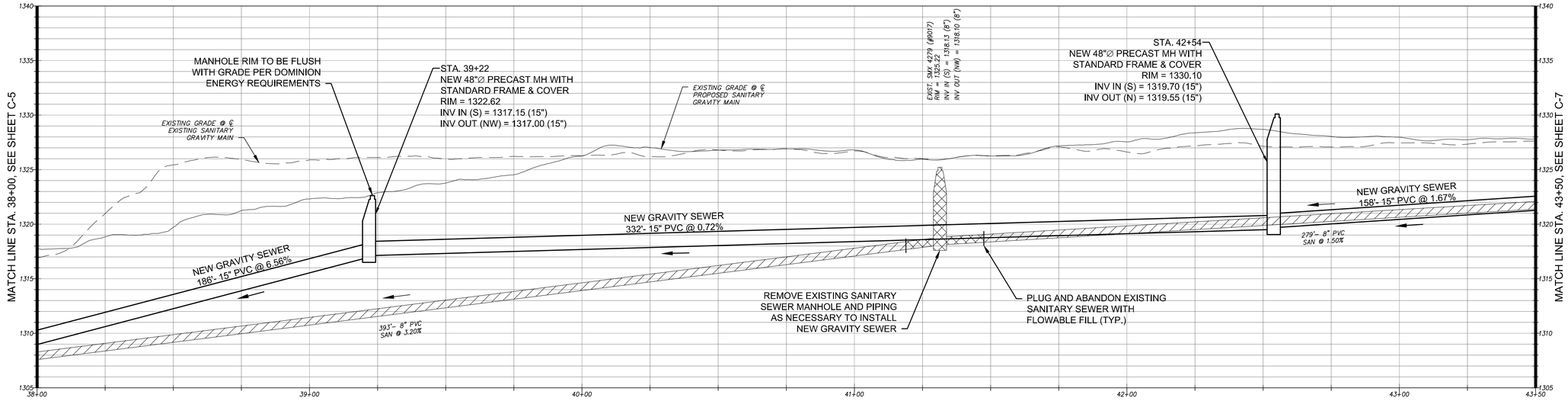
NOTE:

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2. NO BOUNDARY SURVEY WAS COMPLETED AS PART OF THIS PROJECT.

SMX 4279 (#9017)
SANITARY MH
RIM=1325.22'
GROUND ELEV= 1325.13'
INV. IN=1318.13' (8" PVC FROM #9015)
INV. OUT=1318.10' (8" PVC TO #9022)

STAUNTON CROSSING GRAVITY SEWER PLAN & PROFILE

SCALES: HORIZ. 1" = 20'
VERT. 1" = 5'



GRAPHIC SCALES

1" = 20': 20' 0 20' 40'

1" = 5': 5' 0 5' 10'

PLAN REVISIONS -

SHEET C-6 9 OF 17

SCALE 1" = 20' 1" = 5'

STAUNTON CROSSING DOWNSTREAM SEWER UPGRADES

STAUNTON, VIRGINIA

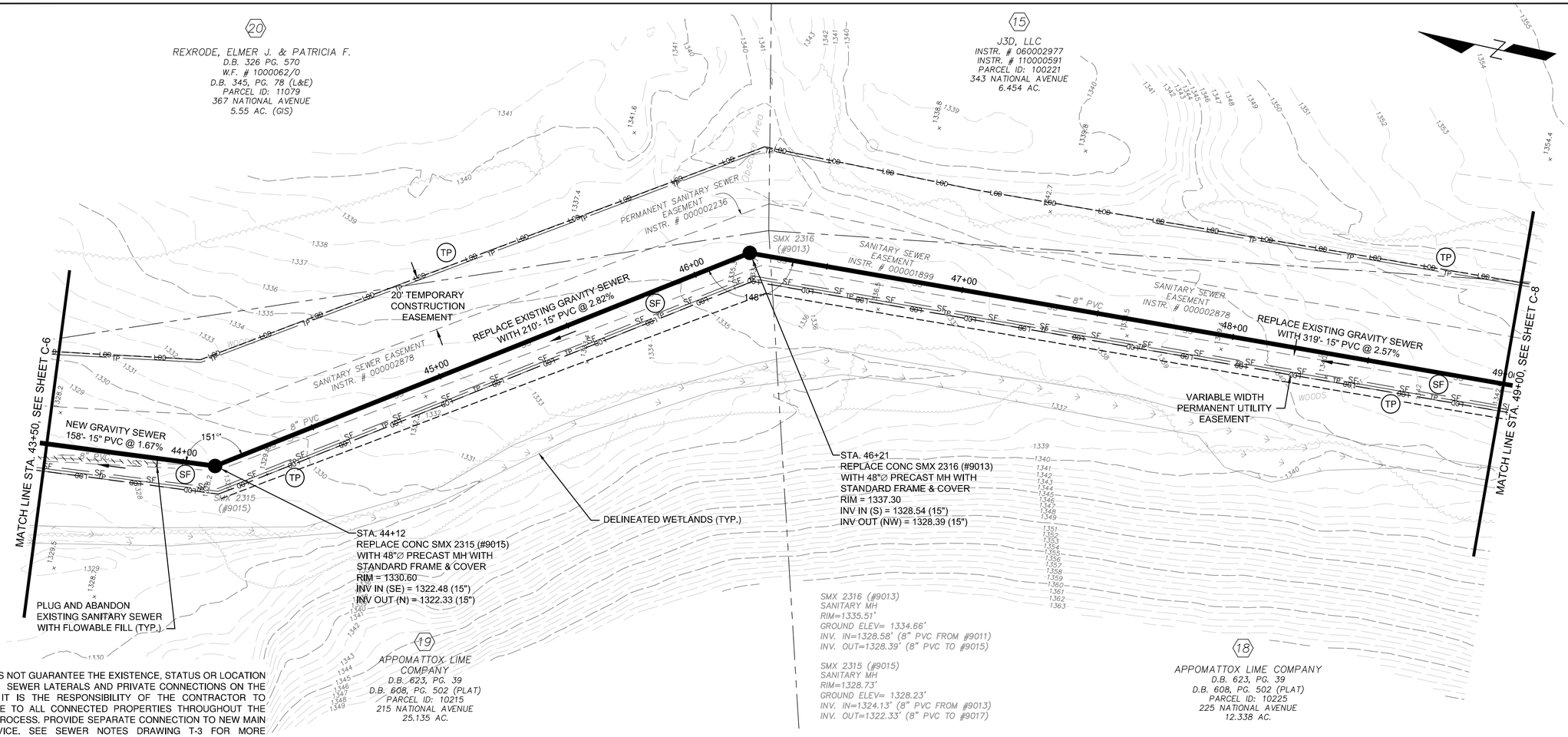
STAUNTON CROSSING GRAVITY SEWER - STA. 38+00 TO STA. 43+50

DATE: JANUARY 2024
ENGINEER: AAD
CHECKED: STW
CAD: PCP
JOB#: 22190

COMMONWEALTH OF VIRGINIA — Stephen Troy Wilkins — Lic. No. 0402058357 — ENGINEER — PROFESSIONAL — 1/12/2024

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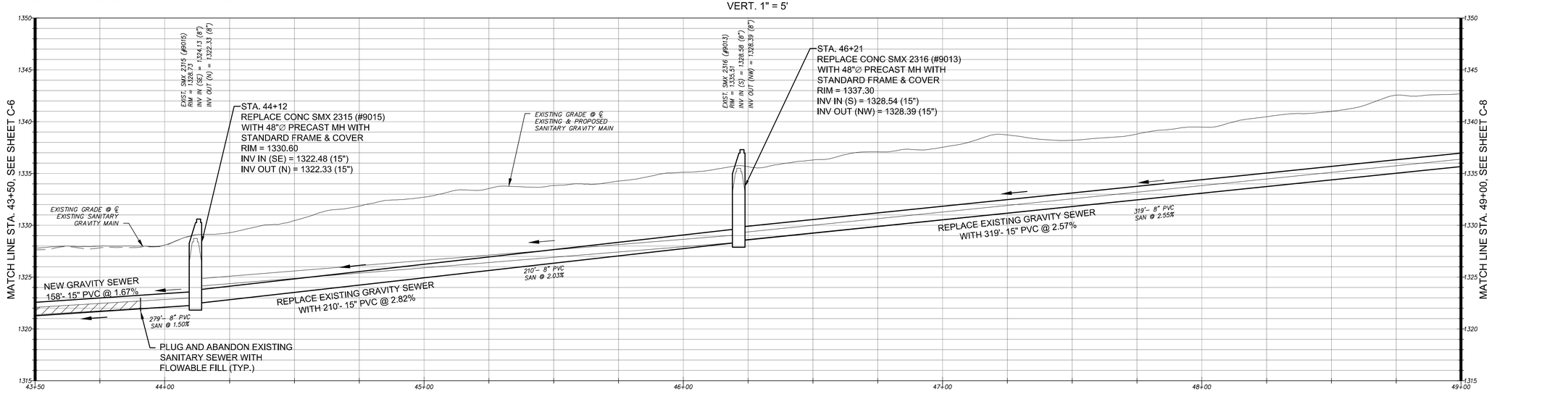


NOTE:

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2. NO BOUNDARY SURVEY WAS COMPLETED AS PART OF THIS PROJECT.

STAUNTON CROSSING GRAVITY SEWER PLAN & PROFILE

SCALES: HORIZ. 1" = 20'
VERT. 1" = 5'



GRAPHIC SCALES

1" = 20': 20' 0 20' 40'
1" = 5': 5' 0 5' 10'

PLAN REVISIONS -

SHEET C-7
10 OF 17

SCALE
1" = 20'
1" = 5'

STAUNTON CROSSING
DOWNSTREAM SEWER UPGRADES
STAUNTON, VIRGINIA

STAUNTON CROSSING GRAVITY SEWER
- STA. 43+50 TO STA. 49+00

DATE: JANUARY 2024
ENGINEER: AAD
CHECKED: STW
CAD: PCP
JOB#: 22190

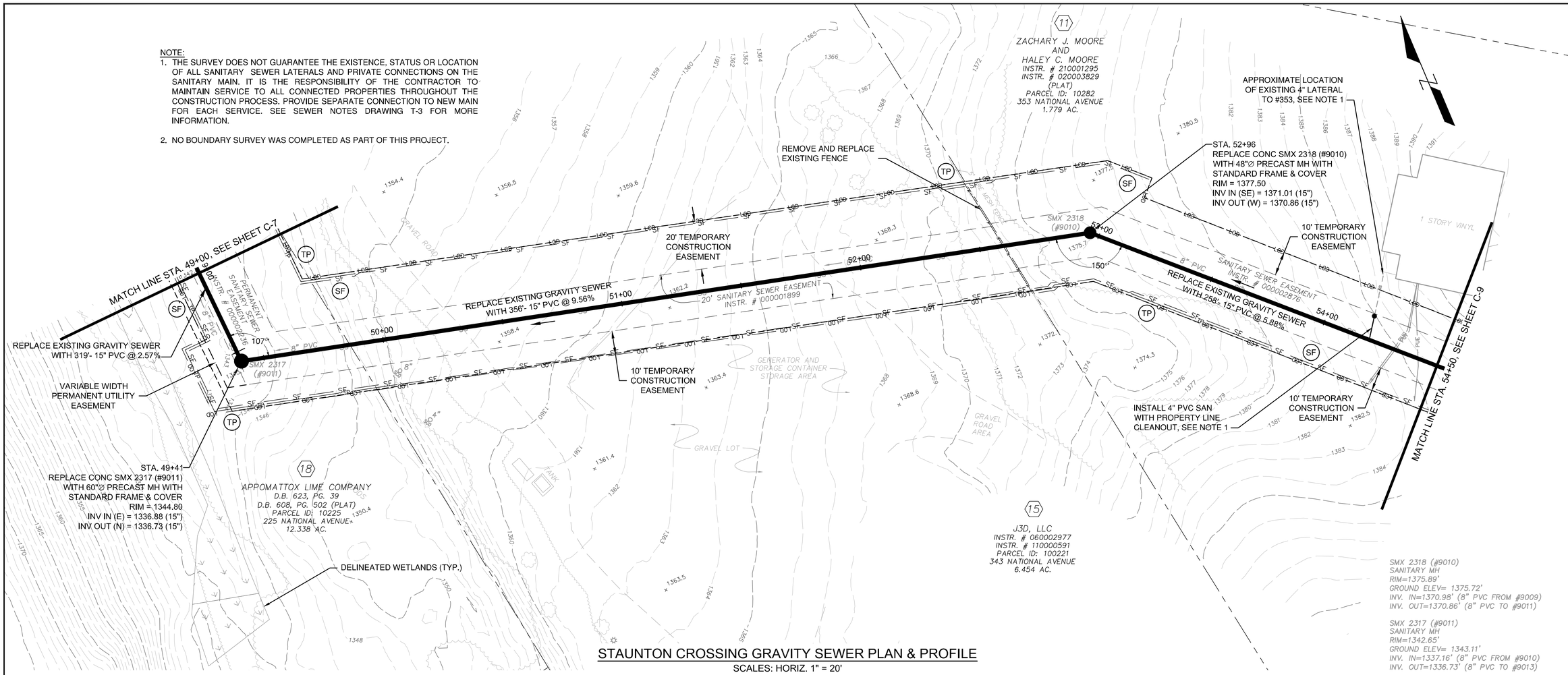
COMMONWEALTH OF VIRGINIA
Stephen Troy Wilkins
Lic. No. 040205937
1/12/2024
REGISTERED PROFESSIONAL ENGINEER

RUMMEL, KLEPPER & KAHL, LLP
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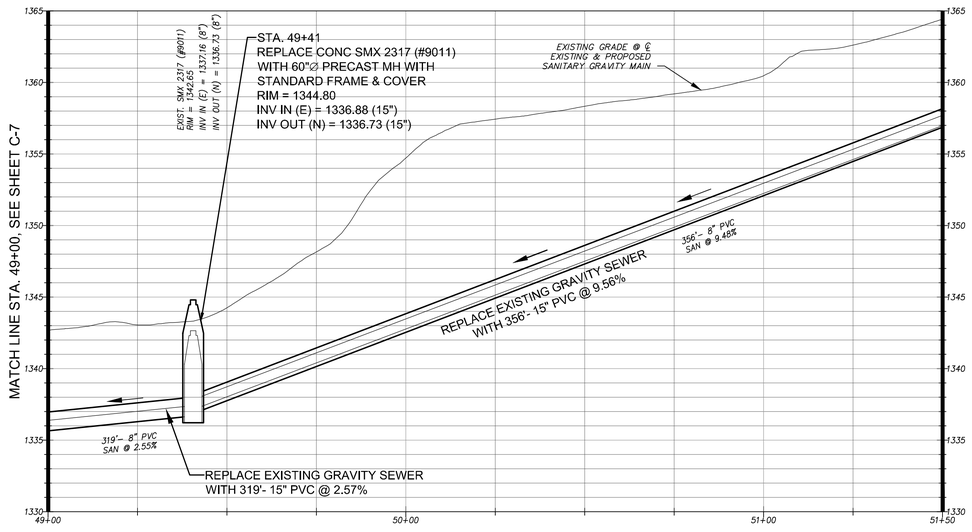
NOTE:
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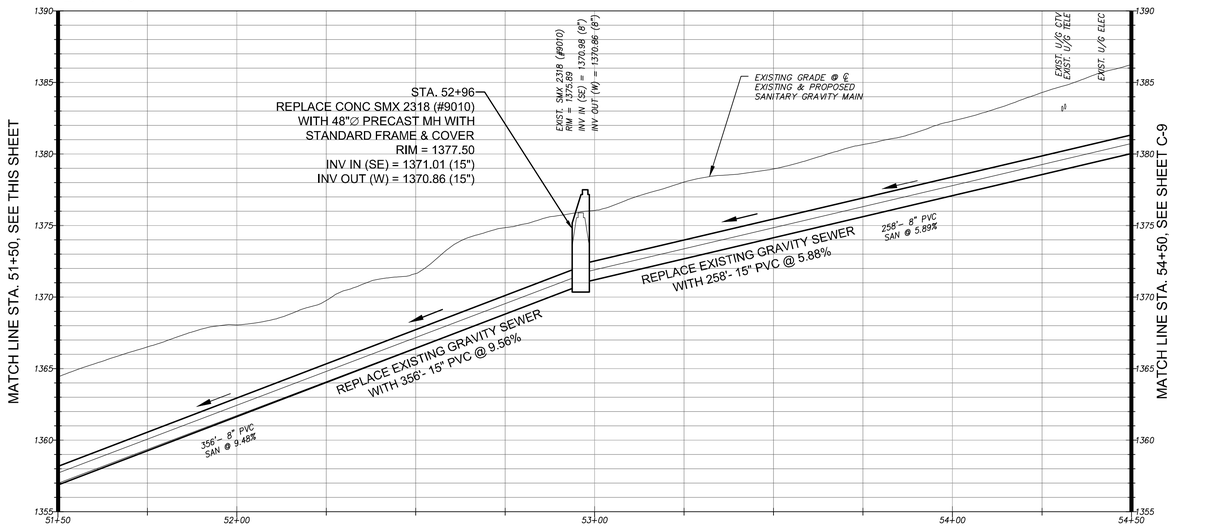
2. NO BOUNDARY SURVEY WAS COMPLETED AS PART OF THIS PROJECT.



STAUNTON CROSSING GRAVITY SEWER PLAN & PROFILE

SCALES: HORIZ. 1" = 20'
VERT. 1" = 5'





GRAPHIC SCALES
1" = 20': 20' 0 20' 40'
1" = 5': 5' 0 5' 10'

PLAN REVISIONS -

SHEET C-8 11 OF 17

SCALE 1" = 20' 1" = 5'

STAUNTON CROSSING
DOWNSTREAM SEWER UPGRADES
STAUNTON, VIRGINIA

STAUNTON CROSSING GRAVITY SEWER
- STA. 49+00 TO STA. 54+50

DATE: JANUARY 2024
ENGINEER: AAD
CHECKED: STW
CAD: PCP
JOB#: 22190

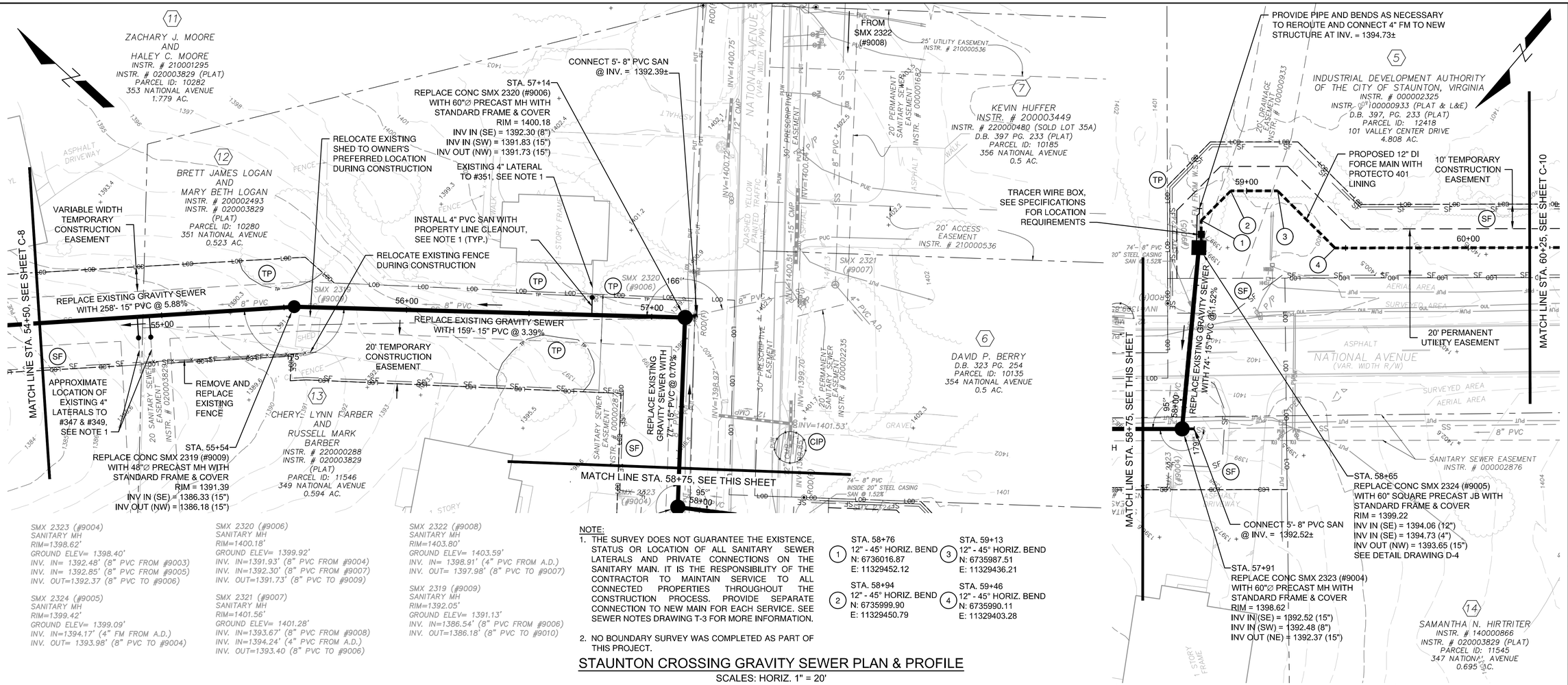
COMMONWEALTH OF VIRGINIA
Stephen Tyler Wilkins
Lic. No. 0402059337
PROFESSIONAL ENGINEER
1/12/2024

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RUMMEL, KLEPPER & KAHL, LLP

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NOTE:

1. THE SURVEY DOES NOT GUARANTEE THE EXISTENCE, STATUS OR LOCATION OF ALL SANITARY SEWER LATERALS AND PRIVATE CONNECTIONS ON THE SANITARY MAIN. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN SERVICE TO ALL CONNECTED PROPERTIES THROUGHOUT THE CONSTRUCTION PROCESS. PROVIDE SEPARATE CONNECTION TO NEW MAIN FOR EACH SERVICE. SEE SEWER NOTES DRAWING T-3 FOR MORE INFORMATION.
2. NO BOUNDARY SURVEY WAS COMPLETED AS PART OF THIS PROJECT.

SMX 2323 (#9004)
SANITARY MH
RIM=1398.62'
GROUND ELEV= 1398.40'
INV. IN= 1392.48' (8" PVC FROM #9003)
INV. IN= 1392.85' (8" PVC FROM #9005)
INV. OUT=1392.37 (8" PVC TO #9006)

SMX 2324 (#9005)
SANITARY MH
RIM=1399.42'
GROUND ELEV= 1399.09'
INV. IN=1394.17' (4" FM FROM A.D.)
INV. OUT= 1393.98' (8" PVC TO #9004)

SMX 2320 (#9006)
SANITARY MH
RIM=1400.18'
GROUND ELEV= 1399.92'
INV. IN=1391.93' (8" PVC FROM #9004)
INV. IN=1392.30' (8" PVC FROM #9007)
INV. OUT=1391.73' (8" PVC TO #9009)

SMX 2321 (#9007)
SANITARY MH
RIM=1401.56'
GROUND ELEV= 1401.28'
INV. IN=1393.67' (8" PVC FROM #9008)
INV. IN=1394.24' (4" PVC FROM A.D.)
INV. OUT=1393.40 (8" PVC TO #9006)

SMX 2322 (#9008)
SANITARY MH
RIM=1403.80'
GROUND ELEV= 1403.59'
INV. IN= 1398.91' (4" PVC FROM A.D.)
INV. OUT= 1397.98' (8" PVC TO #9007)

SMX 2319 (#9009)
SANITARY MH
RIM=1392.05'
GROUND ELEV= 1391.13'
INV. IN=1386.54' (8" PVC FROM #9006)
INV. OUT=1386.18' (8" PVC TO #9010)

STA. 58+76
1 12" - 45° HORIZ. BEND
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E: 11329452.12

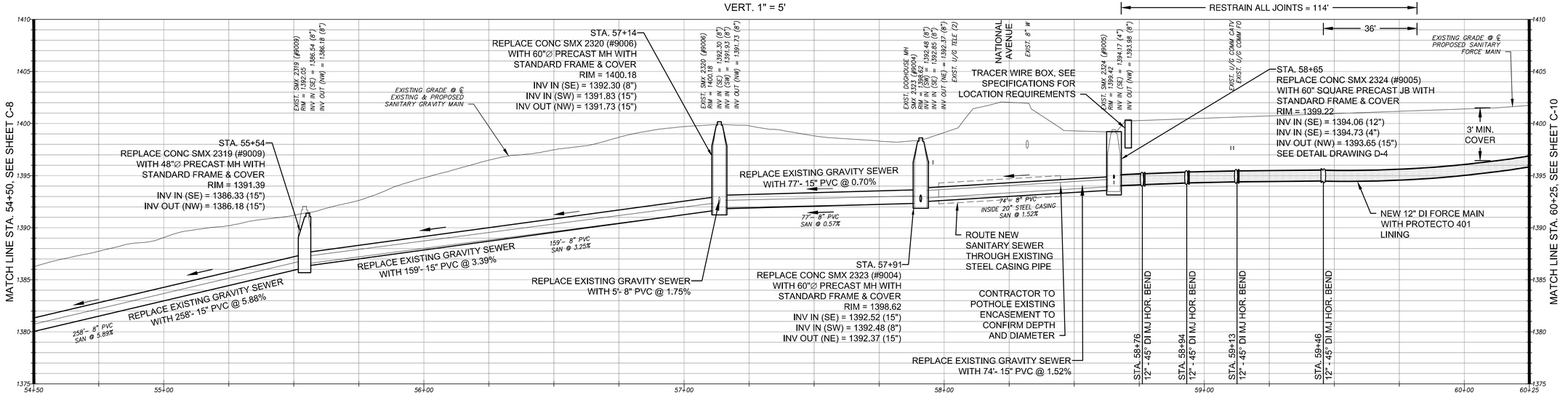
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STA. 59+13
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STA. 59+46
4 12" - 45° HORIZ. BEND
N: 6735990.11
E: 11329403.28

STAUNTON CROSSING GRAVITY SEWER PLAN & PROFILE

SCALES: HORIZ. 1" = 20'
VERT. 1" = 5'



GRAPHIC SCALES
1" = 20'
1" = 5'

PLAN REVISIONS -

SHEET C-9 12 OF 17

SCALE 1" = 20' 1" = 5'

DATE: JANUARY 2024
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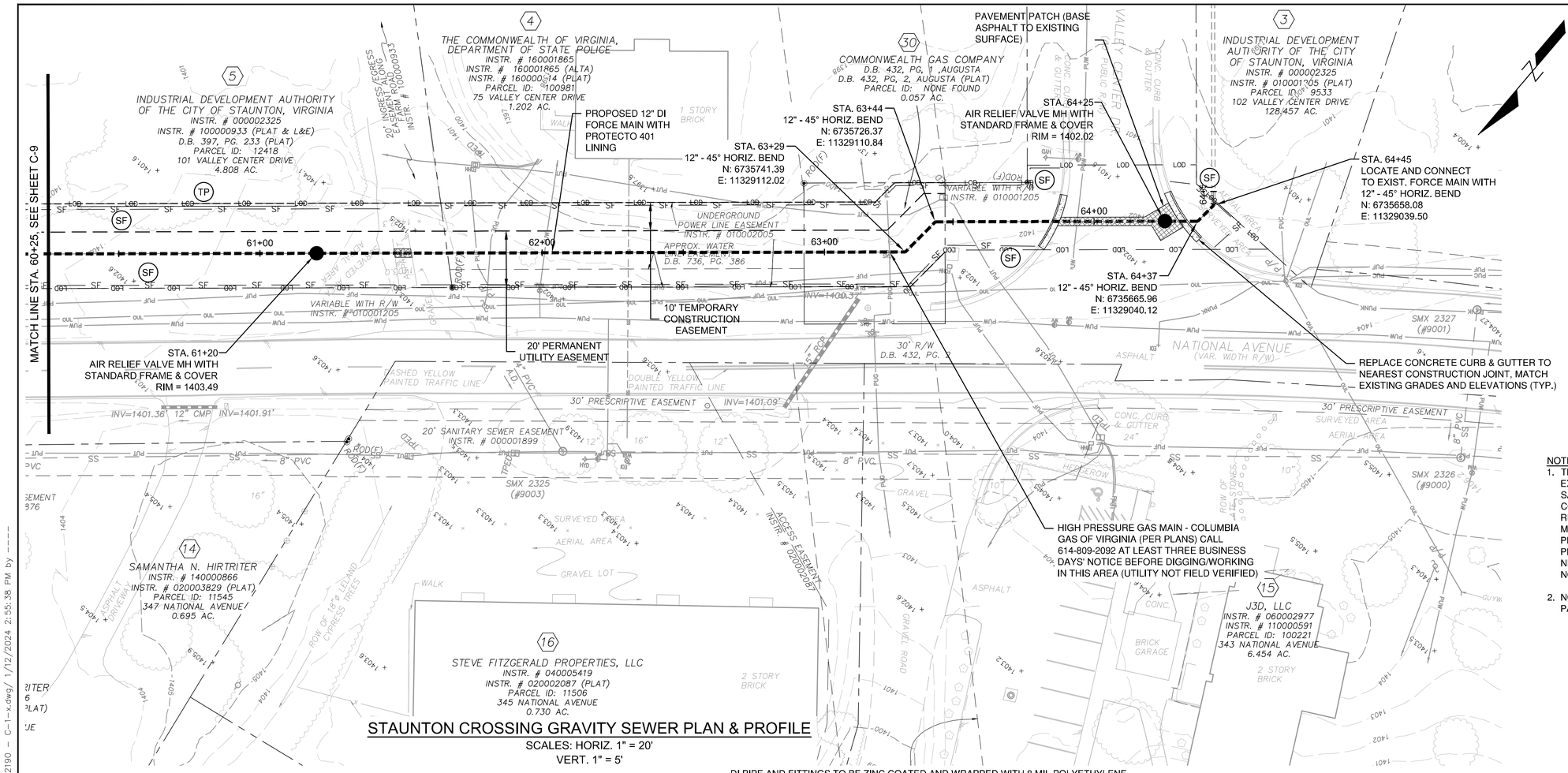
STAUNTON CROSSING DOWNSTREAM SEWER UPGRADES
STAUNTON, VIRGINIA

STAUNTON CROSSING GRAVITY SEWER - STA. 54+50 TO STA. 60+25

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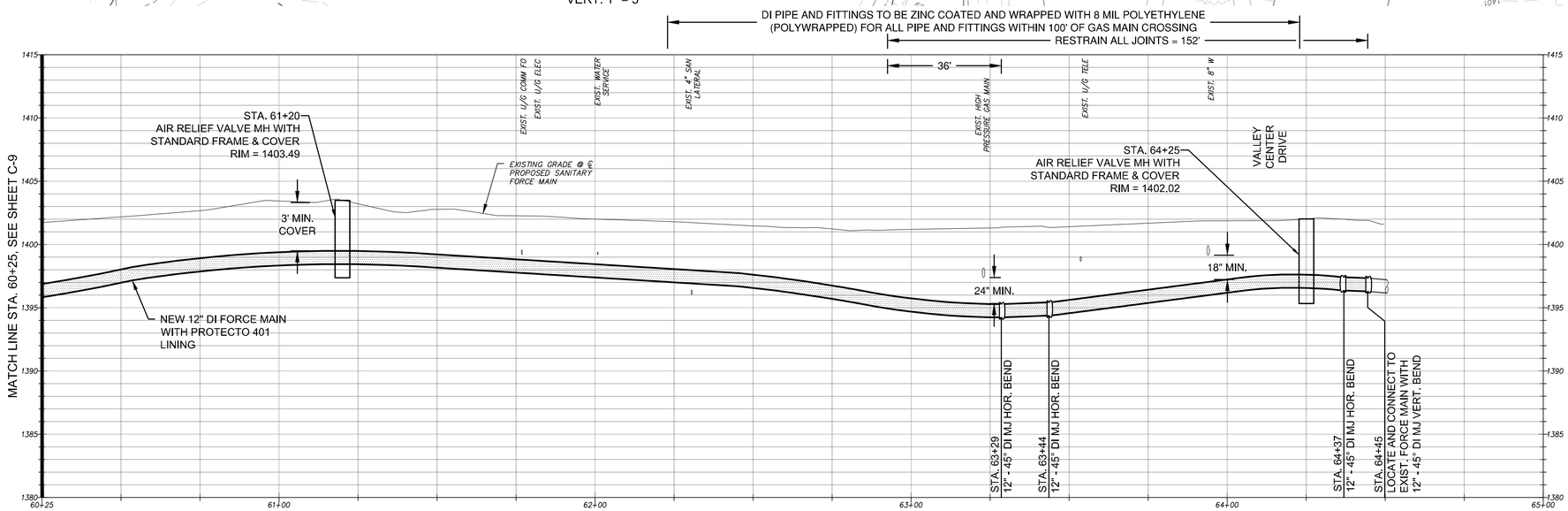


NOTE:

1. THE SURVEY DOES NOT GUARANTEE THE EXISTENCE, STATUS OR LOCATION OF ALL SANITARY SEWER LATERALS AND PRIVATE CONNECTIONS ON THE SANITARY MAIN. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN SERVICE TO ALL CONNECTED PROPERTIES THROUGHOUT THE CONSTRUCTION PROCESS. PROVIDE SEPARATE CONNECTION TO NEW MAIN FOR EACH SERVICE. SEE SEWER NOTES DRAWING T-3 FOR MORE INFORMATION.
2. NO BOUNDARY SURVEY WAS COMPLETED AS PART OF THIS PROJECT.

STAUNTON CROSSING GRAVITY SEWER PLAN & PROFILE

SCALES: HORIZ. 1" = 20'
VERT. 1" = 5'



GRAPHIC SCALES

1" = 20': 20' 0 20' 40'

1" = 5': 5' 0 5' 10'

PLAN REVISIONS -

SHEET C-10 13 OF 17

SCALE 1" = 20' 1" = 5'

STAUNTON CROSSING DOWNSTREAM SEWER UPGRADES

STAUNTON, VIRGINIA

STAUNTON CROSSING GRAVITY SEWER - STA. 60+25 TO STA. 64+44

DATE: JANUARY 2024
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CAD: PCP
JOB#: 22190

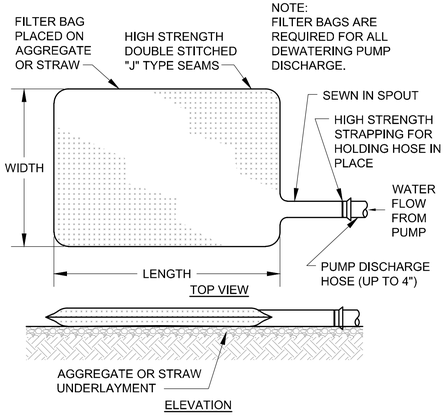
COMMONWEALTH OF VIRGINIA — Stephen Trey Williams — Lic. No. 040205955F — PROFESSIONAL ENGINEER — 1/12/2024

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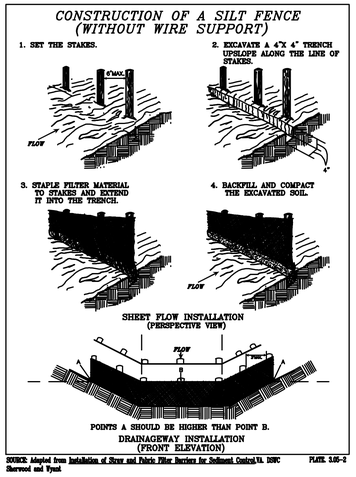
\\ad.rkk.com\rs\Cloud\Projects\2022\22190_CSOnCall\22190.001 - Staunton Crossing Downstream Sewer\CAD\(02)22190 - C-1-x.dwg, 1/12/2024 2:55:38 PM by ----

EROSION AND SEDIMENT MINIMUM STANDARDS:

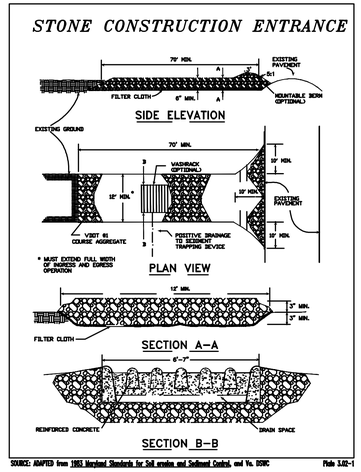
1. PERMANENT OR TEMPORARY SOIL STABILIZATION SHALL BE APPLIED TO DENUDED AREAS WITHIN SEVEN DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE. TEMPORARY SOIL STABILIZATION SHALL BE APPLIED WITHIN SEVEN DAYS TO DENUDED AREAS THAT MAY NOT BE AT FINAL GRADE BUT WILL REMAIN DORMANT FOR LONGER THAN 14 DAYS. PERMANENT STABILIZATION SHALL BE APPLIED TO AREAS THAT ARE TO BE LEFT DORMANT FOR MORE THAN ONE YEAR.
2. DURING CONSTRUCTION OF THE PROJECT, SOIL STOCK PILES AND BORROW AREAS SHALL BE STABILIZED OR PROTECTED WITH SEDIMENT TRAPPING MEASURES. THE APPLICANT IS RESPONSIBLE FOR THE TEMPORARY PROTECTION AND PERMANENT STABILIZATION OF ALL SOIL STOCKPILES ON SITE AS WELL AS BORROW AREAS AND SOIL INTENTIONALLY TRANSPORTED FROM THE PROJECT SITE.
3. A PERMANENT VEGETATIVE COVER SHALL BE ESTABLISHED ON DENUDED AREAS NOT OTHERWISE PERMANENTLY STABILIZED. PERMANENT VEGETATION SHALL NOT BE CONSIDERED ESTABLISHED UNTIL A GROUND COVER IS ACHIEVED THAT IS UNIFORM, MATURE ENOUGH TO SURVIVE AND WILL INHIBIT EROSION.
4. SEDIMENT BASINS AND TRAPS, PERIMETER DIKES, SEDIMENT BARRIERS AND OTHER MEASURES INTENDED TO TRAP SEDIMENT SHALL BE CONSTRUCTED AS A FIRST STEP IN ANY LAND-DISTURBING ACTIVITY AND SHALL BE MADE FUNCTIONAL BEFORE UPSLOPE LAND DISTURBANCE TAKES PLACE.
5. STABILIZATION MEASURES SHALL BE APPLIED TO EARTHEN STRUCTURES SUCH AS DAMS, DIKES AND DIVERSIONS IMMEDIATELY AFTER INSTALLATION.
6. SEDIMENT TRAPS AND SEDIMENT BASINS SHALL BE DESIGNED AND CONSTRUCTED BASED UPON THE TOTAL DRAINAGE AREA TO BE SERVED BY THE TRAP OR BASIN.
   a. THE MINIMUM STORAGE CAPACITY OF A SEDIMENT TRAP SHALL BE 134 CUBIC YARDS PER ACRE OF DRAINAGE AREA AND THE TRAP SHALL ONLY CONTROL DRAINAGE AREAS LESS THAN THREE ACRES.
   b. SURFACE RUNOFF FROM DISTURBED AREAS THAT IS COMPRISED OF FLOW FROM DRAINAGE AREAS GREATER THAN OR EQUAL TO THREE ACRES SHALL BE CONTROLLED BY A SEDIMENT BASIN. THE MINIMUM STORAGE CAPACITY OF A SEDIMENT BASIN SHALL BE 134 CUBIC YARDS PER ACRE OF DRAINAGE AREA. THE OUTFALL SYSTEM SHALL, AT A MINIMUM, MAINTAIN THE STRUCTURAL INTEGRITY OF THE BASIN DURING A 25-YEAR STORM OF 24-HOUR DURATION. RUNOFF COEFFICIENTS USED IN RUNOFF CALCULATIONS SHALL CORRESPOND TO A BARE EARTH CONDITION OR THOSE CONDITIONS EXPECTED TO EXIST WHILE THE SEDIMENT BASIN IS UTILIZED.
7. CUT AND FILL SLOPES SHALL BE DESIGNED AND CONSTRUCTED IN A MANNER THAT WILL MINIMIZE EROSION. SLOPES THAT ARE FOUND TO BE ERODING EXCESSIVELY WITHIN ONE YEAR OF PERMANENT STABILIZATION SHALL BE PROVIDED WITH ADDITIONAL SLOPE STABILIZING MEASURES UNTIL THE PROBLEM IS CORRECTED.
8. CONCENTRATED RUNOFF SHALL NOT FLOW DOWN CUT OR FILL SLOPES UNLESS CONTAINED WITHIN AN ADEQUATE TEMPORARY OR PERMANENT CHANNEL, FLUME OR SLOPE DRAIN STRUCTURE.
9. WHENEVER WATER SEEPS FROM A SLOPE FACE, ADEQUATE DRAINAGE OR OTHER PROTECTION SHALL BE PROVIDED.
10. ALL STORM SEWER INLETS THAT ARE MADE OPERABLE DURING CONSTRUCTION SHALL BE PROTECTED SO THAT SEDIMENT-LADEN WATER CANNOT ENTER THE CONVEYANCE SYSTEM WITHOUT FIRST BEING FILTERED OR OTHERWISE TREATED TO REMOVE SEDIMENT.
11. BEFORE NEWLY CONSTRUCTED STORMWATER CONVEYANCE CHANNELS OR PIPES ARE MADE OPERATIONAL, ADEQUATE OUTLET PROTECTION AND ANY REQUIRED TEMPORARY OR PERMANENT CHANNEL LINING SHALL BE INSTALLED IN BOTH THE CONVEYANCE CHANNEL AND RECEIVING CHANNEL.
12. WHEN WORK IN A LIVE WATERCOURSE IS PERFORMED, PRECAUTIONS SHALL BE TAKEN TO MINIMIZE ENCROACHMENT, CONTROL SEDIMENT TRANSPORT AND STABILIZE THE WORK AREA TO THE GREATEST EXTENT POSSIBLE DURING CONSTRUCTION. NONERODIBLE MATERIAL SHALL BE USED FOR THE CONSTRUCTION OF CAUSEWAYS AND COFFERDAMS. EARTHEN FILL MAY BE USED FOR THESE STRUCTURES IF ARMORED BY NONERODIBLE COVER MATERIALS.
13. WHEN A LIVE WATERCOURSE MUST BE CROSSED BY CONSTRUCTION VEHICLES MORE THAN TWICE IN ANY SIX-MONTH PERIOD, A TEMPORARY VEHICULAR STREAM CROSSING CONSTRUCTED OF NONERODIBLE MATERIAL SHALL BE PROVIDED.
14. ALL APPLICABLE FEDERAL, STATE AND LOCAL REQUIREMENTS PERTAINING TO WORKING IN OR CROSSING LIVE WATERCOURSES SHALL BE MET.
15. THE BED AND BANKS OF A WATERCOURSE SHALL BE STABILIZED IMMEDIATELY AFTER WORK IN THE WATERCOURSE IS COMPLETED.
16. UNDERGROUND UTILITY LINES SHALL BE INSTALLED IN ACCORDANCE WITH THE FOLLOWING STANDARDS IN ADDITION TO OTHER APPLICABLE CRITERIA:
   a. NO MORE THAN 500 LINEAR FEET OF TRENCH MAY BE OPENED AT ONE TIME.
   b. EXCAVATED MATERIAL SHALL BE PLACED ON THE UPHILL SIDE OF TRENCHES.
   c. EFFLUENT FROM DEWATERING OPERATIONS SHALL BE FILTERED OR PASSED THROUGH AN APPROVED SEDIMENT TRAPPING DEVICE, OR BOTH, AND DISCHARGED IN A MANNER THAT DOES NOT ADVERSELY AFFECT FLOWING STREAMS OR OFF-SITE PROPERTY.
   d. MATERIAL USED FOR BACKFILLING TRENCHES SHALL BE PROPERLY COMPACTED IN ORDER TO MINIMIZE EROSION AND PROMOTE STABILIZATION.
   e. RESTABILIZATION SHALL BE ACCOMPLISHED IN ACCORDANCE WITH THIS CHAPTER.
   f. APPLICABLE SAFETY REQUIREMENTS SHALL BE COMPLIED WITH.
17. WHERE CONSTRUCTION VEHICLE ACCESS ROUTES INTERSECT PAVED OR PUBLIC ROADS, PROVISIONS SHALL BE MADE TO MINIMIZE THE TRANSPORT OF SEDIMENT BY VEHICULAR TRACKING ONTO THE PAVED SURFACE. WHERE SEDIMENT IS TRANSPORTED ONTO A PAVED OR PUBLIC ROAD SURFACE, THE ROAD SURFACE SHALL BE CLEANED THOROUGHLY AT THE END OF EACH DAY. SEDIMENT SHALL BE REMOVED FROM THE ROADS BY SHOVELING OR SWEEPING AND TRANSPORTED TO A SEDIMENT CONTROL DISPOSAL AREA. STREET WASHING SHALL BE ALLOWED ONLY AFTER SEDIMENT IS REMOVED IN THIS MANNER. THIS PROVISION SHALL APPLY TO INDIVIDUAL DEVELOPMENT LOTS AS WELL AS TO LARGER LAND-DISTURBING ACTIVITIES.
18. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED WITHIN 30 DAYS AFTER FINAL SITE STABILIZATION OR AFTER THE TEMPORARY MEASURES ARE NO LONGER NEEDED, UNLESS OTHERWISE AUTHORIZED BY THE VESCP AUTHORITY. TRAPPED SEDIMENT AND THE DISTURBED SOIL AREAS RESULTING FROM THE DISPOSITION OF TEMPORARY MEASURES SHALL BE PERMANENTLY STABILIZED TO PREVENT FURTHER EROSION AND SEDIMENTATION.
19. PROPERTIES AND WATERWAYS DOWNSTREAM FROM DEVELOPMENT SITES SHALL BE PROTECTED FROM SEDIMENT DEPOSITION, EROSION AND DAMAGE DUE TO INCREASES IN VOLUME, VELOCITY AND PEAK FLOW RATE OF STORMWATER RUNOFF FOR THE STATED FREQUENCY STORM OF 24-HOUR DURATION IN ACCORDANCE WITH THE FOLLOWING STANDARDS AND CRITERIA. STREAM RESTORATION AND RELOCATION PROJECTS THAT INCORPORATE NATURAL CHANNEL DESIGN CONCEPTS ARE NOT MAN-MADE CHANNELS AND SHALL BE EXEMPT FROM ANY FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS FOR NATURAL OR MAN-MADE CHANNELS:
   a. CONCENTRATED STORMWATER RUNOFF LEAVING A DEVELOPMENT SITE SHALL BE DISCHARGED DIRECTLY INTO AN ADEQUATE NATURAL OR MAN-MADE RECEIVING CHANNEL, PIPE OR STORM SEWER SYSTEM. FOR THOSE SITES WHERE RUNOFF IS DISCHARGED INTO A PIPE OR PIPE SYSTEM, DOWNSTREAM STABILITY ANALYSES AT THE OUTFALL OF THE PIPE OR PIPE SYSTEM SHALL BE PERFORMED.
   b. ADEQUACY OF ALL CHANNELS AND PIPES SHALL BE VERIFIED IN THE FOLLOWING MANNER:
      (1) THE APPLICANT SHALL DEMONSTRATE THAT THE TOTAL DRAINAGE AREA TO THE POINT OF ANALYSIS WITHIN THE CHANNEL IS 100 TIMES GREATER THAN THE CONTRIBUTING DRAINAGE AREA OF THE PROJECT IN QUESTION;
      (2) (a) NATURAL CHANNELS SHALL BE ANALYZED BY THE USE OF A TWO-YEAR STORM TO VERIFY THAT STORMWATER WILL NOT OVERTOP CHANNEL BANKS NOR CAUSE EROSION OF CHANNEL BED OR BANKS.
      (a) ALL PREVIOUSLY CONSTRUCTED MAN-MADE CHANNELS SHALL BE ANALYZED BY THE USE OF A 10-YEAR STORM TO VERIFY THAT STORMWATER WILL NOT OVERTOP ITS BANKS AND BY THE USE OF A TWO-YEAR STORM TO DEMONSTRATE THAT STORMWATER WILL NOT CAUSE EROSION OF CHANNEL BED OR BANKS; AND
      (b) PIPES AND STORM SEWER SYSTEMS SHALL BE ANALYZED BY THE USE OF A 10-YEAR STORM TO VERIFY THAT STORMWATER WILL BE CONTAINED WITHIN THE PIPE OR SYSTEM.
   c. IF EXISTING NATURAL RECEIVING CHANNELS OR PREVIOUSLY CONSTRUCTED MAN-MADE CHANNELS OR PIPES ARE NOT ADEQUATE, THE APPLICANT SHALL:
      (1) IMPROVE THE CHANNELS TO A CONDITION WHERE A 10-YEAR STORM WILL NOT OVERTOP THE BANKS AND A TWO-YEAR STORM WILL NOT CAUSE EROSION TO THE CHANNEL, THE BED, OR THE BANKS;
      (2) IMPROVE THE PIPE OR PIPE SYSTEM TO A CONDITION WHERE THE 10-YEAR STORM IS CONTAINED WITHIN THE APPURTENANCES;
      (3) DEVELOP A SITE DESIGN THAT WILL NOT CAUSE THE PRE-DEVELOPMENT PEAK RUNOFF RATE FROM A TWO-YEAR STORM TO INCREASE WHEN RUNOFF OUTFALLS INTO A NATURAL CHANNEL OR WILL NOT CAUSE THE PRE-DEVELOPMENT PEAK RUNOFF RATE FROM A 10-YEAR STORM TO INCREASE WHEN RUNOFF OUTFALLS INTO A MAN-MADE CHANNEL; OR
      (4) PROVIDE A COMBINATION OF CHANNEL IMPROVEMENT, STORMWATER DETENTION OR OTHER MEASURES WHICH IS SATISFACTORY TO THE VESCP AUTHORITY TO PREVENT DOWNSTREAM EROSION.
   d. THE APPLICANT SHALL PROVIDE EVIDENCE OF PERMISSION TO MAKE THE IMPROVEMENTS.
   e. ALL HYDROLOGIC ANALYSES SHALL BE BASED ON THE EXISTING WATERSHED CHARACTERISTICS AND THE ULTIMATE DEVELOPMENT CONDITION OF THE SUBJECT PROJECT.
   f. IF THE APPLICANT CHOOSES AN OPTION THAT INCLUDES STORMWATER DETENTION, HE SHALL OBTAIN APPROVAL FROM THE VESCP OF A PLAN FOR MAINTENANCE OF THE DETENTION FACILITIES. THE PLAN SHALL SET FORTH THE MAINTENANCE REQUIREMENTS OF THE FACILITY AND THE PERSON RESPONSIBLE FOR PERFORMING THE MAINTENANCE.
   g. OUTFALL FROM A DETENTION FACILITY SHALL BE DISCHARGED TO A RECEIVING CHANNEL. AND ENERGY DISSIPATORS SHALL BE PLACED AT THE OUTFALL OF ALL DETENTION FACILITIES AS NECESSARY TO PROVIDE A STABILIZED TRANSITION FROM THE FACILITY TO THE RECEIVING CHANNEL.
   h. ALL ON-SITE CHANNELS MUST BE VERIFIED TO BE ADEQUATE.
   i. INCREASED VOLUMES OF SHEET FLOWS THAT MAY CAUSE EROSION OR SEDIMENTATION ON ADJACENT PROPERTY SHALL BE DIVERTED TO A STABLE OUTLET, ADEQUATE CHANNEL, PIPE OR PIPE SYSTEM, OR TO A DETENTION FACILITY.
   j. IN APPLYING THESE STORMWATER MANAGEMENT CRITERIA, INDIVIDUAL LOTS OR PARCELS IN A RESIDENTIAL, COMMERCIAL OR INDUSTRIAL DEVELOPMENT SHALL NOT BE CONSIDERED TO BE SEPARATE DEVELOPMENT PROJECTS. INSTEAD, THE DEVELOPMENT, AS A WHOLE, SHALL BE CONSIDERED TO BE A SINGLE DEVELOPMENT PROJECT. HYDROLOGIC PARAMETERS THAT REFLECT THE ULTIMATE DEVELOPMENT CONDITION SHALL BE USED IN ALL ENGINEERING CALCULATIONS.
   k. ALL MEASURES USED TO PROTECT PROPERTIES AND WATERWAYS SHALL BE EMPLOYED IN A MANNER WHICH MINIMIZES IMPACTS ON THE PHYSICAL, CHEMICAL AND BIOLOGICAL INTEGRITY OF RIVERS, STREAMS AND OTHER WATERS OF THE STATE.
   l. ANY PLAN APPROVED PRIOR TO JULY 1, 2014, THAT PROVIDES FOR STORMWATER MANAGEMENT THAT ADDRESSES ANY FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS FOR NATURAL OR MAN-MADE CHANNELS SHALL SATISFY THE FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS FOR NATURAL OR MAN-MADE CHANNELS IF THE PRACTICES ARE DESIGNED TO (I) DETAIN THE WATER QUALITY VOLUME AND TO RELEASE IT OVER 48 HOURS; (II) DETAIN AND RELEASE OVER A 24-HOUR PERIOD THE EXPECTED RAINFALL RESULTING FROM THE ONE YEAR, 24-HOUR STORM; AND (III) REDUCE THE ALLOWABLE PEAK FLOW RATE RESULTING FROM THE 1.5, 2, AND 10-YEAR, 24-HOUR STORMS TO A LEVEL THAT IS LESS THAN OR EQUAL TO THE PEAK FLOW RATE FROM THE SITE ASSUMING IT WAS IN A GOOD FORESTED CONDITION, ACHIEVED THROUGH MULTIPLICATION OF THE FORESTED PEAK FLOW RATE BY A REDUCTION FACTOR THAT IS EQUAL TO THE RUNOFF VOLUME FROM THE SITE WHEN IT WAS IN A GOOD FORESTED CONDITION DIVIDED BY THE RUNOFF VOLUME FROM THE SITE IN ITS PROPOSED CONDITION, AND SHALL BE EXEMPT FROM ANY FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS FOR NATURAL OR MAN-MADE CHANNELS AS DEFINED IN ANY REGULATIONS PROMULGATED PURSUANT TO § 62.1-44.15:54 OR 62.1-44.15:65 OF THE ACT.
   m. FOR PLANS APPROVED ON AND AFTER JULY 1, 2014, THE FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS OF § 62.1-44.15:52 A OF THE ACT AND THIS SUBSECTION SHALL BE SATISFIED BY COMPLIANCE WITH WATER QUANTITY REQUIREMENTS IN THE STORMWATER MANAGEMENT ACT (§ 62.1-44.15:24 ET SEQ. OF THE CODE OF VIRGINIA) AND ATTENDANT REGULATIONS, UNLESS SUCH LAND-DISTURBING ACTIVITIES (I) ARE IN ACCORDANCE WITH PROVISIONS FOR TIME LIMITS ON APPLICABILITY OF APPROVED DESIGN CRITERIA IN 9VAC25-870-47 OR GRANDFATHERING IN 9VAC25-870-48 OF THE VIRGINIA STORMWATER MANAGEMENT PROGRAM (VSMP) REGULATION, IN WHICH CASE THE FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS OF § 62.1-44.15:52 A OF THE ACT SHALL APPLY, OR (II) ARE EXEMPT PURSUANT TO § 62.1-44.15:34 C 7 OF THE ACT.
   n. COMPLIANCE WITH THE WATER QUANTITY MINIMUM STANDARDS SET OUT IN 9VAC25-870-66 OF THE VIRGINIA STORMWATER MANAGEMENT PROGRAM (VSMP) REGULATION SHALL BE DEEMED TO SATISFY THE REQUIREMENTS OF THIS SUBDIVISION 19.



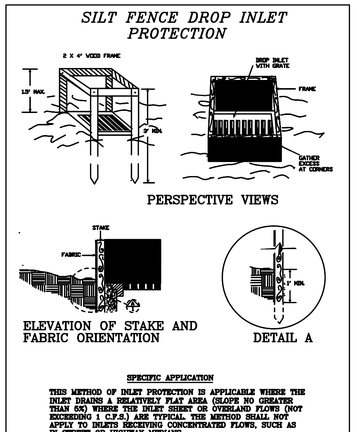
DEWATERING STRUCTURE FILTER BAG
N.T.S.



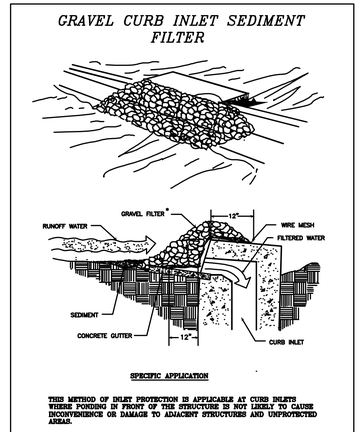
SF — SILT FENCE — N.T.S. — SF



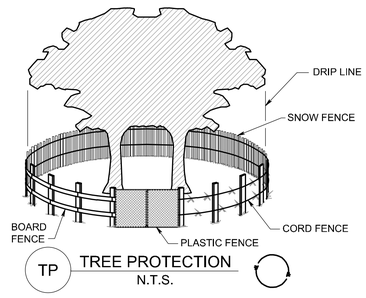
CE — CONSTRUCTION ENTRANCE — N.T.S.



IP — INLET PROTECTION — N.T.S.

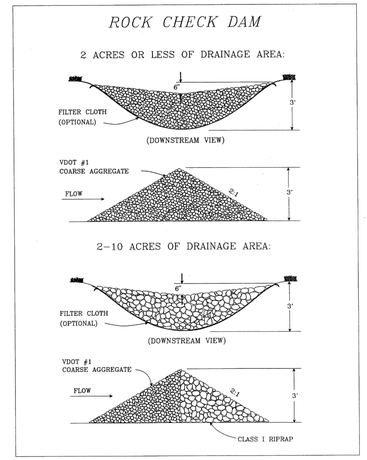


IP — INLET PROTECTION — N.T.S.



TP — TREE PROTECTION — N.T.S.

1992 3.20



Source: Va. DSWC — Plate 3.20-1

RCD — ROCK CHECK DAM — N.T.S.

TABLE 3.31-B
(Revised June 2003)
TEMPORARY SEEDING SPECIFICATIONS
QUICK REFERENCE FOR ALL REGIONS

SEED		
APPLICATION DATES	SPECIES	APPLICATION RATES
Sept 1 - Feb 15	50/50 Mix of Annual Ryegrass (Iolium multi-florum) & Cereal (Winter) Rye (secale cereale)	50-100 (lbs/acre)
Feb 16 - Apr 30	Annual Ryegrass (Iolium multi-florum)	60-100 (lbs/acre)
May 1 - Aug 31	German Millet	50 (lbs/acre)

FERTILIZER & LIME

- Apply 10-10-10 fertilizer at a rate of 450 lbs/acre (or 10 lbs/1,000 sq ft)
- Apply Pulverized Agricultural Limestone at a rate of 2 tons/acre (or 90 lbs/1,000 sq ft)

NOTES:
1. A soil test is necessary to determine the actual amount of lime required to adjust the soil pH of site.
2. Incorporate the lime and fertilizer into the top 4-6 inches of the soil by disking or other means.
3. When applying Slowly Available Nitrogen, use rates available in Erosion & Sediment Control Technical Bulletin #4, 2003 Nutrient Management for Development Sites at http://www.dpr.state.va.us/sw/e&s.htm#pubs

TABLE 3.32-E
(Revised June 2003)
PERMANENT SEEDING SPECIFICATIONS FOR COASTAL PLAIN AREA

SEED [1]		
LAND USE	SPECIES	APPLICATION RATES
Minimum Care Lawn (Commercial or Residential)	Tall Fescue [1] or Bermudagrass [1]	175-200 lbs 75 lbs
High Maintenance Lawn	Tall Fescue [1] or Bermudagrass [1] (seed) or Bermudagrass (by other vegetative establishment method, see Std. & Spec. 3.34)	200-250 lbs 40 lbs (unhulled) 30 lbs (hulled)
General Slope (3:1 or less)	Tall Fescue [1] Red Top Grass or Creeping Red Fescue Seasonal Nurse Crop [2]	128 lbs 2 lbs 20 lbs TOTAL: 150 lbs
Low-Maintenance Slope (Steeper than 3:1)	Tall Fescue [1] Bermudagrass [1] Red Top Grass or Creeping Red Fescue Seasonal Nurse Crop [2] Sericea Lespedeza [3]	93-108 lbs 0-15 lbs 2 lbs 20 lbs 20 lbs TOTAL: 150 lbs

1 - When selecting varieties of turfgrass, use the Virginia Crop Improvement Association (VCIA) recommended turfgrass variety list. Quality seed will bear a label indicating that they are approved by VCIA. A current turfgrass variety is available at the local County Extension office or through vcia at 804-746-4864 or at http://sudan.cses.vt.edu/htm/Turf/turf/publications/publications2.html.

2 - Use seasonal nurse crop in accordance with seeding dates as stated below:

February, March - April	Annual Rye
May 1st - August	Foxtail Millet
September, October - November 15th	Annual Rye
November 16th - January	Winter Rye

3 - May through October, use hulled seed. All other seeding periods, use unhulled seed. If Weeping Lovegrass is used, include in any slope or low maintenance mixture during warmer seeding periods, increase to 30 - 40 lbs/acre.

FERTILIZER & LIME

- Apply 10-20-10 fertilizer at a rate of 500 lbs/acre (or 12 lbs/1,000 sq ft)
- Apply Pulverized Agricultural Limestone at a rate of 2 tons/acre (or 90 lbs/1,000 sq ft)

NOTES:
1. A soil test is necessary to determine the actual amount of lime required to adjust the soil pH of site.
2. Incorporate the lime and fertilizer into the top 4-6 inches of the soil by disking or other means.
3. When applying Slowly Available Nitrogen, use rates available in Erosion & Sediment Control Technical Bulletin #4, 2003 Nutrient Management for Development Sites at http://www.dpr.state.va.us/sw/e&s.htm#pubs

PLAN REVISIONS -

SHEET D-1 14 OF 17

SCALE N/A

STAUNTON CROSSING DOWNSTREAM SEWER UPGRADES
STAUNTON, VIRGINIA

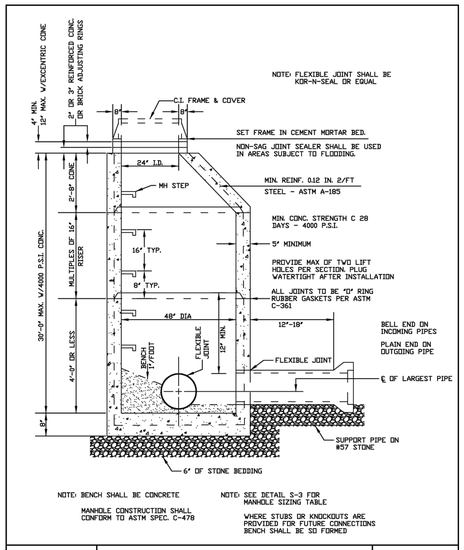
EROSION AND SEDIMENT CONTROL NOTES AND DETAILS

DATE: JANUARY 2024
ENGINEER: AAD
CHECKED: STW
CAD: PCP
JOB#: 22190

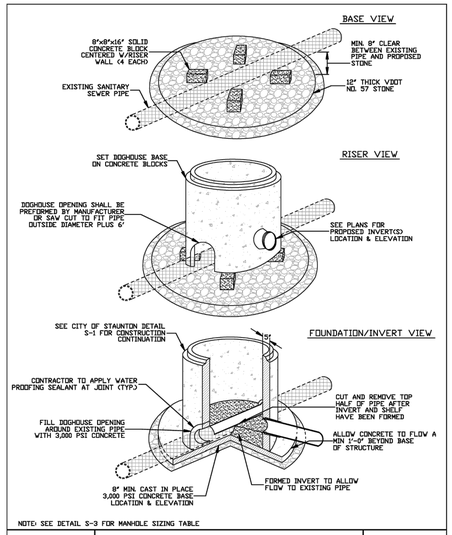
COMMONWEALTH OF VIRGINIA — Stephen Trey Wilkins — Reg. No. 040205952 — PROFESSIONAL ENGINEER — 1/12/2024

RK&K Engineers|Construction Managers|Planners|Scientists
310 FIRST STREET, SUITE 400
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RUMMEL, KLEPPER & KAHL, LLP

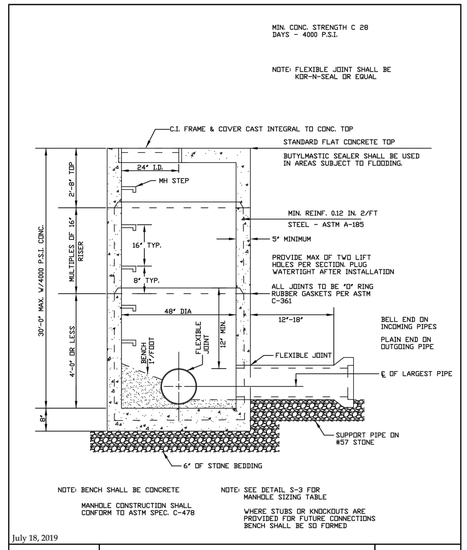
\\ad.rkk.com\ls\Cloud\Projects\22022\22190_CSOnCall\22190.001 - Staunton Crossing Downstream Sewer\CAD\(03)22190 - D-1-x.dwg/ 1/12/2024 2:56:00 PM by ----



CITY OF STAUNTON, VA	**STANDARD PRECAST CONCRETE MANHOLE**	Draw No. **S-1**

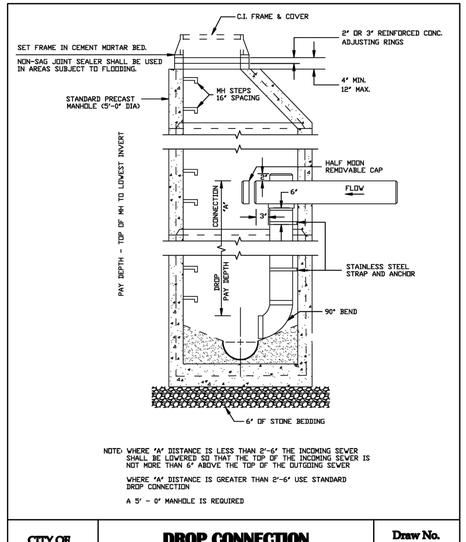


CITY OF STAUNTON, VA	**STANDARD PRECAST DOGHOUSE MANHOLE**	Draw No. **S-1A**

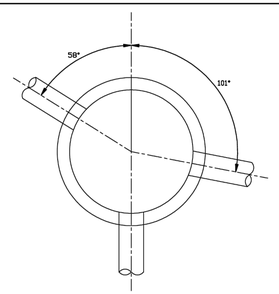


July 18, 2019

CITY OF STAUNTON, VA	**FLAT TOP CONCRETE MANHOLE**	Draw No. **S-1 B**

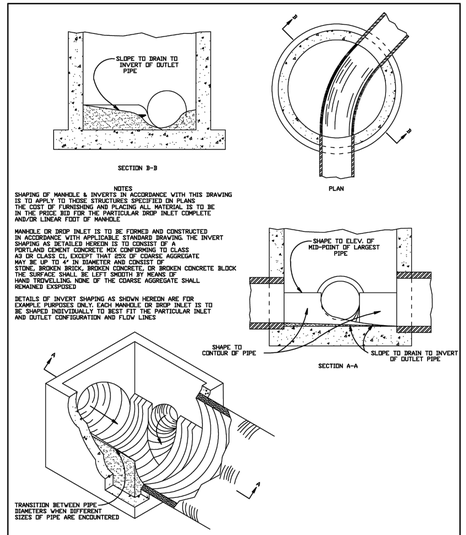


CITY OF STAUNTON, VA	**DROP CONNECTION 8" MAIN AND SMALLER**	Draw No. **S-2**

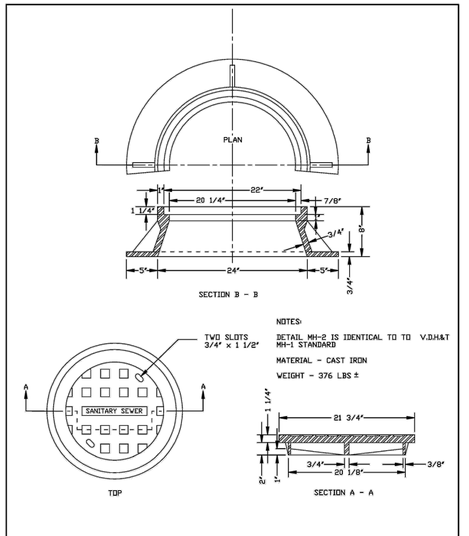


MANHOLE SIZING TABLE					
MAXIMUM Δ'S AT MANHOLE (DEGREES)					
SEWER PIPE SIZE	SIZE OF MANHOLE				
	48"	60"	72"	84"	96"
21"	68°	92°	107°		
24"	58°	85°	101°		
27"	47°	77°	95°		
30"	35°	68°	89°	103°	
36"	USE NEXT SIZE	50°	75°	92°	103°
42"		USE NEXT SIZE	60°	80°	94°
48"			USE NEXT SIZE	67°	84°
54"				USE NEXT SIZE	72°

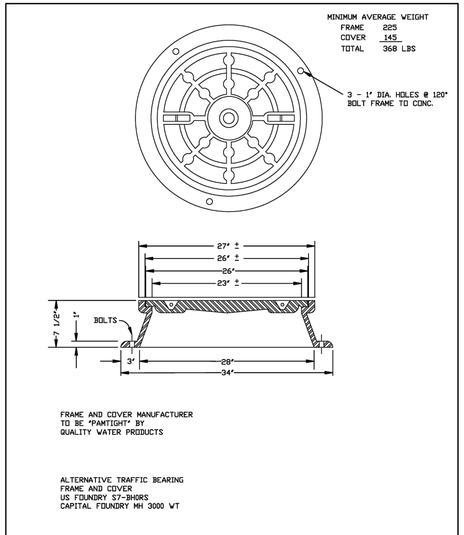
CITY OF STAUNTON, VA	**MANHOLE SIZING TABLE**	Draw No. **S-3**



CITY OF STAUNTON, VA	**STANDARD METHOD OF SHAPING MANHOLE & INLET INVERTS**	Draw No. **S-4**



CITY OF STAUNTON, VA	**STANDARD HEAVY TRAFFIC MANHOLE FRAME & COVER**	Draw No. **S-5**



CITY OF STAUNTON, VA	**WATERTIGHT MANHOLE FRAME & COVER**	Draw No. **S-6**

PLAN REVISIONS -

SHEET **D-2** 15 OF 17

SCALE N/A

STAUNTON CROSSING
DOWNSTREAM SEWER UPGRADES
STAUNTON, VIRGINIA

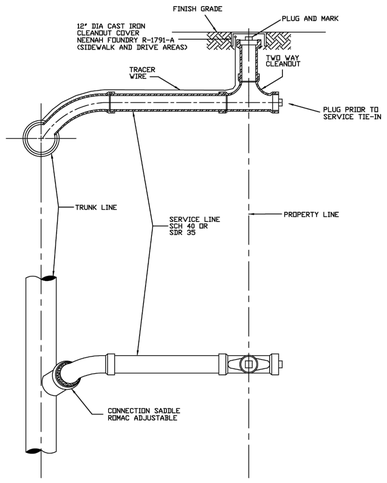
CITY OF STAUNTON SANITARY SEWER DETAILS

DATE: JANUARY 2024
ENGINEER: AAD
CHECKED: STW
CAD: PCP
JOB#: 22190

COMMONWEALTH OF VIRGINIA — Stephen Trey Wilkins — Lic. No. 040205958F — PROFESSIONAL ENGINEER — 1/12/2024

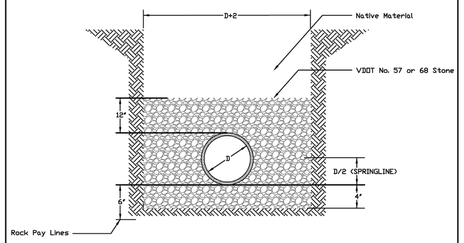
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(P) 540 682-7570 (F) 844 890-1689
RUMMEL, KLEPPER & KAHL, LLP

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NOTE: CLEANOUT TOP SHALL BE LEFT VISIBLE ABOVE GRADE

CITY OF STAUNTON, VA	**SEWER SERVICE CONNECTION**	Draw No. **S-7**

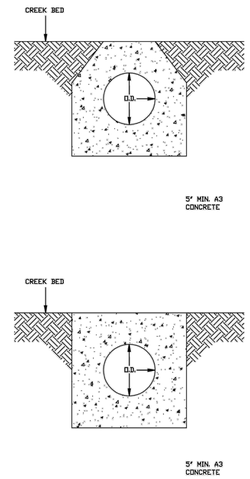


BACKFILL SHALL BE PLACED IN 6" LAYERS FROM THE BOTTOM OF THE TRENCH TO A POINT AT LEAST 6" ABOVE THE PIPE AND THOROUGHLY TAMPED BY HAND OR PNEUMATIC TAMPER, HOWEVER DO NOT TAMP DIRECTLY OVER THE PIPE

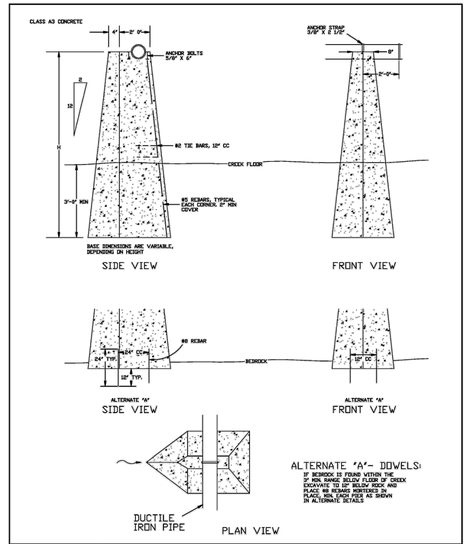
FINAL BACKFILL MAY BE PLACED IN LAYER THICKNESSES WHICH WILL PERMIT COMPACTION TO A DENSITY OF AT LEAST 95%

REINFORCED CONCRETE AND DUCTILE IRON PIPE SHALL BE BACKFILLED W/57 OR 68 TO SPRINGLINE ONLY

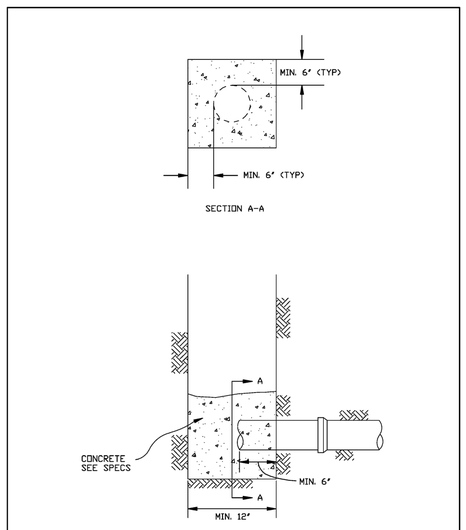
CITY OF STAUNTON, VA	**SEWER PIPE INSTALLATION**	Draw No. **S-8**



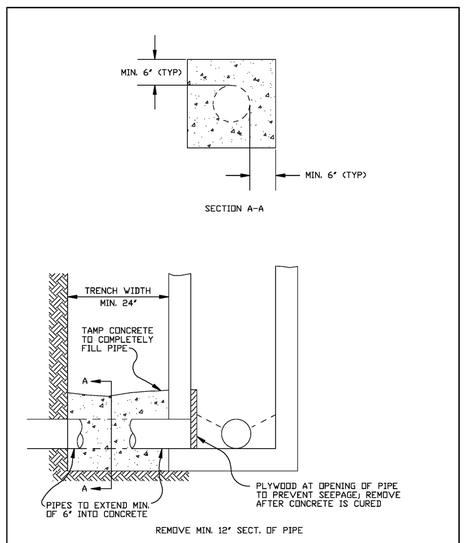
CITY OF STAUNTON, VA	**CONCRETE ENCASEMENTS**	**Draw No. S-9**



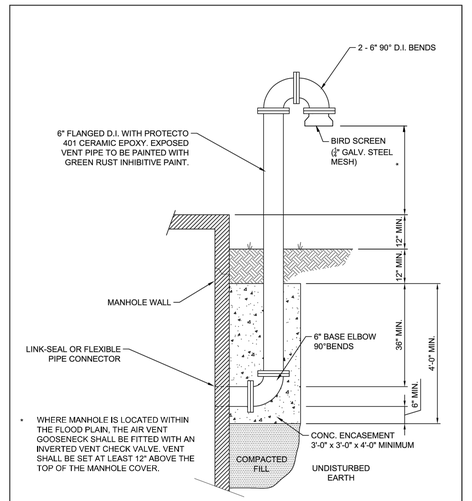
CITY OF STAUNTON, VA	**CONCRETE PIER**	**Draw No. S-10**



CITY OF STAUNTON, VA	**END PLUGGING ABANDONED SEWER LINE**	Draw No. **S-11**



CITY OF STAUNTON, VA	**PLUGGING ABANDONED LINE AT MANHOLE**	Draw No. **S-12**



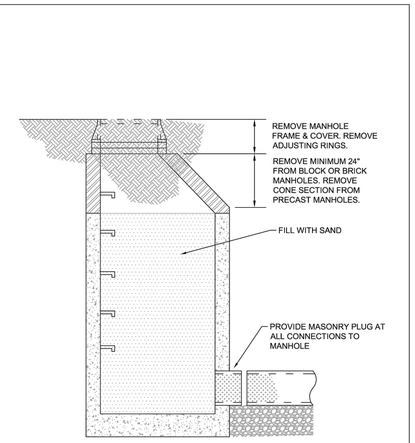
* WHERE MANHOLE IS LOCATED WITHIN THE FLOOD PLAIN, THE AIR VENT GOOSENECK SHALL BE FITTED WITH AN INVERTED VENT CHECK VALVE. VENT SHALL BE SET AT LEAST 12" ABOVE THE TOP OF THE MANHOLE COVER.

NOT TO SCALE

July 18, 2019

CITY OF STAUNTON, VA	**MANHOLE VENT**	Draw No. **S-13**

(MODIFIED)



1. WHERE MANHOLES ARE LOCATED IN PAVEMENT, PAVEMENT WILL BE RESTORED IN ACCORDANCE WITH CITY STANDARDS.
2. FOR MANHOLES NOT LOCATED IN PAVEMENT, PROVIDE TOPSOIL, SEED AND MULCH AS REQUIRED. AREA WILL BE GRADED AND RESTORED SIMILAR TO SURROUNDING CONDITIONS.

CITY OF STAUNTON, VA	**ABANDONMENT OF MANHOLES**	Draw No. **S-14**

PLAN REVISIONS -

SHEET **D-3** 16 OF 17

SCALE N/A

STAUNTON CROSSING
DOWNSTREAM SEWER UPGRADES
STAUNTON, VIRGINIA

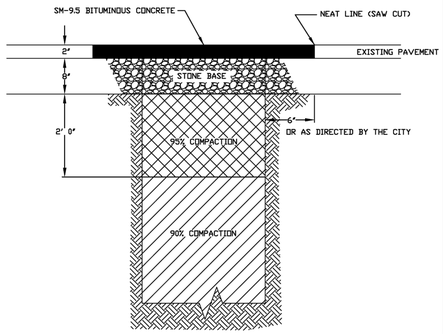
CITY OF STAUNTON SANITARY SEWER DETAILS

DATE: JANUARY 2024
ENGINEER: AAD
CHECKED: STW
CAD: PCP
JOB#: 22190

COMMONWEALTH OF VIRGINIA — Stephen Trey Wilkins — Lic. No. 040205957 — ENGINEER — PROFESSIONAL — 1/12/2024

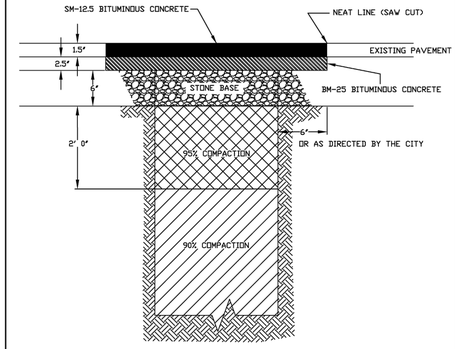
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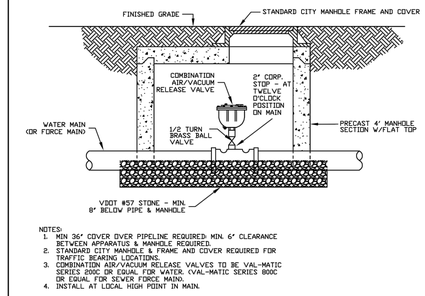
NOTE:
1. COMPLETED PATCH TO BE FLUSH WITH EXISTING PAVEMENT

CITY OF STAUNTON, VA	**STANDARD PATCH FOR ASPHALT PAVEMENT**	Draw No. **M-5**



NOTE:
1. COMPLETED PATCH TO BE FLUSH WITH EXISTING PAVEMENT

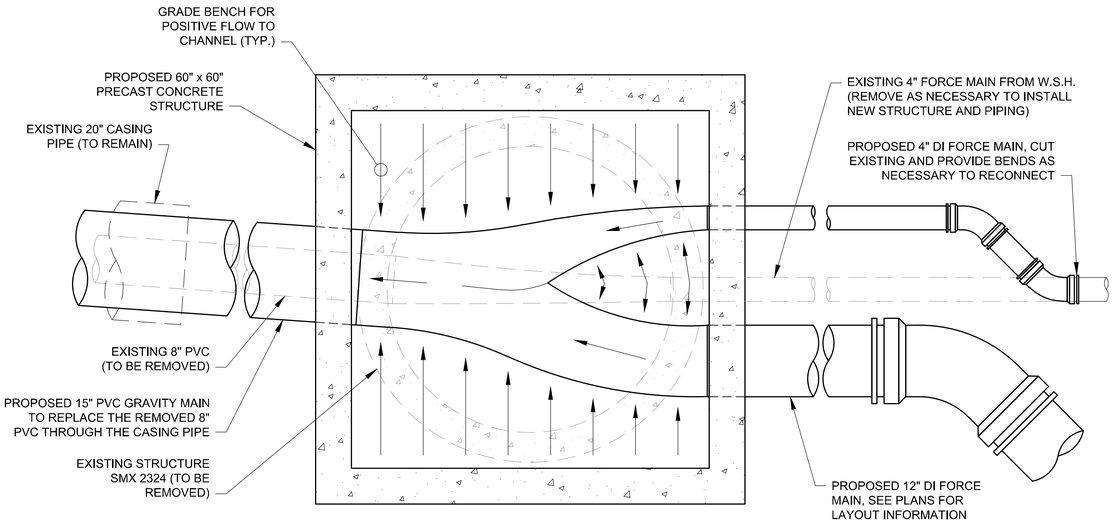
CITY OF STAUNTON, VA	**HEAVY DUTY PATCH FOR ASPHALT PAVEMENT**	Draw No. **M-5(H)**



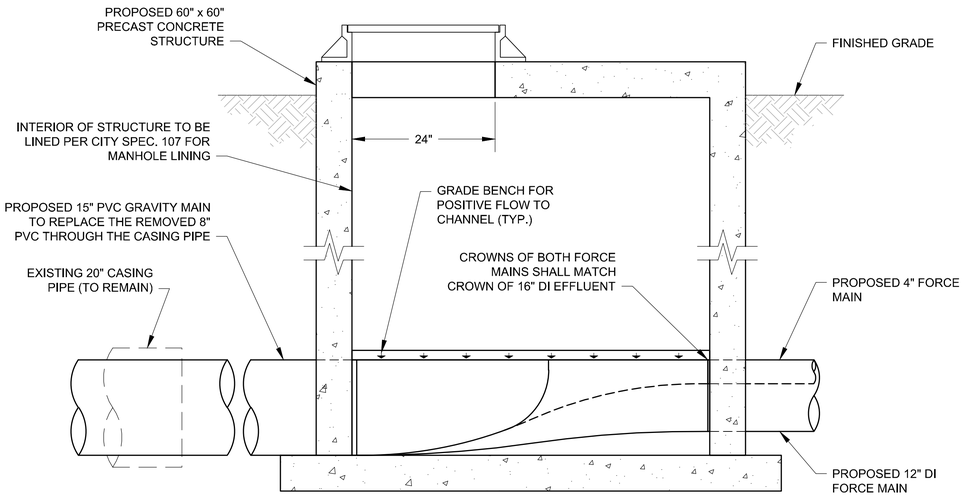
NOTES:
1. MIN 36" COVER OVER PIPELINE REQUIRED MIN 6" CLEARANCE BETWEEN APPARATUS & MANHOLE REQUIRED.
2. STANDARD CITY MANHOLE & FRAME AND COVER REQUIRED FOR TRAFFIC BEARING LOCATIONS.
3. COMBINATION AIR/VACUUM RELEASE VALVES TO BE VAL-MATIC SERIES 200C OR EQUAL FOR WATER. (VAL-MATIC SERIES 800C OR EQUAL FOR SEWER FORCE MAIN).
4. INSTALL AT LOCAL HIGH POINT IN MAIN.

REVISED: 2023-10-20

CITY OF STAUNTON, VA	COMBINATION AIR/VACUUM RELEASE VALVE	Drawing No. W-18



PLAN



SECTION

SMX 2324 (#9005) REPLACEMENT STRUCTURE
N.T.S.

PLAN REVISIONS -

SHEET **D-4** 17 OF 17

SCALE N/A

STAUNTON CROSSING
DOWNSTREAM SEWER UPGRADES
STAUNTON, VIRGINIA

CITY OF STAUNTON SITE DETAILS

DATE:	JANUARY 2024
ENGINEER:	AAD
CHECKED:	STW
CAD:	PCP
JOB#:	22190

COMMONWEALTH OF VIRGINIA — Stephen Trey Wilkins — Lic. No. 040205957 — PROFESSIONAL ENGINEER — 1/12/2024

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