OLD STAGE ROAD
BOOSTER PUMP STATION

Technical Specifications

Engineer:
Timmons Group
2901 S Lynnhaven Rd, # 200
Virginia Beach, VA 23452

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Site Development | Residential | Infrastructure | Technology
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January 2023
Project Number 48527

PROJECT DIRECTORY

PUMP STATION OWNER:
Isle of Wight County
13048 Poor House Road
P.O. Box 80
Isle of Wight, Virginia 23397
Director of Utility Services: Donald Jennings, P.E.
Phone: (757) 365-6319

WATER MAIN OWNERS:
Isle of Wight County
13048 Poor House Road
P.O. Box 80
Isle of Wight, Virginia 23397
Director of Utility Services: Donald Jennings, P.E.
Phone: (757) 365-6319

Town of Smithfield
Department of Public Works & Utilities
310 Institute Street
Smithfield, Virginia 23430
Director of Public Works and Utilities: Jack Reed
Phone: (757) 365-3338

SCHOOL OWNER:
Isle of Wight County Public Schools
820 West Main Street
Smithfield, Virginia 23454
Director of Support Services: Chris Coleman
Phone: (757) 357-4393

CIVIL ENGINEER:
Timmons Group, Inc.
2901 S. Lynnhaven Road
Suite 200
Virginia Beach, Virginia 23452
Project Manager: Kenneth Turner, P.E.
Phone: (757) 213-6671

NOTE: The word "Architect" used in these specifications may mean Architect or Engineer depending on the specific context.

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SECTION 01000 - SUMMARY OF WORK

GENERAL

1.01 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:

Furnish and install one Booster Pump Station as shown on the contract drawings that consists of:

a) A precast building containing one room of pumps and controls, and one room with sodium hypochlorite chemical feed pumps, injection, and storage.

b) Water connections and piping from the water main along Old Stage Road to the onsite booster station.

c) All site work as indicated on the contract drawings.

d) Electrical work as indicated on the contract drawings.

e) All other appurtenances and work as indicated on the contract drawings and specifications.

1.02 REFERENCE DOCUMENTS

A. Applicable Codes, Specifications, and Standards:

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.

B. Documents on the Site

The Contractor shall maintain, on the site, copies of all appropriate documents including codes, specifications, permits, and reference standards referred to for this project.

C. Specs and Standards

The Contractor shall follow the Isle of Wight County Construction Specifications and Standards for Waterworks and Sanitary Sewerage Facilities

The Contractor shall follow the Hampton Roads Planning District Commission (HRPDC) *Regional Construction Standards Details*

1.03 ABBREVIATIONS AND SYMBOLS

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ANSI	American National Standards Institute

ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BOCA	Building Officials Code Administration, Inc.
HRPDC	Hampton Road Planning District Commissions
NACE	National Association of Corrosion Engineers
NEC	National Electrical Code
OSHA	Occupational Safety and Health Administration
USACE	US Army Corps of Engineer
VDEQ	Virginia Department of Environmental Quality
VDH	Virginia Department of Health
VDOT	Virginia Department of Transportation
VMRC	Commonwealth of Virginia Marine Resources Commission
VSWCC	Virginia Soil and Water Conservation Board

1.04 CONTRACTOR'S RESPONSIBILITIES

A. The Contractor shall, at his own expense, obtain any and all permits and surety required and be responsible for all submittals necessary to obtain said permits required in the Contract Documents. Permits include but shall not necessarily be limited to.

VDOT Land Use Permit

VPDES VAR-10 (General Permit for Land Disturbance > 1 acre)

Locality's Land Disturbing (E & S) Permit

Locality's Building and Trade Permits

B. Use of Premises and Off-Site Work

Lands by Contractor - Any land and access thereto not furnished by the County 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.

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

The Contractor shall, at all times, so conduct his work as to insure 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 insure 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

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

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.

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.

Contractor Checklist for Major Items to be Performed and/or Submitted

This checklist is intended to be a guide 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.

Required as Part of This Contract		Description of Submittal Item or Service to be Performed	Check Once Item is Completed
	No	Diagram of location of fuel storage areas on plans	
	No	Diagram of location of temporary sanitary Facilities on plans	
Yes		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	
Yes		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., construction general 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	
Yes		Shop drawings and product data	
	No	Samples	
Yes		Layout data/schedule for pipe joining and special connections	
	No	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 data 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.	
	No	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	

END OF SECTION 01000

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SECTION 01200 – PROJECT MEETINGS

1. GENERAL

1.01 REQUIREMENTS INCLUDED

A. Contractor participation in preconstruction conferences.

B. Contractor participation of progress meetings and pre-installation conferences.

1.02 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).

1.03 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, records 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.

1.04 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.

END OF SECTION 01200

SECTION 01330 - SUBMITTALS

1. GENERAL

1.1 REQUIREMENTS INCLUDED

A. Procedures

B. Schedule of Submittals

C. Construction Progress Schedules

D. Schedule of Values

E. Shop Drawings

F. Product Data

G. Manufacturer's Instructions

H. Certificate of Compliance

I. Certificate of Proper Installation

J. Manufacturer’s Written Warranty

K. Operation & Maintenance Manuals

L. Project Record Drawings

1.2 PROCEDURES

A. The Contractor is required to provide submittals for all materials and equipment furnished and installed under this contract.

B. The Contractor shall deliver submittals to the Engineer.

C. Transmit each item with the Submittal cover attached.

1. Number submittals by specification section and revision number (e.g. 01 3300-1 for initial submission of Schedule of Submittals.)

2. Submit only one item per cover. Highlight all deviations from the Contract Documents, and provide an explanation/justification for the deviation.

3. Complete all portions of the form above the Contractor's signature line. Incomplete submittals or submittals with un-highlighted deviations will be returned un-reviewed.

D. Submit initial Progress Schedules, Schedule of Values, and Schedule of Submittals in duplicate within 15 days after date of Owner-Contractor Agreement. After review by the Engineer revise and resubmit as required. Submit revised schedules with each Application for Payment, reflecting changes since the 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. The Contractor is to provide to the Engineer a Schedule of Submittals for all products

and equipment used during construction at least 2 weeks prior to the start of work.

B. Submit the number of copies required by the Contractor, plus one for the Engineer to retain.

C. If the Schedule of Submittals is incomplete, the Engineer shall require the Contractor to address the missing items and resubmit a complete Schedule of Submittals.

1.4 CONSTRUCTION PROGRESS SCHEDULES

A. 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.

B. 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 SCHEDULE OF VALUES

A. A Schedule of Values based on the Contractor's lump sum price shall be typed on 8-1/2 x 11 inch paper.

B. Items of Work shall be broken down into separate values for materials and labor.

C. The breakdown shall be detailed sufficiently to be able to properly identify Work value completed at the end of each month's progress. It shall include as a minimum, the following:

1. A Schedule of Values in bar chart format
2. List each item separately
3. Indicate start and finish dates
4. List all critical path items

D. Submit the number of copies required by the Contractor, plus three for the Engineer to retain.

1.6 SHOP DRAWINGS

A. Submit the number of copies required by the Contractor, plus three for the Engineer to retain.

1.7 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.

1.8 MANUFACTURER'S INSTRUCTIONS

A. Submit the 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.

1.9 MANUFACTURER'S CERTIFICATE OF COMPLIANCE

A. Prior to shipment of equipment or materials, the Contractor shall submit a written certification from the Manufacturer stating that the equipment was manufactured and assembled in accordance with the applicable specifications.

B. The Owner shall not accept any Work associated with the major unit process equipment without having received the Manufacturer's Certificate of Compliance

1.10 CERTIFICATE OF PROPER INSTALLATION

A. Subsequent to the Contractor's installation, start-up and testing of the major unit process equipment and controls, the Contractor shall submit to the Engineer the Manufacturer's Certificate of Proper Installation.

B. The Engineer nor Owner shall accept any work associated with the major unit process equipment without having received the Manufacturer's Certificate of Proper Installation

1.11 MANUFACTURER'S WRITTEN WARRANTY

A. As part of the initial submittal of product data and shop drawings, the Contractor shall submit to the Engineer the Manufacturer's Written Warranty for each piece of major equipment and or material.

B. The Engineer shall not approve any submittal without the accompanying Manufacture's Written Warrantee.

1.12 OPERATION & MAINTENANCE MANUALS

A. Prior to delivery of each piece of major equipment, the Contractor shall submit to the Engineer the appropriate Operation and Maintenance Manuals.

B. The Operation and Maintenance Manuals shall comply with Section 01 78 23.

C. The Engineer shall not approve a request for payment for equipment or materials, delivered, stored or install without first having received and approved the Operation and Maintenance Manuals applicable to the equipment or materials.

1.13 PROJECT RECORD DRAWINGS

A. Prior to Engineer's approval of final payment, the Contractor shall have delivered to the Engineer and the Engineer shall have approved the Project Record Drawings.

B. The Project Drawings shall comply with the Standard General Conditions.

2. PRODUCTS – NOT USED

3. EXECUTION

3.1 Shop Drawings and Submittals

A. The Contractor shall keep a copy of all shop drawings and submittals on the project site for the duration of the contract.

B. The Contractor shall allow for a minimum of 10 working days for the Engineer to review and or approve any submittal before any work may be started or any material or equipment be delivered associated with a given submittal.

END OF SECTION

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

Month	J	F	M	A	M	J	J	A	S	O	N	D
Scheduled	6	4	4	3	4	4	4	3	3	3	3	5
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 01400 - TESTING AND INSPECTION

1. GENERAL

1.1 REQUIREMENTS INCLUDED

A. Testing and Inspection

B. Masonry Testing and Inspection

C. Reinforcing Steel Inspection

D. Testing and Inspection of Piping Systems

E. Equipment and Systems Testing and Inspection

F. Testing and Inspection of Plumbing Systems

G. Testing and Inspection of Mechanical Systems

H. Testing and Inspection of Electrical Systems

1.2 INSPECTION SERVICES

A. The Owner shall retain the services and be responsible for providing a County Inspector or payment for an independent inspection firm or firms (Inspection Firm) to provide onsite inspection.

1.3 CONTRACTOR FURNISHED TESTING SERVICES

A. At the time of the Preconstruction Conference, the Owner shall provide to the Engineer and Contractor the identity of the concrete testing firm and laboratory (QC Firm) proposed to perform the field quality control measure. The Owner shall be responsible for the costs of the field quality control measures.

B. The QC firms shall not be authorized to:

1. Release, revoke, alter, or expand on the requirements of the Contract Documents.
2. Approve or accept any portion of the Work.
3. Perform any duties of the Contractor.

C. In coordination with the QC firms, the Contractor shall:

1. Cooperate with testing personnel, to provide access to the work and to the Manufacturer's operations where applicable.
2. Secure and deliver to the QC firm(s) adequate quantities of representational samples of materials proposed to be used and which require testing.
3. Provide to the QC firm the preliminary design mix proposed to be used for concrete, and other materials mixes which require control.
4. Furnish incidental labor and facilities:
   a) To provide access to the Work to be tested.
   b) To obtain and handle samples at the project site or at the source of the product to be tested.
   c) To facilitate inspections and tests.
   d) For storage and curing of test samples.
5. Notify the QC firm sufficiently in advance of operations to allow for firm assignment of personnel and scheduling of tests.

D. Copies of test results and product test reports shall be transmitted in quantities required by the Engineer directly from the QC firm and shall not be handled or received by the Contractor prior to being received by the Engineer.

E. Testing services other than those called for in these Contract Documents may be called for by the Owner to check compliance with the specification requirements. When tests indicate compliance with specifications, the testing service charges shall be borne by the Owner, but when non-compliance with specifications is indicated, the testing service charges shall be the Contractor's responsibility and be deducted from the Contract sum.

1.4 INSPECTION AND TESTING

A. Equipment Installation

1. All equipment shall be installed in accordance with the Manufacturer's installation instructions. The O & M Manual for the specific equipment shall be on hand during the inspection phases for confirmation of correct installation. Contractor shall have on site a copy of the O & M Manual with the installation instructions for review by the County Inspector and/or Inspection Firm and Engineer.

B. Inspection

1. The County Inspector or Inspection Firm has the right to inspect all material and equipment at all stages of development or fabrication and shall be allowed access to the site and to the Contractor's and Supplier's shops to conduct such inspections. Inspection by the County Inspector or Inspection Firm shall not release the Contractor from responsibility or liability with respect to material or equipment.

2. When specified inspections or tests are required by the Contract Documents, the Work involved shall not proceed beyond that point until such inspections or tests have been completed and approved by the County Inspector or Inspection Firm. The Contractor shall inform the County Inspector or Inspection Firm of the progress of the Work and shall give the County Inspector or Inspection Firm a minimum of three working days written notice of appropriate times for specified inspections and tests. The Contractor shall insure that the portion of Work to be inspected is safe, accessible, dry, ventilated and well lit.

3. When local codes or laws require approval and inspection of the Work by other agencies or organizations before installation or operation, the Contractor shall obtain such approval and submit one signed original and three copies of the approval to the County Inspector or Inspection Firm.

4. That portion of the Work subject to the provisions of the Virginia Uniform Statewide Building Code shall be constructed in accordance with the latest version.

5. The Work shall be subjected to continuous inspection by the County Inspector or Inspection Firm and a formal inspection by the Engineer: All required labor, materials, equipment, instruments, lubricants and incidentals necessary to perform these inspections shall be furnished by the Contractor. This includes providing competent and experienced personnel, who are authorized representatives of the Manufacturers of the equipment furnished, to assist the Contractor in the installation, testing and adjustments of the equipment to perform in accordance with the Contract Documents. Before proceeding to the next inspection, all discrepancies and deficiencies observed during each inspection shall be noted and corrected and, if directed by the Engineer, the inspection shall be rescheduled and re-performed at no additional cost to the Owner.

6. Pre-final Inspection: The Contractor shall schedule in accordance with his construction

schedule and with the approval of the Engineer a Pre-final Inspection to take place a minimum of 10 days before the Contractor's date of substantial completion. The Pre-final Inspection shall fully demonstrate to the Engineer or County Inspector/Inspecting Firm that all individual project components function as required by the Contract Documents and that all systems are internally coordinated, as well as coordinated with other systems. Equipment shall be operated and required system tests performed. In addition, the Contractor shall demonstrate that all major site work has been brought to final configurations and restoration initiated. All items of deficiency noted for correction shall be completed before the Final Inspection is scheduled. The Engineer will prepare a punch list of items to be accomplished prior to Final Acceptance.

7. Final Inspection: After the Contractor has shown that all systems and project work are completed and deficiencies noted in the Pre-final Inspection are corrected, a Final Inspection of the project including a test and demonstration of all equipment and systems shall be scheduled. This Inspection shall take place a minimum of 20 days before the Contractor's scheduled Final Completion date. Correction of the deficiencies noted in the Pre-final Inspection shall be accomplished before the Engineer will approve the scheduling of the Final Inspection. This Inspection shall demonstrate that all elements of the project are ready to be placed in operation and all work has been fully completed in accordance with the Contract Documents.

C. Equipment Testing: Test procedures as specified in the Contract Documents or as otherwise required shall be coordinated and demonstrated during the Pre-final and Final Inspections. Each test shall be scheduled and performed by the Contractor in the presence of the Engineer or County Inspector/Inspection Firm. All required labor, materials, equipment, instruments, lubricants, and incidentals to perform the tests shall be furnished by the Contractor. This shall include providing competent and experienced personnel, who are authorized representatives of the Manufacturers of the equipment furnished, to assist the Contractor in the installation, testing and adjustments of the equipment to perform in accordance with the Contract Documents. Before proceeding to the next test, all discrepancies and deficiencies observed during each test shall be noted and corrected and, if directed by the Engineer, the test rescheduled and re-performed at no additional cost to the Owner. The filter underdrain systems shall have a phased acceptance of equipment as underdrains will be sequentially refurbished and placed back into service. It is expected that underdrains will be broken into three separate test dates.

1. Pre-final Test: During the Pre-final Inspection, equipment shall be operated and tested to fully demonstrate to the Engineer that it works as a unit and a part of the entire system in accordance with the Contract Documents and that all systems are internally coordinated as well as coordinated with other systems. All items of deficiencies and required adjustments noted during this Test shall be corrected before the Final Inspection is scheduled.

2. Final Test: After all equipment and systems have passed the Pre-final Inspection and are completely installed with controls, instrumentation, safety devices and all items of Work completed including correction of deficiencies, and adjustments, the Final Inspection and Test shall be scheduled. This Test shall consist of continuously operating the equipment and systems without interruption under actual operating conditions to demonstrate that all are fully operative and ready to be permanently placed in operation.

D. Acceptance: The Engineer shall recommend to the Owner that the Work be accepted upon the Contractor's completion and to the satisfaction of the Owner, all of the Work required by the Contract Documents and all items identified on the punchlist prepared by the Engineer and Contractor, if any, at the time of the Final Inspection. The Contractor is

required to coordinate with the Engineer reinspections of Work listed on the punchlist. The Engineer may require the Contractor to have groups of punchlist items completed prior to reinspecting the Work. The Owner shall accept the Work upon the recommendation by the Engineer and completion of all of the Work required by the Contract Documents and all punchlist items; all Operation and Maintenance Manuals, "as-built" drawings, Certificates and Written Warranties having been submitted and approved by the Engineer.

2. PRODUCTS – NOT USED

3. EXECUTION – NOT USED

END OF SECTION

SECTION 01500 - TEMPORARY FACILITIES AND ENVIRONMENTAL PROTECTION

1. GENERAL

1.01 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 Contractor will furnish water required during the entire construction period for the project at no cost to the Owner. The Contractor shall assure the availability of drinking water for his work force, and provide temporary pumps, tanks, pre-assembled flushing mechanisms and compressors as necessary to produce the required pressures.

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.

1.02 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. Contractor shall not obstruct any driveway longer than two (2) hours without providing an alternate temporary access to the property.

1.03 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 Pollution Prevention Plan shown on the approved contract drawings in accordance with the VSMP General Permit.

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 contaminated with oil, bitumins, harmful 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.

1.04 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.

1.05 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.

END OF SECTION

SECTION 01730 - OPERATING AND MAINTENANCE DATA

1. GENERAL

1.01 Requirements

A. Operation and Maintenance manuals are required for all materials and equipment provided and installed in the project.

B. Two preliminary copies of each manual shall be submitted to Engineer prior to the date of shipment of the equipment. After review and approval by Engineer, four final copies of each operation and maintenance manual shall be prepared and delivered to Engineer not later than 30 days prior to placing the equipment in operation. Copies supplied to Engineer are in addition to those required by the Contractor. Preliminary and 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 Project identification.

C. Operation and Maintenance 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; and,
13. Any other information concerning operation or maintenance of equipment readily available to Contractor and as required to repair and order parts.

D. At a minimum, operating and maintenance data shall be supplied for the following equipment:

1. Control Systems (including dialer, etc.)

2. Process equipment and devices
3. Pumps
4. Electrical Devices
5. Generator Set (including transfer switch)
6. Control Valves (check, pressure reducing/sustaining, etc.)
7. Pipe valves and fittings
8. Instrumentation
9. SCADA systems if applicable
10. Flow measuring devices
11. Pressure measuring devices
12. Sensors
13. Unit Heaters
14. Lighting
15. Air Handling Equipment
16. Electrical switch gear
17. Chemical Feed Equipment

2. PRODUCTS NOT USED

3. EXECUTION

A. 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 pertinent information shall be highlighted to make it clear which information applies.

B. 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.

C. 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.

END OF SECTION

SECTION 01770 – CLOSEOUT PROCEDURES

GENERAL

1.01 SUMMARY

A. This Section provides for the orderly and efficient transfer of the WORK from the CONTRACTOR to OWNER.

1.02 RELATED SECTIONS

A. The provisions and intent of the AGREEMENT, including the General Conditions, Supplementary Conditions, and other requirements of the Contract Documents apply to the WORK as specified in this Section. WORK related to the Section is described throughout the Specifications.

1.03 SUBMITTALS

A. Guarantees/Warranties: Four (4) copies of all guarantees, warranties and bonds called for in these Specifications commencing on the date of Substantial Completion.

B. Governmental Compliance: Provide evidence of compliance with requirements of governmental agencies having jurisdiction, but not necessarily limited to:

1. Certificates of Inspection
2. Certificates of Occupancy
3. Certificate to Operate

C. Affidavit of Payment of Claims: Provide evidence of payment and release of liens.

D. Affidavit of Release of Liens.

E. Consent of Surety for Final Payment.

F. Contractor’s Certification of Completion.

G. Final Pay Application.

H. List of Project Participants: Provide a list of subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service at all times including nights, weekends, and holidays.

1.04 WARRANTEES AND GUARANTEES

A. Contractor shall provide Warrantees 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. Warrantees and Guarantees shall be for a period of one year after.

1. Being placed in service by Owner for the Owner’s use before substantial completion of the project.
2. Date of substantial completion of the project.
3. Being installed and put in service after substantial completion of the project.
4. Equipment installed does not constitute being “in service”.

C. Guarantee: CONTRACTOR warrants the equipment and/or materials delivered and installed under the AGREEMENT are free from defects in design, material, or workmanship, and against damage caused prior to final inspection.

D. Prompt Repair: CONTRACTOR shall promptly repair or replace all defective or damaged items delivered under the AGREEMENT. CONTRACTOR may elect to have any replaced item returned to its plant at its sole expense.

E. Owner's Option: In the event of equipment and/or materials failure, during such time or in such a a location that immediate repairs are mandatory, CONTRACTOR shall respond promptly, regardless of time. If CONTRACTOR is not available, OWNER personnel or other contractors, secured by OWNER, will affect repairs. CONTRACTOR shall then reimburse OWNER for parts and labor and/or other contractors' costs necessary to correct deficiencies as defined within the warranty clause and time.

F. This specification shall apply to all sections of the specifications as applicable whether mentioned in a specific specification or not. Should the specific specification section have additional requirements or more stringent requirements that this section the more stringent shall apply.

G. 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.

2. PRODUCTS

2.01 SUBSTANTIAL COMPLETION

A. Record Drawings: The CONTRACTOR shall maintain an accurate set of Record Drawings and Specifications. Prior to Substantial Completion 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 ENGINEER at completion of the WORK.

Record drawing information shall include the following as a minimum, where applicable:

1. Size, horizontal and vertical location of any existing utilities uncovered during the course of the work. This shall include telephone cables and conduits, fiber-optic cables and conduits, television cables, electrical cables and conduits, gas lines, water lines, sewer force mains, sanitary sewers, storm sewers, and the like.
2. Horizontal and vertical location of all water lines, sewer mains, and force mains installed at every 100-foot station.
3. Location of all cleanouts new and existing, size of service lines installed, and the like.
4. Northing and Easting of all surface fixtures, i.e., valve boxes, manholes, etc.
5. Location of lines plugged or capped.
6. Swing ties to all structures installed such as manholes, air vents, hydrants, valve boxes, blowoffs, cleanouts, and the like.

7. Depth from rim of valve box to top of operating nut on all valves, and length of valve extensions installed.
8. Sizes and types of materials used and changes in sizes and types of materials. Rims and inverts of all manholes installed or ties into shall be provided.
9. Location of all sleeves, bends, and other fittings including method of restraint used; for example, thrust block, retainer glands, tie rods, and the like.
10. 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. Owner's Manuals: Not Applicable

2.02 WARRANTIES

A. Four (4) copies of all warranties shall be permitted prior to substantial completion.

2.03 TRAINING

A. CONTRACTOR shall provide a written schedule of all training that will be provided to the OWNER to be reviewed and approved, a minimum of 1 month before the first scheduled training session.

B. Training shall consist of, at a minimum, the level of training as recommended by the manufacturers of the equipment to be installed.

C. CONTRACTOR shall give the OWNER at least 2 weeks advance notice of each anticipated training session to allow for proper personnel to be present at the training.

D. The OWNER reserves the right to request specific training on equipment as he deems necessary for the successful transfer of ownership of the equipment from the CONTRACTOR to the OWNER.

E. All training shall be completed prior to issuance of Substantial Completion.

3. EXECUTION

3.01 SUBSTANTIAL COMPLETION PROCEDURES

A. Owner's Use: The following procedures are to be applied towards OWNER'S utilizing the Project:

1. Initial Punch List: Within a reasonable time after receipt from CONTRACTOR of a comprehensive list of items which need to be completed or corrected, the ENGINEER will determine status of completion.
2. Incomplete Work: Should ENGINEER determine that the WORK is not substantially complete:
   a) Notification: ENGINEER will promptly so notify CONTRACTOR, in writing, given the reasons therefore.
   b) Contractor Remedy: CONTRACTOR shall promptly remedy the deficiencies and notify ENGINEER when ready for inspection.
   c) Additional Cost: The cost of re-inspection for Substantial Completion will be borne by the CONTRACTOR.

3. Completed Work: When ENGINEER concurs that the WORK is substantially complete:
   a) Engineer's Acceptance: ENGINEER will submit the Certificate to OWNER and to CONTRACTOR for their written acceptance of the responsibilities assigned to them in the Certificate.
4. Occupancy: Upon Substantial Completion, CONTRACTOR shall obtain a temporary Certificate of Occupancy or other permission from the inspecting authority for OWNER to begin moving in its equipment and furnishings.

3.02 INSTRUCTIONS TO OWNER

A. Operation and Maintenance: CONTRACTOR shall instruct OWNER or its authorized representative in the proper operation and maintenance of all elements of the Project systems as specified.

3.03 CLEAN-UP/RESTORATION

A. Definition: Except as otherwise specifically provided, "clean" (for the purpose of this Section) shall be interpreted as meaning the level of cleanliness generally provided by VDOT roadway construction projects.

B. General: Prior to completion of the WORK, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described above. Restore all disturbed areas to a condition equal to or better than that prior to construction.

C. Site: Unless otherwise specifically directed by ENGINEER, hose down all paved areas on site. Completely remove all resultant debris.

D. Structure: Not Applicable.

E. Timing: Schedule final cleaning as approved by ENGINEER, to enable OWNER to receive a completely clean Project.

3.04 FINAL COMPLETION

A. Notification: Prepare and submit to ENGINEER a written notice that the Project is complete and ready for final inspection and acceptance.

B. Releases/Consent of Surety: Contractor shall forward a completed "Release of Liens", "Release and Waiver of Depts and Claims" and "Consent of Surety" to ENGINEER prior to Final Payment.

C. Verification: CONTRACTOR shall provide written documentation that the CONTRACTOR has verified that all work has been completed prior to notifying the ENGINEER of such,. ENGINEER shall verify that Work is complete prior to Final Payment.

D. Certification: CONTRACTOR shall certify that:

1. Review: Contract Documents have been reviewed.
2. Inspection: WORK has been inspected for compliance with the Contract Documents.
3. Completeness: WORK has been completed in accordance with eh Contract Documents.

4. Testing: Equipment and systems have been tested as required and are operational.
5. Final Inspection: WORK is completed and ready for Final Inspection.

E. Incomplete Determination: Should ENGINEER determine that the WORK is incomplete or defective:

1. Notification: ENGINEER will promptly so notify CONTRACTOR, in writing, listing the incomplete or defective WORK.
2. Contractor Remedy: CONTRACTOR shall remedy the deficiencies promptly and notify ENGINEER when ready for inspection.
3. Additional Cost: The cost of re-inspection for Final Completion will be borne by CONTRACTOR.

F. Acceptance: When ENGINEER determines that the WORK is acceptable under the Contract Documents, it will request the final Application for Payment from CONTRACTOR.

G. Reimbursement: CONTRACTOR shall reimburse OWNER for all trips to the Project Site by ENGINEER after Substantial Completion in excess of two (2) trips if such excess trips are necessitated due to the Project's remaining incomplete.

H. Retainage: Retainage will be released per the provisions of the Contract Documents.

3.05 FINAL PAYMENT

A. Application: Submit a final Application for Payment to ENGINEER, showing all adjustments to the agreed to sum.

B. Change Order: If so required, ENGINEER will prepare a final Change Order showing adjustments to the AGREEMENT which were not made previously by Change Orders.

END OF SECTION 01770

SECTION 02205 - SITE CLEARING

1. GENERAL

1.01 Clearing work shall be restricted to area within rights of way or easements or within construction limits specified in the Contract Documents.

2. PRODUCTS - NOT APPLICABLE

3. EXECUTION

3.01 The Contractor shall provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements not specified to be removed, and improvements on adjoining properties.

A. The Contractor shall restore all improvements damaged by the work to their original condition in a manner acceptable to the Owner.

3.02 Protect trees and other vegetation which is indicated to remain to the greatest extent practical against cutting, breaking, skinning and bruising of bark, and skinning of roots.

A. Minimize foot and vehicular traffic in vegetated areas to remain.

B. Within drip lines of trees to remain, do not stockpile construction materials or excavated materials, nor park vehicles.

C. Provide temporary fences, barricades or guards as required to protect trees and vegetation to be left standing.

D. Use only hand methods for grubbing inside drip line of trees indicated to remain. Leave or replace existing topsoil within these drip lines to prevent damage to root systems.

E. Replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to the Owner.

3.03 Clearing

A. Remove only those trees necessary to perform the work associated with this Project.

B. Remove from the site all trees, brush, shrubs, down timber, rotten wood, rubbish, other vegetation, as well as fences, and incidental structures necessary to allow for the mobilization of equipment to perform the proposed construction.

C. All stumps and roots within the disturbed area of the rights of way, easement, or construction limits shall be removed and properly disposed.

D. Unless noted otherwise, items removed within the construction limits shall become the property of the Contractor, and shall be removed from the site and legally disposed of at an approved site.

3.04 Clean up debris resulting from site clearing operations continuously with the progress of the work, and remove all waste material from the site.

A. Remove debris from the site in such a manner as to prevent spillage. Pavements and the area adjacent to site shall be kept clean and free from mud, dirt and debris at all times.

3.05 At the Owner's direction, remove trees within or immediately adjacent to clearing limits, which appear to be dying or weakening for any reason and at any point during construction up to and including substantial completion.

3.06 Seed all cleared areas unless otherwise noted on the Contract Documents.

END OF SECTION

SECTION 02325 - TRENCHING AND BACKFILLING

1. GENERAL

1.01 This section is designed to provide the minimum requirements for trenching and backfilling of pipe trenches. Should the drawings provide specific details for specific installations the drawing requirements shall take precedent. When working in VDOT right of ways the VDOT requirements shall take precedent.

1.02 Geotechnical Report

A. Earthwork and trenching EXCAVATION IS UNCLASSIFIED and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered. No extra payment will be made, regardless of the suitability or unsuitability of on-site soils for the disposal or importing of soils to the project site.

1.03 Existing Utilities

A. Locate existing utilities, culverts, and structures, above 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 the Contract Drawings or when locations differ from those shown on the Contract Drawings, notify the Inspector for instructions before proceeding

1.04 Explosives

A. Work with explosives shall be executed by persons who are licensed or otherwise authorized by governing authorities for the work required.

B. Store and use explosives in accordance with Federal, State, and Local regulations. The Contractor shall be responsible for and shall satisfactorily correct all damage resulting from use of explosives.

1.05 Testing and Inspection

A. In trenching operations, compaction testing shall be performed at increments of approximately 1000 L.F. of trench, and at all commercial driveway entrance crossings.

B. Allow Inspector to approve subgrade and each fill layer, or for every 2,000 square feet of fill placed, whichever results in more frequent inspection.

C. The degree of compaction obtained shall be verified by means of field density tests made by an Independent Laboratory. Where tests indicate a deficiency in degree of compaction, the Contractor shall correct such conditions and the Testing Laboratory shall make additional tests in order to verify that the corrected work has been satisfactory. The Testing Laboratory shall provide four (4) certified copies of all test reports.

1.06 Definitions

A. Excavation: Removal of material encountered to required subgrade and/or subsoil elevations indicated, and the subsequent disposal of materials removed.

B. Fill: Material placed and compacted above the level of the subsoil, which existed before construction of the project.

C. Rock: Hard bed rock, boulders, or similar material requiring the use of rock drills and/or explosives for removal. The criteria for classification of general excavation as rock is any material that cannot be dislodged by a Caterpillar D-8 Tractor, or equivalent, equipped with a single tooth hydraulically operated power ripper. The criteria for trench rock shall be that a Caterpillar 345 Backhoe, or equivalent, with a proper width bucket cannot remove the material.

D. Subgrade: The undisturbed earth, or the compacted soil layer, immediately below granular sub base, drainage fill, or topsoil materials.

E. Subsoil: The undisturbed earth immediately below the existing topsoil layer.

F. Unauthorized Excavation: Removal of materials below indicated subgrade elevations or beyond horizontal excavation dimensions without specific direction of the Inspector.

G. Undercut Excavation: When excavation has reached required sub grade elevations, notify the Inspector who will make an inspection of conditions. If unsuitable bearing material is encountered at required subgrade elevations, carry excavations deeper as directed by the Inspector.

H. Unsuitable Material: Material such as clay mass, frozen materials, cinders, ashes, refuse, and vegetable, organic material, or any other material deemed unsuitable by the Inspector. Unsuitable material shall be removed and replaced with suitable material as specified herein for the intended use.

I. Bedding. Bedding is the material placed under the pipe.

J. Haunching. Material that is placed on the sides of the pipe to the spring line.

K. Initial Backfill. Material placed on top of the haunch material until 12” above the pipe.

L. General Backfill. Material Placed on top of the initial backfill up to grade.

1.07 Suitability of Materials

A. Unless otherwise noted, the Contractor shall be responsible for the disposal of excess material (including but not limited to undercut, root mat and excess topsoil and fill material), obtaining borrow material and the suitability of all on-site material above subgrade.

2. PRODUCTS

2.01 Clean Earth Fill: Approved material free of debris, roots, frozen materials, organic matter, rock, or gravel larger than 2 inches in any dimension or other harmful matter and be classified as ML or better material in accordance with the Unified Soils System, ASTM D-2487.

2.02 Fine Aggregate: #9 or #10 stone as per VDOT Road and Bridge Specifications Section 203 or Grade A or Grade B fine aggregate as per VDOT Road and Bridge Standard Section 202.

2.03 Coarse Aggregate: #57 stone as per VDOT Road and Bridge Specifications Section 203.

2.04 Crusher Run Aggregate: #26 as per VDOT Road and Bridge Specifications Section 205.

2.05 Select Material: Type I or II according to Section 207 of the VDOT Road and Bridge Specifications.

2.06 Shoulder Stone: Aggregate material #21A or #21B as per VDOT Road and Bridge Specifications Section 209.

2.07 Topsoil: In trenching operations, topsoil shall be the top 6 inches of original soil from the trench. Otherwise, topsoil shall be fertile, friable loam, containing not less than 2 percent by weight of finely divided, decomposed vegetation. Topsoil shall be free of subsoil, clay lumps, brush, weeds, roots larger than 1/2-inch diameter, stones larger than 1/2 inch diameter and other material toxic or harmful to growth.

2.08 Geotextile Fabric: Woven or nonwoven polypropylene or polyester equaling or exceeding the following test.

A. TEST	TEST METHOD	TYPICAL TEST VALUES
1. Weight	ASTM D-1910	3.9 oz per sq. yd. minimum
2. Grab Tensile Strength	ASTM D-1682	200 lbs. minimum
3. Trapezoid Tear Strength	ASTM D-1117	100 lbs. minimum
4. Grab Modulus (Mullen Burst)	ASTM D-3786	370 lbs. minimum

3. EXECUTION

3.01 General Excavation

A. Remove vegetation, debris, unsatisfactory materials, and harmful materials prior to placement of fill. Plow, strip, or break up sloped surfaces steeper than 4 to 1 so that fill material will bond with existing surface.

B. Strip existing topsoil, leaf mold and organic materials, meeting topsoil requirements. Deposit in storage piles separate from other excavated material.

C. Provide adequate and positive site drainage throughout construction. Keep excavations free of water while work is being performed and until backfilled. Where underground streams or springs are found, provide temporary drainage, and notify the Inspector.

D. Excavate unsatisfactory soil materials encountered that extend below required elevations, to the additional depth as directed by the Inspector.

E. Where rock is encountered so that a manhole, vault, or other structure will bear on rock, the rock shall be used to support the foundation. When only a portion of the foundation

will bear on rock, the Contractor shall excavate the rock at least 8 inches below the foundation and provide at least 8 inches of coarse aggregate fill.

F. Where unauthorized excavation has been carried below authorized depth, backfill and compact in the same manner as specified for authorized excavations of same classification, unless otherwise directed by the Inspector.

G. Stockpile excavated soil material satisfactory for backfill or fill until required. Place, grade, and shape stockpiles for proper drainage. Do not store within drip lines of trees indicated to remain.

H. Sheeting and Shoring

1. Sheeting and shoring shall be provided as necessary to construct and protect the excavation, structures of all types, and as necessary for the safety of the employees.

2. All sheeting and bracing shall be removed unless directed otherwise by the Inspector, in such a manner so the construction or other structures are not endangered. All voids left or caused by the withdrawal of sheeting shall be backfilled immediately with approved material and compacted by ramming with tools especially adapted for that purpose, or by other means directed by the Inspector.

3. All sheeting and bracing that is left in place shall be cut to a depth of eighteen inches below the final grade line. The cut off ends shall be removed from the site.

I. Remove surplus or unsuitable material and dispose of the materials off the site at no additional cost to the Owner.

J. Dewatering

1. Where conditions are such that running or standing water occurs in the trench bottom or the soil in the trench bottom displays a “quick” tendency, the water should be removed by pumps and suitable means such as well points or pervious under drain bedding until the pipe has been installed and the backfill has been placed to a sufficient height to prevent pipe flotation.

3.02 Trenching

A. Excavate to the lines and grades indicated for pipelines and structures making proper allowance for pipe bedding materials, pipe bells and concrete form work.

B. Excavate pipeline trenches with vertical walls. Maintain trench width within al-allowable trench width from bottom of trench to a point 12 inches above top of pipe.

C. Where rock is encountered, excavate 6 inches below the pipe bottom and provide stone to bed the pipe.

D. Where unsuitable soil is encountered, excavate to depth determined by the Inspector and replace with pipe bedding material thoroughly and uniformly compacted.

3.03 Backfilling of Pipe and Trenches

A. The following is the minimum requirement for backfilling of pipes and trenches. Should the drawings indicate a deviation from these minimum specifications the more stringent shall apply.

B. Pipe Bedding

1. Ductile Iron Pressure Pipe

a) Ductile iron pipe shall be laid in a flat bottom trench on undisturbed earth. If rock is encountered at the bottom of the trench, bedding shall be a minimum of six inches of compacted course aggregate. Trench bottom shall be hand excavated for bell holes at all joints. Over rock, the six-inch minimum depth of bedding shall be maintained at all joints or other pipe appurtenances. Bedding shall be compacted to a mini-mum 95 percent of maximum density as determined by ASTM D698 (standard Proctor).

2. Ductile Iron Gravity Pipe
   a) Ductile iron pipe shall be laid on a minimum of 4 inches of compacted course aggregate. If rock is encountered at the bottom of the trench, bedding material shall be a minimum of six inches. Trench bottom shall be hand excavated for bell holes at all joints. Over rock, the six-inch minimum depth of bedding shall be maintained at all joints or other pipe appurtenances. Bedding material shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698 (standard Proctor).
3. PVC, HDPE, PE and CT Pressure Pipe 3 inches and smaller
   a) PVC, HDPE, PE and CT pipe shall be laid on a minimum of 4 inches of compacted fine aggregate placed upon undisturbed earth. If rock is en-countered at the bottom of the trench, fine aggregate shall be a minimum of six inches. Trench bottom shall be hand excavated for bell holes at all joints. The minimum depth of bedding shall be maintained at all joints or other pipe appurtenances. Bedding material shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698 (standard Proctor).
4. PVC Pressure Pipe 4 inches and larger
   a) PVC pressure pipe shall be laid on a minimum of 4 inches of compacted course aggregate placed upon undisturbed earth. If rock is encountered at the bottom of the trench, course aggregate shall be a minimum of six inches. Trench bottom shall be hand excavated for bell holes at all joints. The minimum depth of bedding shall be maintained at all joints or other pipe appurtenances. Bedding material shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698 (standard Proctor).
5. PVC Gravity Pipe 6 inches and larger
   a) PVC pressure pipe shall be laid on a minimum of 4 inches of compacted course aggregate placed upon undisturbed earth. If rock is encountered at the bottom of the trench, bedding shall be a minimum of six inches. Trench bottom shall be hand excavated for bell holes at all joints. The minimum depth of bedding shall be maintained at all joints or other pipe appurtenances. Bedding material shall be compacted to a min-imum 95 percent of maximum density as determined by ASTM D698 (standard Proctor).

C. Haunching

1. Haunching material shall be the same as the bedding material. Material shall be placed and consolidated under the pipe haunch to provide adequate side support to the pipe while avoiding both vertical and lateral displacement of the pipe from proper alignment. Haunching is placed to the pipe spring line and shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698 (standard Proctor).

D. Backfilling Trenches

1. General:
   a) All trenches shall be backfilled immediately after the pipes and appurtenances are laid therein with the exception of pressure pipe, where joints are to remain uncovered until after pressure testing is completed.
2. Initial Backfill:
   a) Ductile Iron Pressure Pipe and Gravity Pipe
      i. Initial backfill shall be with select material. Initial backfill shall begin at the spring line of the pipe and shall be placed in six-inch layers up to a minimum level of 12 inches above the crown of the pipe. Initial backfill shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698 (standard Proctor).
   b) PVC Pressure Pipe and Gravity Pipe 4" and larger
      i. Initial backfill shall be with select material. Initial backfill shall begin at the spring line of the pipe and shall be placed in six-inch layers up to a minimum level of 12 inches above the crown of the pipe. Initial backfill shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698 (standard Proctor).
   c) PVC, HDPE, PE and CT Pressure Pipe 3" and smaller
      i. Initial backfill shall be with the same material as the haunching material and shall be placed in 6" layers to a minimum level of 6" over the crown of the pipe. The remainder of the initial backfill shall be with select material to a minimum level of 12" above the crown of the pipe. Initial backfill shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698 (standard Proctor).
3. Final Backfill:
   a) General:
      i. Final backfill for trenches shall be with general backfill material. Final backfill not subjected to vehicular traffic or greater than 5' feet from the edge of pavement shall be placed in layers no greater than one foot thick and compacted to at least 85 percent maximum density as determined by ASTM D698 (standard Proctor). Final backfill shall not contain stones larger than 6 inches in their greatest dimension, the stones shall not be in excess of 20 percent of the volume of backfill material, and such stones shall be well distributed throughout the mass. Topsoil (in grassed areas) shall be de-posited in the final layer of backfill to guarantee the areas will be re-turned to original or better conditions.
   b) Roadways:
      i. Where excavation has been made through pavement, subgrades of roadways under construction, where subgrades are undercut by excavation, or where excavation is within 5' of edge of pavement, backfilling shall be performed with shoulder stone. Backfill material shall be placed in layers not greater than six inches thick, with each layer thoroughly compacted to 95 percent of maximum density as determined by ASTM D698(standard Proctor) . Work within VDOT rights-of-way shall meet all requirements of the Virginia Department of Transportation.

3.04 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) Standard Proctor. Compact soil materials using equipment suitable for materials to be compacted and work area locations.

1. 95 percent beneath and within 25 feet of buildings and structures, including those shown for future construction.
2. 95 percent beneath pavements, walks, road shoulders, including those shown for future construction or proposed, 95 percent up to 12 inches above top of pipes.
3. 85 percent in other unpaved areas.
4. If the density of the adjacent soil is more than the density specified, compact to a density not less than the density of the adjacent soil.

B. Use power-driven hand tampers for compacting materials adjacent to structures and in areas inaccessible to rollers. Use equipment capable of adding moisture to the soil material as determined by moisture-density tests. Where required, uniformly apply water to the surface of the subgrade or layer of soil material in such a manner as to prevent free water appearing on the surface, either during or subsequent to compacting operations.

C. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified percentage of maximum density.

D. Do not place or compact material that is muddy, frozen, or contains frost or ice.

3.05 General Backfill

A. Place clean earth fill to obtain elevations shown on the drawings. Do not place fill on muddy or frozen areas.

B. When the existing ground surface has been disturbed and has a density of less than that specified for the particular area classification, scarify the ground surface, pulverize, adjust moisture condition to optimum moisture content, and compact to required depth and percentage of maximum density. Excavate depressions caused by removal of stumps or other clearing operations to firm subgrade. Fill with clean earth fill.

C. Place backfill and fill materials in loose lifts no less than 4 inches and no more than 8 inches in depth. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content.

D. Place backfill materials evenly adjacent to structures. 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.

E. Backfill excavations to excess elevations (above the finished grade) to allow for shrinkage and settlement. Excess elevation under paved and surfaced roadways and parking areas shall not exceed 2 inches.

3.06 Pipe Bedding and Backfill

A. Place and compact bedding in accordance with the construction plans below bottom of pipe prior to laying pipe. Where directed by the Inspector place soil stabilization fabric in the excavation before placing bedding. Place fabric in accordance with the manufacturer's recommendations.

B. Compact pipe bedding by tamping or rodding to prevent settlement.

C. Do not backfill when the subgrade is muddy or frozen or when the backfill material is frozen or muddy.

3.07 Grading.

A. Grade in compliance with VDOT specifications, Section 303. Uniformly grade areas within limits of grading, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

B. Unless otherwise indicated, evenly slope subgrade to provide positive drainage away from building walls in all directions at a grade not less than 1/4 inch per foot.

C. Protect newly graded areas from traffic and erosion. Where compacted areas settle, or are disturbed by subsequent construction or adverse weather, scarify the surface, reshape and compact to the required density, with additional fill material if required. Use hand tamper for recompaction over underground utilities.

D. Where topsoil is specified, excavate or fill below finished grades shown, leaving space for topsoil.

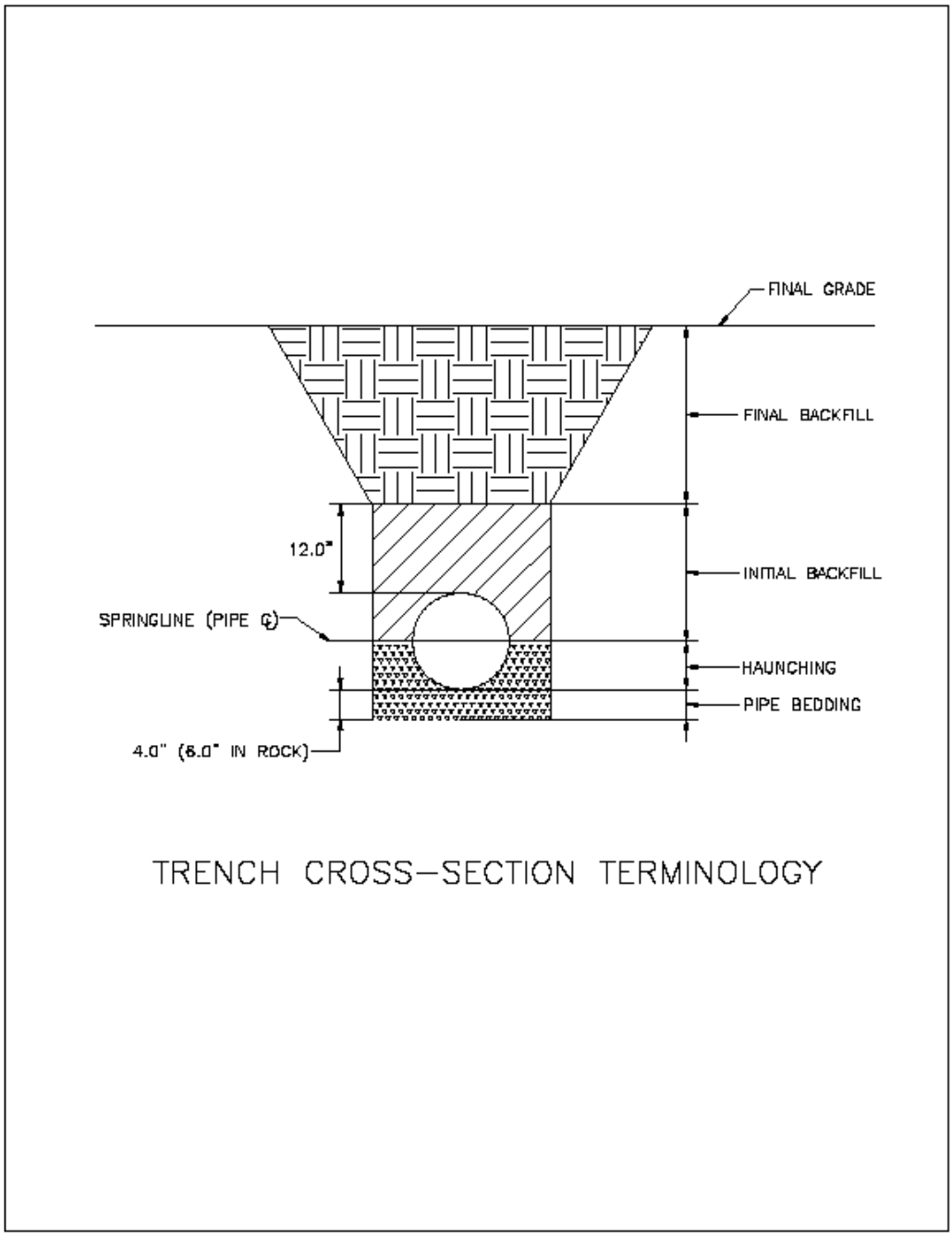
E. Where not otherwise shown on the Contract Drawings, all disturbed areas shall be restored to the original grade.

F. Tolerances

1. Shape subgrade under pavements to line, grade, and cross-section to within 1/2 inch of required subgrade elevations.

2. Finish areas to receive topsoil to within 0.10 foot of required elevations.

Trench Cross-section Terminology



TRENCH CROSS–SECTION TERMINOLOGY

END OF SECTION

SECTION 02370
SILTATION AND EROSION CONTROL

PART 1 – GENERAL

1.1 SUMMARY

A. This work shall be performed in accordance with the siltation and erosion control plan on the Construction Drawings and the details provided therein, and as described, detailed, and required by the Virginia Erosion and Sediment Control Handbook, latest edition.

B. The erosion and sediment control measures and devices shown on the Drawings and described herein have been reviewed and approved by the appropriate governing State and/or Local agencies. The Contractor is responsible for stabilizing all disturbed areas, fill slopes, borrow areas, etc. with whatever means necessary to ensure a dense, well vegetated ground cover. If the Contractor has not installed, repaired, or maintained these devices, or seeded disturbed areas at optimum dates, additional measures or devices may be required at no additional cost to the Owner.

PART 2 – PRODUCTS

2.1 PRODUCTS

A. All products shall comply with details shown on the Drawings and the requirements of the Virginia Erosion and Sediment Control Handbook, latest edition.

PART 3 – EXECUTION

3.1 EXECUTION

A. Siltation and Erosion Control Measures: Inlet protection, slope protection, mat linings, ditch linings, diversion dikes, silt fence, construction entrances, temporary & permanent vegetation, sediment traps & ponds, diversion ditches and all other items for siltation and erosion control shall be constructed as directed by the Engineer or in the locations shown or designated on the plans in accordance with the details provided.

1. The Contractor shall institute the erosion control program as part of clearing and grubbing, and prior to rough grading. The initial program shall include, but not be limited to, the installation of construction entrance, inlet protection, silt fence, as shown on the Drawings at the limits of clearing and grubbing where silt-carrying surface water runoff may be diverted and/or filtered prior to leaving the disturbed area.
2. All siltation and erosion control devices installed during the course of construction shall be maintained in proper working order at all times and shall not be removed until final stabilization of all disturbed areas or at the direction of the Architect.

B. Temporary Seeding: All disturbed areas that have no construction activity in close proximity shall be temporarily seeded within 7 days of completion of the disturbing activities. Establish temporary cover for erosion control by seeding and/or mulching. This shall be accomplished as soon as rough grading work is done.

1. When construction schedule requires seeding outside of the appropriate seeding dates, temporary seeding shall be installed per the detailed seeding schedules on the Drawings. Contractor shall reseed at an appropriate time.

C. Cleaning of Roads and Streets: The Contractor shall maintain a gravel bed according to details shown. All vehicles shall be thoroughly cleaned of mud and silt before leaving the construction site to avoid tracking mud and silt onto roads, streets, and highways. In the event that tracking does occur, the Contractor shall immediately clean the street or road of all debris, mud or silt and shall pay all damages resulting therefrom. A daily survey of the condition of the adjacent streets and roads shall be made and recorded in the field log.

D. Protection of Stormwater Systems: Stormwater structures which will receive runoff from the construction shall be protected from the buildup of mud or silt as detailed on the Drawings and shall be cleaned out as silt loading occurs and prior to end of construction.

E. Fines for Siltation and Erosion Control: Any fines that are assessed upon the Contractor or Owner by the governing agency due to negligence of the Contractor shall be paid by the Contractor.

END OF SECTION 02370

SECTION 02510 - WATER DISTRIBUTION SYSTEM

1. GENERAL

1.01 All pumps, piping, valves, fittings, fire hydrants, meters, meter vaults, appurtenances and other products shall conform to the requirements of the latest edition of the Local Utility Standards, where applicable.

1.02 Quality Assurance

A. Comply with all applicable codes and regulations as required by regulatory agencies having jurisdictions over this Work.

1.03 Connections to existing system:

A. The Contractor shall make connections to the existing system under a pressure or non-pressure condition, as indicated, complying with the system owner's requirements for the time of day such work can be done. The Contractor shall pay all costs associated with the connections unless otherwise indicated. If the system owner performs the work, the Contractor shall arrange for the work to be done.

B. Owner's valves and equipment shall be operated only by the Owner.

1.04 Contractor shall submit for approval dimensioned layout drawings for all flanged ductile iron pipe. Drawings shall include all fittings, valves, equipment, taps, appurtenances, and dimensions to locate pipe in buildings.

1.05 Exposed pipe shall be installed level, plumb and square to building walls and equipment in accordance with industry standards and practices.

2. PRODUCTS

2.01 Underground Pipe and fittings

A. Ductile Iron Pipe:

1. Ductile iron pipe shall meet the requirements of AWWA C151,AWWA C150 and Rubber-gasket joints shall meet the requirements of AWWA C111 3" through 24" pipe shall be, at a minimum, class 52 with a working pressure of 350 psi. Pipe shall have a single cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA C104. A minimum of 5% of the pipe furnished shall be gauged for roundness full length and so marked. Pressure class of pipe shall be increased if the specific installation warrants it.

B. PVC Pipe

1. PVC pipe shall meet requirements of AWWA C900 (DR-14, CL. 200) for sizes up to 12". Joints shall be in accordance with manufacturer's instructions and ASTM D2564, D2464, D2467, D319, and F477. If working pressures over 150 psi are encountered ductile iron pipe shall be used. Cell classification for water pipe shall be 12454-B

C. Polyethylene pipe

1. 2 Inches and Smaller –Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material will meet the specifications of ASTM D3350-02 with a cell classification of PE:345464C. Pipe shall have a manufacturing standard of ASTM D2737 (copper tubing size), ASTM D2239 (iron pipe size, controlled inside diameter)

and ASTM D 3035 (iron pipe size, controlled outside diameter). Pipe shall have a pressure class as specified on the plans. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits, and per AWWA C901, have nominal burst values of three times the Working Pressure Rating (WPR) of the pipe. Pipe shall also have the following agency listing of NSF 61.

2. 2-1/2 Inches and Larger - Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material will meet the specifications of ASTM D3350 with a cell classification of PE:345464C. Pipe shall have a manufacturing standard of ASTM F714. Pipe O.D. size shall be ductile iron pipe size (DIPS) unless specified otherwise on the drawings. Pipe shall be pressure class as indicated on the plans. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits, listed as NSF 61, and per AWWA C906. Pipe shall have a nominal burst value of three and one-half times the Working Pressure Rating (WPR) of the pipe. Peak flow water velocity of 5 ft/sec shall be used in the hydraulics engineering design.

D. Fittings

1. Ductile Iron Fittings
   a) Fittings for PVC pipe and DI pipe shall be Standard Size Mechanical Joint ductile iron in accordance with AWWA C110/A21.10 or Compact Mechanical Joint ductile iron in accordance with AWWA C 153. Pressure ratings shall be a minimum of 350 psi for fittings 24-inch and smaller and 250 psi for 30-inch. All fittings shall have a single cement mortar lining on the interior and a bituminous seal coating on the exterior. Fittings shall have mechanical joints conforming to the requirements of AWWA C111/A21.11. Bolts for mechanical joint fittings shall be high strength, corrosion – resistant low alloy steel with hexagon nuts having a minimum yield point of 45,000 psi in accordance with AWWA C111. Mechanical joint bolts shall be torqued with a torque wrench as per manufacturer’s recommendations.

2. Polyethylene Pipe Fittings
   a) Fittings for polyethylene pipe shall be manufactured specifically for the intended use and be approved by the piping manufacturer to be compatible with their product. All fittings shall have a working pressure rating equal to or greater than the pipe, and shall meet all requirements of NSF 61.
   b) Butt Fusion Fittings
      i. Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02, and approved for AWWA use. Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using Data Loggers. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records. All fittings shall be suitable for use as pressure conduits, and per AWWA C906, shall have a nominal burst values of three and one-half times the Working Pressure Rating (WPR).
   c) Electrofusion Fittings
      i. Electrofusion Fittings will not be accepted for use on this project.

d) Coupling Style Fittings
   i. Pipe fittings 2" and smaller shall be brass Ford Meter Products Quick Joint or pack joint fittings or approved equal suitable for underground service. All fitting connections shall have stainless steel inserts.

E. Thrust Restraint

1. All pipe fittings, plugs, caps, tees, and bends in underground ductile iron or PVC piping must be restrained utilizing Megalug Series 1100 retainer glands by EBAA Iron Sales, Inc.(or approved equal). Glands shall be manufactured of ductile iron conforming to ASTM A 536-80. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and C153/A21.53. Twist-off nuts shall be used to insure proper actuating of the restraining devices. The mechanical joint restraint device shall have a working pressure of at least 250 psi with a minimum safety factor of 2.

2. All ductile iron bell and spigot pipe joints shall be restrained using US Pipe Field Lok 350 type gaskets unless indicated otherwise on the drawings. If all joints are not required to be restrained the minimum restrained lengths and locations will be indicated on the drawings. Gaskets shall be manufactured by the pipe manufacturer to be compatible with their pipe.

3. PVC Pipe joints shall be restrained on either side of valves and fitting for a length as indicated on the drawings. Harness type restraining devices shall be used on Bell and spigot pipe joints utilizing Megalug Series 1100HD harness by EBAA Iron Sales, Inc. (or approved equal).

F. Couplings for underground or buried service shall be ductile iron mechanical joint in accordance with underground ductile fittings in this section.

G. Buried Copper Tubing

1. Copper tubing for underground services shall be seamless, annealed copper tubing Type K, in conformance with ASTM B88. Fittings shall be case bronze with flared joints.

2.02 Above Ground or Exposed Piping

A. Ductile Iron Pipe

1. Ductile iron pipe installed above ground, inside buildings or underground vaults, shall be flanged ductile iron pipe class 53 in accordance with ANSI A21.15 (AWWA C115). Unless indicated otherwise on the drawings pipe shall have Class 125 flanged joints utilizing factory installed screwed flanges (no uniflange type flanges are permitted) meeting the requirements of ANSI B 16.1, outside coating shall be red primer, and gaskets for flanged pipe shall be 1/8" thick full face red rubber. All steel flanges mating to flat face flanges shall have the raised face machined off. Pipe shall have a single cement mortar lining with asphaltic seal coat meeting the requirements for AWWA C104.

B. Ductile Iron Fittings

1. Fittings for ductile iron pipe shall be flanged ductile iron in accordance with ANSI A21.10 (AWWA C110. Fittings up to 30" diameter shall have a minimum working pressure rating of 250 psi. Unless indicated otherwise on the drawings, pipe shall have Class 125 flanged joints meeting the requirements of ANSI B 16.1, outside coating shall be red primer, and gaskets

for flanged pipe shall be 1/8" thick full face red rubber. Fittings shall have a single cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA C104.

C. Above Ground Copper Tubing

1. Copper tubing for exposed services shall be seamless, hard copper tubing Type L, in conformance with ASTM B88. Fittings shall be wrought copper with soldered joints. Solder shall be lead free approved for potable water service.

D. Couplings

1. Couplings for above ground or exposed service shall be Dresser Style 38 or approved equal. Transition couplings shall be Dresser Style 162 or approved equal. All couplings shall be rodded unless otherwise noted.

E. Flange adaptors

1. Flange adaptors shall be used where indicated on the drawings or as approved by the engineer. Flange adaptors may be used as a final connection or to allow for disassembly of pipe for equipment maintenance in approved locations. Flange adaptors are not to be used to make up for misaligned pipe.

2. Flanged Adapter shall be JCM flanged coupling adaptors model 301R or approved equal.

2.03 Gate Valves

A. Gate valves 3" through 12" shall open counter-clockwise, have a resilient seat and meet the requirements of AWWA C509. Body shall be of cast iron with a 250 psig maximum working pressure and hydrostatically tested to 500 psig. Wedge shall be constructed of cast iron, bonded in synthetic rubber in accordance with ASTM D2000. Valve shall be coated inside and out with a fusion epoxy coating of a nominal 10 mil thickness on all exposed iron surfaces in compliance with AWWA C550 and be NSF 61 certified. Valves shall be bi-directional flow and have a ten year limited warranty.

1. Above ground valves or exposed valves in vaults shall utilize outside screw and yoke (OS&Y) with rising stems and have flanged ends meeting the requirements of ANSI B 16.1, Class 125.

2. Underground valves shall utilize non rising stems, mechanical joint ends with a 2" operating nut in accordance with AWWA C111.

3. Gate valves 3" and larger when located 6ft. or more above the finish floor or operating platform shall have chain operators.

4. Valves shall be Mueller series 2360, or approved equal.

B. Gate valves 14" through 24" shall open counter-clockwise, resilient seat and meet the requirements of AWWA C515. Body shall be of cast iron. Valves 14"-20" shall have a 250 psi working pressure and 24" valves shall have a 200 psig maximum working pressure. Valves 14" through 20" shall be hydrostatically tested to 500 psig, 24" valves shall be hydrostatically tested to 400 psig. Wedge shall be constructed of cast iron, bonded in synthetic rubber in accordance with ASTM D2000. Valves shall be coated inside and out with a fusion epoxy coating of a nominal 10 mil thickness on all exposed iron surfaces in compliance with AWWA C550 and be NSF 61 certified. Valves shall be bi-directional flow and have a ten year limited warranty. Valves shall be Mueller series 2361, or approved equal.

1. Above ground valves or exposed valves in vaults shall utilize outside screw and yoke (OS&Y) with rising stems and have flanged ends meeting the requirements of ANSI B 16.1, Class 125.
2. Underground valves shall utilize non rising stems, mechanical joint ends with a 2" operating nut in accordance with AWWA C111.
3. Valves shall be Mueller series 2361, or approved equal.

C. Buried gate valves 2" in size shall utilize a non-rising stem, open counter-clockwise, resilient seat and meet the requirements of AWWA C509. Valve shall be equipped with a 2-inch square AWWA operating unit. Valve ends shall be NPT connections. Valves shall be Mueller series A-2360, or approved equal.

D. Above ground gate valves 2" and smaller shall be 150 lb.bronze body union bonnet, rising stem (as indicated on the drawings), gate valves with threaded connections. Valves shall be Crane Figure 431UB or approved equal.

2.04 Butterfly Valves

1. Butterfly valves shall have a ductile iron body, seat in body design, ductile iron disk with a 316 stainless steel disc edge (3" and 4" valves to have 316 disk), symmetrical disc, nonmetallic bearings, chevron self-adjusting "V" type packing and have a 250 psi working pressure. Valves shall meet or exceed all the requirements of AWWA C504 standard class 250B and be NSF 61 certified. Exposed piping shall have flange ends Class 125 and underground valves shall have mechanical joint ends. Valves 6" and larger shall have gear operators. All exposed valves with gear operators shall have a position indicator.
2. Valves shall be Mueller Lineseal XP butterfly valves (class 250B) or approved equal.

2.05 Ball Valves - Above Ground

A. Ball valves 2" and smaller shall be 150 lb rated, threaded ends, bronze or stainless steel body (stainless steel valves are to be used on stainless steel pipe), full port, lever operated, ball valves, with stainless steel ball and stem, and Teflon seats. Ball valves shall be Crane figure 9201 (bronze body), 9231(stainless steel) or approved equal.

2.06 Check Valves

A. Swing check valves

1. 3 inch and larger
2. Check valves 3" and larger shall be Class 125 flanged ends ductile iron body bronze mounted, bronze disc facing, swing type lever and weight check valves in accordance with AWWA C508. Flanged end dimension and drilling shall comply with ANSI B 16.1, Class 125. Check valves 3" through 12" shall have a 175 psig maximum working pressure and a 350 psig test pressure. Check valves 14" through 24" shall have a 150 psig maximum working pressure and a 300 psig test pressure.
3. Check valves shall have an adjustable oil decelerator (oil cushion) installed on the outside of the valve to control valve closing.
4. Check valves 2" and smaller shall be class 150 bronze or stainless steel y-pattern swing check valves with threaded ends. Valves shall be Crane figure 137 (bronze), Crane Aloyco figure 49 or approved equal.

B. Silent check valves

1. Silent check valves shall be the globe type with a spring loaded disk. Valve shall have a ductile iron body, bronze plug, 316 stainless steel spring and a working pressure rating of 250 psig. Valves shall be flanged in accordance with ANSI B 16.1 class 125. Valves shall be APCO globe style series 600, Clow style 636 or approved equal. Wafer type check valves shall not be permitted.

2.07 Corporation Stops and Tapping Saddles for Underground Service

A. Corporation stops shall be Ford Ballcorp or equal with corporation thread by flared end for copper tubing. All corporation stops shall be installed with a tapping saddle. Saddles shall be double strap epoxy coated ductile iron with stainless steel straps, bolts and nuts. Saddles shall be Ford Style FC202 or equal.

2.08 Above Ground or Exposed Taps

A. All taps on exposed pipe. Flanged pipe or above ground pipe shall be made on fitting bosses. No tapping saddles or tapping of pipe will be allowed.

2.09 Valve Boxes

A. Valve boxes for buried valves shall be cast iron, screw adjustable shaft boxes, with a minimum shaft diameter of 5-1/4 inches, unless otherwise specified on the Drawings. Valve box covers shall be marked with the word "WATER". Valves with valve boxes shall have an extended shaft pinned to the 2" operating nut and terminate 12" below finish grade. Valve box shall have a 24" x 24" x 4" concrete collar around top of valve box as per drawing detail.

2.10 Air Release Valves

A. Air release valves shall have a minimum of a 1" N.P.T. inlet for pipe sizes 16" and smaller with a 3/32" minimum size outlet orifice and a 2" N.P.T. inlet for pipes 20" and larger with 3/16" minimum size outlet orifice. Valves shall have a cast iron body and cover, stainless steel float, Buna –N seat, Delrin lever frame and all other internal part shall be stainless steel or bronze. Air release valves shall be suitable for 150 psi working pressure at a minimum. 1" size air release valves shall be Apco model 143C or approved equal. 2" size air release valves shall be Apco model 145C or approved equal.

B. All air release valve installations shall contain an isolation valve to allow removal of the air release valve while the line is under pressure and a means to manually vent the pipeline without removal of the air release valve.

2.11 Reduced Pressure Zone Backflow Preventer

A. Reduced Pressure Zone Backflow Preventer assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs. Service of all internal components shall be through a single access cover secured with stainless steel bolts. The assembly shall also include two resilient seated isolation valves, for resilient seated test cocks, a protective bronze wye strainer with a 20-mesh screen and an air gap drain fitting.

B. The assembly shall meet the requirements of: the latest available American Water works Association (AWWA) standards including Std. C511; hold current University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USC) approval and hold the American Society of Sanitary engineers (ASSE) listing.

C. All RPZ backflow preventers shall be installed in strict accordance with manufacturer's instructions.

D. Shall be a Watts Regulator Co. Series 009QT-S or equal. Size shall be as indicated on the drawings.

2.12 Sample Taps

A. All sample taps are to be threadless hose bibs unless indicated otherwise on the drawings. Those indicated to have threads shall be provided with a hose bib vacuum breaker.

2.13 Wall Pipes and Sleeves

A. Pipes through concrete walls and slabs shall be provided with wall pipes or penetration seals. Wall pipes shall comply with cast iron fittings specification and shall have flanged joint connections unless otherwise noted on the drawings. Penetration seals shall be Link-Seal as manufactured by Thunderline Corporation of Wayne Michigan, or equal. All hardware shall be stainless steel. Sleeves inside diameters shall be sized to fit the outside diameter of the penetrating pipe and the link seal. Sleeves shall be of a thickness to maintain their shape and shall be manufactured buy the seal manufacturer. All Sleeves shall have waterstops and be hot dipped galvanized after fabrication. Where pipe penetrations are in existing concrete structures, core drilling is acceptable provided the hole size is coordinated with the seal manufacturer.

2.14 Flushing Hydrants

A. Flushing hydrants shall comply with AWWA C502 standards for "dry barrel" compression type hydrants that open against pressure. Hydrants shall have a working pressure rating of 150 psi and a test pressure of 300 psi. They shall meet all the requirements of fire hydrants regarding operating nuts, stems, working parts, stem design, full 360 rotation, body castings, and repairs without dismantling. Flushing hydrants shall be equipped with a threaded or mechanical joint inlet of the size as indicated on the plans and have one 2-1/2 inch outlet with cap and chain. Outlet thread type will be as required by owner.

B. Flushing Hydrants shall be Mueller model A-411 or approved equal.

2.15 Fire Hydrants

A. Fire hydrants shall be manufactured in full compliance with this specification and shall also comply with the AWWA Fire Hydrant Specification C-502, latest revision and the following:

1. Type: Compression - Dry Standpipe: Valve shall open against and close with the pressure. The design shall be such that all internal operating parts can be removed through the standpipe and main valve rod extended without excavating.

2. Size: Internal valve diameter shall be a minimum 5-1/4".

3. Inlet Size and Type: 6" mechanical joint end with accessories.

4. Hose Nozzles: Each hydrant shall be equipped with two 2-1/2" I.D. hose nozzles with National Standard threads, one quarter turn bayonet lock or threaded in with O-ring seal and suitable locking arrangement.

5. Pumper Nozzle: Each hydrant shall be equipped with one 4-1/2" pumper nozzle having National Standard Threads, one quarter turn bayonet lock, or threaded in with O-ring seal and suitable locking arrangement.

6. Direction of Open: Left, counterclockwise.

7. Size and Shape of Operating Nut and Cap Nuts: to be 1-1/2" point to flat pentagon. Each hydrant shall be equipped with a weather cap.
8. Seal Plate: The hydrant shall be so constructed that a moisture-proof lubricant chamber is provided which encloses the operating threads, thereby automatically lubricating the threads each time the hydrant is operated. The lubricant chamber shall be enclosed with at least three O-rings. The two lower O-rings will serve as pressure seals; the third O-ring will serve as a combined dirt and moisture seal to prevent foreign matter from entering the lubricant chamber. The hydrant shall be equipped with either an anti-friction washer or bronze bushing to reduce operating torque. The bonnet will be secured to the hydrant using bolts and nuts.
9. Standpipe - Groundline Safety Construction: The standpipe sections shall be connected at the groundline by a two part, bolted safety flange or breakable lugs. The main valve rod sections shall be connected at the groundline by a frangible coupling. The standpipe and groundline safety construction shall be such that the hydrant nozzles can be rotated to any desired position without disassembling and removing the top operating components and the top section of the standpipe. The minimum inside diameter of the standpipe shall be 6".
10. Main Valve, Rod Assembly: The main valve rod assembly shall be so constructed to allow removal of all operating parts through the standpipe regardless of depth of bury, using a removal wrench which does not extend below the groundline of the hydrant. The main valve seat ring shall be bronze, and its assembly into the hydrant shall involve bronze to bronze thread engagement, and the valve assembly pressure seals shall be obtained without the employment of torque compressed gaskets. The design of the main valve rod shall be such that operating threads at the top of the rod and the valve assembly threads at the bottom of the rod are isolated from contact with water in the standpipe or in the hydrant inlet shoe.
11. Drain Valve: The operation of the drain mechanism shall be correlated with the operation of the main valve and shall involve a momentary flushing of the drain ports each time the hydrant is opened. The drain ports shall be fully closed when the hydrant valve is more than 2-1/2 turns open and the drainage channel in the bronze valve seat ring shall connect to two or more outlet drain ports. No springs may be employed in the hydrant valve or drain valve mechanism.
12. Depth of Bury: Normally hydrants shall be suitable for installation in trenches 4-1/2' deep. Required parts and materials to adjust fire hydrants to different depth of bury shall be provided by the manufacturer to meet actual field conditions as required.
13. Painting Instruction: One prime coat and two finish coats shall be factory applied. Finish coats shall be McCormick Cote-all multi purpose enamel polyurethane modified alkyd 33 series, 33320 safety yellow, 1.5 mils dft each. Touch up any damaged areas in the field. The wetted surface of the hydrant shoe shall be epoxy coated to prevent corrosion of the waterway.
14. Pressure Rating: Hydrants shall be rated for 250 working pressure and a 500 psi static test pressure.
15. Hydrants shall be Mueller Super Centurion 250 or approved equal

2.16 Pipe Locating Devices

A. Tracer wire shall be a #10 stranded copper wire with a blue jacket for water.

B. Wire Connectors

1. Connector, Wire, Set Screw Pressure type for use with No. 10 stranded wire size.
   a) Holub Industries MA-2 or equivalent
   b) Ideal Industries Model 30-222 or equivalent

2. Wire nuts shall not be allowed underground.Locator Stations

3. Locator stations shall be cast iron with a round locking lid. Inside diameter shall be a minimum of 5-3/4 inches and the length shall be a minimum of 15-1/2 inches.

4. Lid shall be labeled "Water Test" or as approved during submittal process.

5. Locator stations shall be capped in a round or square concrete collar a minimum of 4" thick and 12" outside diameter or square. Concrete collar shall have #3 bar reinforcing or other approved reinforcing mat.

6. Lid shall have stainless steel or brass screws to attach the tracer wire.

7. Locator stations shall be Bingham and Taylor figure number 6005 or approved equal.

C. Marking Tape

1. Tape shall be 3.5 mill polyethylene tape 3" in width, with the continuous printed message, "Caution – Waterline Buried Below." Tape shall be style 48288 as manufactured by the Seton Safety and Identification or approved equal

2.17 Bore Casing Pipe

A. Steel pipe shall be welded or seamless or smooth wall, consisting of Grade "B" steel as specified in ASTM A-139. Minimum yield strength shall be 35,000 psi, and pipe thickness shall be as specified on the construction plans. All pipe shall be furnished with beveled ends prepared for field welding of circumferential joints. Welds shall be a full penetration welds subject to visual inspection. All burrs at pipe ends shall be removed. Encasement pipe must be approved by the appropriate controlling agency (V.D.O.T., R.R., etc.) and the Engineer prior to ordering. Spiral weld casing pipe will not be allowed.

2.18 Pressure Gages

A. Pressure gauges shall be of all stainless steel construction, 3.5 inch case size, accuracy of 1% over the entire dial arch, ¼" NPT bottom connection, Pressure range shall be as indicated on the drawings.

B. Pressure gages shall be Ashcroft stainless steel–case 1009 pressure gauges or approved equal.

C. All pressure gages shall be installed with a ¼" stainless steel ball valve and stainless steel nipples.

D. All pressure gages shall be mounted with fittings or on fitting bosses. NO TAPPING OF PIPE OR SADDLES WILL BE ALLOWED.

2.19 Pipe Supports

A. Pipes shall be supported by steel pipe hangers, clamps . brackets, rods and inserts as required to support the imposed pipe loads. Hangers in general shall be new, manufactured of carbon steel and hot dipped galvanized after fabrication or 304 stainless steel.

B. Pipes 2 ½ inches and larger shall be supported with adjustable floorstand type pipe supports as detailed on the drawings. Pipe supports shall be Standon Model S89 flange support, Standon Model S96 cradle support as manufactured by Material Resources, Inc. or approved equal.

C. Pipes 2" and smaller shall be supported from the floor, walls or ceiling depending on the type of building construction. Pipe supports for these size pipes shall be as manufactured by Unistrut Building Systems. Supports shall consist of floor stands, wall brackets or clevis type hangers. Unistrut and appurtenances shall be stainless steel. Clips for copper tubings shall be copper coated. Minimum threaded rod size shall be 3/8 inch.

D. Ductile Iron and steel pipe supports shall be spaced in accordance with the following schedule:

Pipe sizes (inches)	½ - 3/4	1- 1 1/4	1 ½ - 2	3 – 4	6	8
Max spacing (feet)	4	6	8	10	12	14

E. Copper tubing pipe supports shall be spaced in accordance with the following schedule:

F.

Nominal tubing size (inches)	½ - 3/4	1- 1 1/4	1 ½ - 2
Max spacing (feet)	4	6	8

G. Pipe supports shall be located as per the following:

1. Maximum spacing as indicated above
2. Maximum of 12 inches from all horizontal and vertical changes in direction.
3. On the suction and discharge of pump piping to eliminate pipe stresses on the pump flanges.
4. On the connections to all equipment to eliminate pipe stresses on the equipment connections and allow equipment removal.
5. On the inlet and outlet piping to the water meter to allow the removal of the water meter.
6. Additional pipe supports as indicated on the drawings.

3. EXECUTION

3.01 General

A. Water lines shall be laid to lines and grades shown on the drawings with appurtenances and service connections at required locations. Installation of all materials shall be in strict conformance with manufacturer's recommendations and AWWA standards.

3.02 Separation of Potable Water Lines And Sanitary and/or Combined Sewer

A. Follow State Health Department standards for separation of water mains and sewer lines.

B. Parallel Installation:

1. Normal Conditions Water lines shall be constructed at least 10 feet horizontally from a sewer or sewer manhole whenever possible. The distance shall be measured edge to edge.

2. Unusual Conditions When local conditions prevent a horizontal separation of at least 10 feet, the water line may be laid closer to a sewer or sewer manhole provided that:
   a) The bottom of the water line is at least 18 inches above the top of the sewer.
   b) Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe pressure tested in place to 50 psi without leakage prior to backfilling. The sewer manhole shall be of watertight construction and tested in place.
   c)

C. Crossing:

1. Normal Conditions: Water lines crossing over sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible.

2. Unusual Conditions: When local conditions prevent the vertical separation described in crossing, normal conditions, (paragraph above) the following construction shall be used.
   a) Sewers passing over or under water lines shall be constructed of the materials described in parallel installation, unusual conditions Paragraph b. above.
   b) Water lines passing under sewers shall, in addition, be protected by providing:
      i. A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water lines.
      ii. That the length of the water line shall be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.

D. Sanitary and/or combined sewers or sewer manholes No water pipes shall pass through or come in contact with any part of sewer or sewer manhole.

3.03 Examination of Material:

A. All pipes, fittings, valves and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Owner, who may prescribe corrective repairs or reject materials.

3.04 Pipe Ends:

A. All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt sand, grit, or any other foreign material before the joint is made. Proper lubricant shall be used for all push joint pipe.

3.05 Pipe Cleanliness:

A. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe.

3.06 Pipe Placement:

A. Laying of the pipe shall be commenced immediately after the excavation is started, and every means must be used to keep pipe lying closely behind the trenching as each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade before the next length of pipe is laid. No more than 200 lf of trench shall be opened at any one time. No opened trenches will be allowed at the end of the work day.

B. Lay pipe with bell ends facing the direction of laying. Where grade is 10 percent or greater, lay pipe uphill with bell ends upgrade.

3.07 Pipe Plugs:

A. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a water tight plug or other means approved by the Engineer. When practical, the plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation should the trench fill with water.

3.08 Laying Conditions

A. Pipe shall be placed in a dry trench at the proper line and grade.

3.09 Pipe Deflection

A. Permissible deflection in mechanical joint pipe shall not be greater than 1/2 of that listed in AWWA C600 or as recommended by pipe manufacturer. No joint deflection shall be allowed in PVC pipe. Radius turn with PVC pipe shall be by bending pipe at 1/2 manufacturers recommended deflection.

3.10 Pipe Cutting:

A. Cutting of the pipe shall be done in a neat, workmanlike manner with the proper tools without creating damage to the pipe or cement mortar lining.

3.11 Restrained Joints

A. Provide reaction anchors of concrete blocking, metal harness, retainer gland type, restaining gaskets or restrained joint type pipe at all changes in direction of pressure pipelines and as shown on Drawings.

B. All mechanical joint bolts shall be torqued with a torque wrench as recommended by the manufacturer.

Bolt Size – Inches	Torque Ft. - Lbs.
5/8	45 - 60
3/4	75 - 90
1	100-120

C. Tighten nuts on alternate side of the gland until pressure on the gland is equally distributed

3.12 Polyethylene Pipe Installation

A. Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 PSI. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. All welds will be made using a Data Logger to record temperature, fusion pressure, with a graphic representation of the fusion cycle shall be part of the Quality Control records.

B. Sidewall fusions for connections to outlet piping shall be performed in accordance with HDPE pipe and fitting manufacturer’s specifications. The heating irons used for sidewall fusion shall have an inside diameter equal to the outside diameter of the HDPE pipe being fused. The size of the heating iron shall be ¼ inch larger than the size of the outlet branch being fused.

C. Mechanical joining will be accomplished by either using a HDPE flange adapter with a Ductile Iron back-up ring or HDPE Mechanical Joint adapter with a Ductile Iron back-up ring.

D. Socket fusion, hot gas fusion, threading, solvents, and epoxies will not be used to join HDPE pipe.

3.13 Manholes (at air release, valves, etc., as called for in the Drawings):

A. Manholes shall be constructed to the elevations shown on the Contract Drawings in accordance with the provisions of the Standard Details.

B. Set manhole base section on bed of VDOT #57 stone to a minimum depth of 8 in. Stone shall be thoroughly compacted and carefully leveled.

C. Join all manhole riser and cone or flat slab top sections by the use of o-ring type round rubber gaskets.

D. Install flexible manhole connections for all pipes sizes 4 in. to 24 in., inclusive and apply sealant to completely fill joint between manhole barrel and flexible connection for the full thickness of the manhole barrel.

E. Plug lift holes and repair any defects in manhole.

F. Set adjusting rings in Portland cement mortar bed.

1. Rings will not be required outside of paved roadways or walkways unless called for on the Contract Drawings.

2. Rings in paved roadways or walkways shall permit upward or downward adjustment of manhole frame by six inches.

G. All manhole frames shall be set on a bed of butyl mastic and bolted down with a minimum of 4 - 5/8” stainless steel anchor blots. Anchor bolts shall be embedded a minimum of 4” into concrete.

3.14 Road/Highway Crossings

A. Where crossing is to be installed beneath a Commonwealth of Virginia road or highway, all operations and materials shall conform to the requirements of the Virginia Department of Transportation governing such crossings, and the contractor shall obtain approval of all materials and methods to be employed before such work is started. A copy of such permission shall be filed with the Owner prior to starting the work. The contractor will also be required to furnish a release from the proper authorities before final acceptance of the work by the Owner. The contractor shall secure from the Department of Transportation the necessary information regarding proper bracing, sheeting, shoring and other required protection of the highway and traffic during the construction operation.

B. Where an open cut is permissible in crossing the State Highway instead of boring, the contractor shall make the necessary provisions for handling traffic and replacing the roadbed and surface as required by the Virginia Department of Transportation.

3.15 Setting Valves and Valve Boxes.

A. Install valves with operator stems plumb in the vertical plane. Locate valves where shown on Drawings.

B. Equip all underground valves with valve boxes or standard precast concrete manholes where shown on the Drawings. Set valve boxes or manholes in accordance with drawings. Set box plumb in the vertical direction in alignment with valve stem centered on valve nut. Where valve

boxes or manhole covers are used, 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.

3.16 Tracer Wire

A. Wire shall be placed on the top of all underground pipes and attached to the pipe with wire ties at a minimum of every ten (10) feet. Water service connections will have a single wire attached from the main line wire and terminating in the meter box as close to the surface as possible. Tracer wire within Meter Boxes will be stripped three-quarter (3/4) inch from the end and capped with a wire nut to minimize electrical ground contact. All connections at the main line must be electrically sound and physically secure with screw connections or clamps. All connections must be taped with electric tape and sealed with an electrical coating sealant.

3.17 Locator Stations

A. Locator Stations shall be installed every 1000 ft along the pipe line and within ten (4) feet of each fire hydrant.

3.18 Marking Tape

A. Install marking tape in utility trenches above all pipes in accordance with manufacturer's recommendations. Install tape approximately 18 inches above the pipe and not less than 18 inches deep.

3.19 Testing

A. Contractor shall supply water at no cost, for testing potable water lines.

B. Pressure Testing of Water Mains and Pressure Pipe

1. Hydrostatic testing shall be performed in accordance with AWWA C600.

2. After the pipe has been installed, all pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure or 150 psi which ever is greater, at the lowest point in the system.

3. Test Pressure Restrictions:
   a) Test pressures shall:
      i. Not be less than 1.25 times the working pressure or 125 psi which ever is greater at the highest point along the test section.
      ii. Not to exceed pipe or thrust restraint design pressures.
      iii. Be of at least 2-hour duration.
      iv. Not vary by more than 5 psi± for the duration of the test.
      v. Not to exceed the rated pressure of the valves, hydrants and appurtenances.

   b) Each valved section of pipe shall be filled with water slowly and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gage, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Owner's Representative.
   c) Before applying the specified test pressure, air shall be expelled completely from the pipe, valves and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall remain closed and be left in place.

d) All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or eplaced with sound material and the test shall be repeated until it is satisfactory.

C. Leakage Test For Bell and Spigot and Mechanical Joint Pipe

1. A leakage test shall be conducted concurrently with the pressure test
2. Leakage shall be defined as the quality of water that must be supplied into the newly installed pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. Leakage shall not be measured by a drop in pressure in a test section over a period of time.
3. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

in which **L** is the allowable leakage, in gallons per hour; **S** is the length of pipeline tested, in feet; **D** is the nominal diameter of the pipe, in inches; and **P** is the average test pressure during the leakage test in pounds per square inch gage.

4. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gallons/hour/inch of nominal valve size shall be allowed.
5. Acceptance shall be determined on the basis of allowable leakage. If any test of pipe installed discloses leakage greater than that specified above, the Contractor shall, at his own expense, locate and make repairs as necessary until the leakage is within the specified allowance. ALL VISIBLE LEAKS ARE TO BE REPAIRED REGARDLESS OF THE AMOUNT OF LEAKAGE.

D. Leakage testing of exposed and above ground pipe

1. ALL JOINTS ARE TO BE WATERTIGHT. THERE SHALL BE NO VISIBLE LEAKS ALLOWED. ALL LEAKS ARE TO BE REPAIRED.

3.20 Disinfection

A. The water used in the disinfection and flushing process shall be potable water from an approved supply. If water is to be transported to the subject site, then the tank trucks must also be properly disinfected prior to transporting water. Disinfection of the vehicle should also include all appurtenances used such as valves, hoses, etc.

B. Preliminary Flushing

1. 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 3.0 ft./sec. Adequate provisions shall be made for drainage of flushing water. Flushing is to be performed only with the approval of and under the direction of the Town Inspector. The Contractor shall inspect areas of discharge and provide the necessary equipment to prevent any environmental damage or erosion. The Contractor shall be responsible for any damage that may result from flushing.

C. 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, and 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 tabular in 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 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.

D. Methods of Chlorine Application:

1. Continuous Feed Method
   a) 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 pitot gage 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. Table 1 gives the amount of chlorine required for each 100 ft. 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 gal. of water.

TABLE 1
CHLORINE REQUIRED TO PRODUCE 50 MG/L CONCENTRATION
IN 100 FT. OF PIPE - BY DIAMETER

Pipe Size In.	100 Percent Chlorine Lb.	1 Percent Chlorine Solutions 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

b) During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the line supplying the water. 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 Utilities Department)
   a) 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.
   b) As the chlorinated water flows past tees and crosses, related valves and hydrants shall be operated so as to disinfect appurtenances.

3. Tablet Method
   a) 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 have entered the main or if the water is below 41 degrees F (5 degrees 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.
   b) Place tablets in each section of pipe and also in hydrants, hydrant branches, and other appurtenances. Attach tablets using an adhesive that is a NSF 61 listed product. 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.
   c) 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 Ft. Joint

3 in.	1
4 in.	1
6 in.	2
8 in.	3
10 in.	4
12 in.	7

d) When installation is complete, 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.

E. Final Flushing: After the applicable retention period, the heavily chlorinated water shall be flushed from the main. Using a "Neutralization Station", neutralize the waterline until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than 1 MG/L. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipeline.

3.21 Bacteriological Tests

A. After final flushing, and before the water main is placed in service, samples shall be collected and tested for bacteriologic 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 1,200 ft. and tested by the Department of Consolidated Laboratory Services or a Department of Consolidated Laboratory Services certified laboratory and the results submitted to engineer.

B. 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 will 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.

C. 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.

D. 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 done at the contractor's expense.

END OF SECTION

SECTION 02741 - ASPHALT PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and the provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hot-mix asphalt paving over prepared subbase.
2. Hot –mix asphalt patching.
3. Hot-mix asphalt overlays.
4. Asphalt surface treatments
5. Pavement-marking paint

1.3 SUBMITTALS

A. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

B. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

C. Material Test Reports: For each paving material.

D. Traffic maintenance and Work Area Protection Plan: Submit a plan indicating sequencing and measures to be used for the maintenance and protection of traffic during operations within or immediately adjacent to existing roadways open to vehicular traffic. The Engineer and the Virginia Department of Transportation must approve this plan prior to commencement of work within the Right-of-Way.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Asphalt paving materials and installation shall conform to the requirements of the latest edition of the Virginia Department of Transportation (VDOT) Road and Bridge Specifications and Road and Bridge Standards.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum ambient temperature of 50 deg F (10 deg C), and when temperature has not been below 35 deg F (1 deg C) for 12 hours immediately prior to application.

2. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.

1.6 TESTING AND INSPECTION

A. Within the road Right-of-Way, VDOT inspectors shall observe the asphalt placement. Coordinate the necessary inspection schedule with the Franklin Residency.

B. The Owner's testing agency will observe the asphalt placement in the on-site areas not in Right-of-Way.

PART 2 - PRODUCTS

2.1 ASPHALT-AGGREGATE MIXTURE

A. General: Provide plant-mixed, hot-laid asphalt-aggregate mixture complying with the requirements of the VDOT Road and Bridge Specifications and as recommended by local paving authorities to suit project conditions.

2.2 ASPHALT MATERIALS

A. Tack Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

B. Prime Coat: Asphalt emulsion prime conforming to VDOT requirements.

2.3 AUXILIARY MATERIALS

A. Paving Geotextile: Nonwoven polypropylene, specifically designed for paving applications, resistant to chemical attack, rot, and mildew.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Notify Engineer in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

D. Verify that utilities and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.2 MAINTENANCE AND PROTECTION OF TRAFFIC

A. Utilize flagmen, barricades, warning signs and warning lights as required by the Virginia Work Area Protection Manual.

3.3 PATCHING AND REPAIRS

A. Patching: Saw cut perimeter of patch and excavate existing pavement section to sound base. Recompact new subgrade. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.

1. Tack coat faces of excavation and allow to cure before paving.

2. Fill excavation with dense-graded, hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

B. Leveling Course: Install and compact leveling course consisting of dense-graded, hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.

C. Crack and Joint Filling: Remove existing filler material from cracks or joints to a depth of 1/4 inch (6 mm). Refill with asphalt joint-filling material to restore watertight condition. Remove excess filler that has accumulated near cracks or joints.

D. Tack Coat: Apply uniformly to existing surfaces of previously constructed asphalt or Portland cement concrete paving and to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m) of surface.

1. Allow tack coat to cure undisturbed before paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillage and clean affected surfaces.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

C. Prime Coat: For asphalt sections less than 4” thick, apply uniformly over surface of compacted-aggregate base at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 24 hours minimum.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

2. Protect primed substrate from damage until ready to receive paving.

3.5 GEOTEXTILE INSTALLATION

A. Apply bond coat, consisting of asphalt cement, uniformly to existing surfaces at a rate of 0.20 to 0.30 gal./sq. yd. (0.8 to 1.2 L/sq. m).

B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches (100 mm) and transverse joints 6 inches (150 mm).

1. Protect paving geotextile from traffic and other damage and place overlay paving the same day.

3.6 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt mix on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.

1. Place hot-mix asphalt base course in number of lifts and thickness indicated.

2. Spread mix at minimum temperature of 225 deg F (107 deg C).

B. Place paving in consecutive strips not less than 10 feet (3 m) wide, except where infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete asphalt base course for a section before placing intermediate or surface courses.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 JOINTS

A. Construct joints between old and new pavement, or between successive days work, to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat.

2. Offset longitudinal joints in successive courses a minimum of 6 inches (150 mm).

3. Offset transverse joints in successive courses a minimum of 24 inches (600 mm).

4. Construct transverse joints as required by the VDOT Road and Bridge Specifications.

5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

3.8 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve indicated density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 95 percent of reference laboratory density according to ASTM D 1559.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm. Surface course average density shall be 95 percent of reference laboratory density.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method. Edges adjacent to curbs and curb and gutter sections shall be flush with the edge of concrete.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch (13 mm).

2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch (6 mm).

2. Surface Course: 3/16 inch (3 mm).

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

C. Check surface areas at intervals as directed by Architect.

3.10FIELD QUALITY CONTROL

A. Within the VDOT Right-of-Way, coordinate required inspections with the Franklin Residency of the Virginia Department of Transportation.

B. Testing Agency: Owner will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with requirements.

D. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with requirements.

END OF SECTION 02741

SECTION 02821 - CHAIN LINK FENCES AND GATES

1. GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.02 WORK INCLUDED

A. Polyester powder coated black chain link fence and gates.

1.03 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

1.04 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 resources to provide chain-link fences and gates of consistent quality in appearance and physical properties.

1.05 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

2.01 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. Black Powder 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.

2.02 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. Polyester Powder Coating: ASTM 1234, black color.

E. Selvage shall be twisted at the top and knuckled at the bottom.

2.03 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 surfaces 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.

2.04 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 polyester powder coating 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 gate posts and at bother 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 pull post, except where fabric is integrally woven into post.

H. Tension and Brace Bands: Minimum ¾" wide hot-dip galvanized steel with minimum 1.2 oz. zinc coating per sq. ft. of surface area.

1. Tension bands: Minimum 14 gauge (0.074") thick.

2. Tension and Brace bands: Minimum 12 gauge (0.105") thick.

I. Concrete: Comply with the requirements for VDOT Std. Class A3 concrete.

J. 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.

2.05 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.

2. 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.

3. 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 the open position until manually released. Keeper shall be set in concrete. On double gates each gate shall have a keeper.
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, permitting both gate leaves to be locked with single padlock.

3. EXECUTION

3.01 INSTALLATION:

A. General: Install fence in compliance with ASTM F 567 and manufacturers 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.

D. Top Rails:

1. 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.

E. 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.

F. 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.

G. Brace Assemblies:

1. Install braces so posts are plumb when diagonal rod is under proper tension.

H. 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 - ga. galvanized steel hog rings spaced maximum 24" o.c..

I. 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, unless otherwise indicated, and anchor to framework so that fabric remains in tension after pulling force is released.

J. Stretcher Bars:

1. Thread through fabric 4" o.c., and secure to end, corner, pull and gate posts with tension bands spaced maximum 15" o.c.

K. 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.

L. 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.

M. 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.

2. Tack weld all hinges after gates are set.

END OF SECTION

SECTION 03150 - ADHESIVE 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 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 shall be a hybrid adhesive consisting of a methacrylate resin, hardener, cement and water.

D. Injection adhesive shall be Hilti HIT-HY 200 or HIT-ICE or approved equal.

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. 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”

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 cure time (as specified by the Manufacture) has elapsed.
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 the Manufacturer for drilling holes with a diamond bit.
2. Hole depth shall be as indicated in the manufacturer's instructions. Minimum embedment depths shall be:

Anchor Bolt Dia.	Embedment Depth
3/8”	3”
1/2”	3”
5/8”	3-1/2”
3/4”	3-1/2”
7/8”	4”
1”	4”

3. Hole must be cleaned to remove dust, debris, water, oil, chemicals and any other foreign matter or contaminants.
4. Using the dispenser with static mixer inject adhesive into hole.
5. Install rod and allow adhesive to cure, per Manufacturer’s specifications.
6. 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 the Manufacturer's instructions

END OF SECTION

SECTION 03300 - CAST-IN-PLACE CONCRETE

1. GENERAL

1.01 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for Building and Equipment Structures.

1.02 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.

1.03 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.

1.04 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 301-16, "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.

1.05 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

2.01 MANUFACTURERS

2.02 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.

2.03 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.

2.04 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.

2.05 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.

2.06 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.

2.07 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.

2.08 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.

2.09 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.

2.10 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.

2.11 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.

2.12 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.

2.13 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: None allowed.
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.

2.14 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.

2.15 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

2.16 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.17 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

3.01 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.

3.02 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.

3.03 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.

3.04 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.

3.05 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.

3.06 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.

3.07 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.

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.

3.08 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.

3.09 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 bonding agent 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 03600 - GROUT

1. GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment, and incidentals as shown, specified and re- quired 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.
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 03300, Cast-In-Place Concrete.
All anchor bolts and reinforcing steel set in grout.	Refer to Section 03 15 00, Anchor Bolts, Toggle Bolts, and Concrete Inserts.
Any application not listed above, where grout is called for on the Drawings.	Non-shrink Class I, unless noted otherwise.

1.2 REFERENCES

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 his 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 the 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 per- formed which does not conform to the requirements of the Specifications. The Con- tractor 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 the 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 re- vised 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. The Manufacturer's specifications and installation instructions for all proprietary materials.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Grout materials from the 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 protect- ed from moisture.

2. PRODUCTS

2.0 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. The 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 ap- plication 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.
   a) At temperatures of 45, 73.4, and 95°F.

2. 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.
3. The non-shrink property is not based on a chemically generated gas or gypsum expansion.
4. Fluid grout shall pass through the flow cone, with a continuous flow, one hour after mixing.
5. 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. The 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 03 30 00, 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 03 30 00, Cast-In-Place Concrete, may be used when accepted by the Engineer.
3. Coarse aggregate shall be graded as follows:

U.S. STANDARD SIZE	PERCENT BY SIEVE 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 03 30 00, Cast-In-Place Concrete, with aggregate coarser than 1/2-inch removed. Themix 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 03 30 00, 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 the 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 the Engineer.

2.2 CURING MATERIALS

2.3 Curing materials shall conform to the requirements of Section 03 30 00, Cast-in-Place Concrete, and as recommended by the Manufacturer of prepackaged grouts.

2.4 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.

2. EXECUTION

3.1 INSPECTION

A. The Contractor shall examine the substrate and conditions under which grout is to be placed and notify the Engineer, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.2 INSTALLATION

A. General:

1. Place grout as shown and in accordance with the Manufacturer's instructions. If Manufacturer's instructions conflict with these Specifications, do not proceed until the Engineer provides clarification.

2. The 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 03300, Cast-In-Place Concrete.

4. Grout shall be cured following the Manufacturer’s instructions for prepackaged grout and the requirements in Section 03300, 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 03 30 00, 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 sand-blasting 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 slur- ry 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 recom- mended 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 03300, 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 03300, 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 uni-formly to drain and to detect high and low spots which shall be immediately elimi-nated. 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 wa-ter, dry cement, or mixture of dry cement and sand shall be applied to the surface.

END OF SECTION

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units.
2. Split Face masonry units
3. Mortar
4. Flashing
5. Foam Insulation
6. Reinforcing

B. See Section 05500 "Metal Fabrications" for furnishing steel lintels installed in unit masonry assemblies.

1.2 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1.3 SUBMITTALS

A. Product Data: For each masonry unit, accessory, and other manufactured product indicated.

B. Shop Drawings: For masonry reinforcing bars; comply with ACI 315, "Details and Detailing of Concrete Reinforcement."

C. Material Test Reports: For each type of masonry unit, mortar, and grout required.

D. Material Certificates: For each type of masonry unit required.

E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1.4 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

B. Hot-Weather Requirements: When ambient temperature exceeds 100 deg. F, or 90 deg. F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Colors, Textures, and Patterns: Provide masonry units and mortar for exposed work matching Architect's samples or, if none, as selected by Architect from manufacturer's full range of colors, textures, and patterns.

B. Concrete Masonry Units: ASTM C 90 and as follows:

1. Compressive Strength: 1900 psi (13.1 MPa) minimum average net-area compressive strength.
2. Compressive Strength: As required to produce concrete unit masonry construction of compressive strength indicated.
3. Weight Classification: Lightweight for Standard CMU
4. Provide Type I, moisture-controlled units.
5. Size: Manufactured to the actual dimensions of 3/8 inch (10 mm) less than nominal sizes indicated on Drawings:

C. Split Face and Ground Face Blocks listed below are to be manufactured using a water repellant admixture equal to Dry-Block by W. R. Grace.

D. Mortar and Grout Materials: As follows:

1. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. For pigmented mortars, use premixed, colored-cement or cement-lime mix of formulation required to produce color indicated. Mortar colors to be selected in the field using submitted masonry units and mortar samples.
2. Hydrated Lime: ASTM C 207, Type S.
3. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm), use aggregate graded with 100 percent passing the No. 16 (1.18 mm) sieve.
   a. Colored-Mortar Aggregates: Natural-colored sand or ground marble, granite, or other sound stone, as required to match Architect's sample.
4. Aggregate for Grout: ASTM C 404.
5. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.
6. Water: Potable.
7. Admixtures: Mortar in exterior walls to be manufactured using a water repellant admixture equal to Dry-Block by W. R. Grace.

E. Deformed Reinforcing Wire: ASTM A 496, with ASTM A 153, Class B-2 zinc coating.

F.Joint Reinforcement: Provide joint reinforcement formed from galvanized carbon-

steel wire, ASTM A 153, Class B-2, for exterior walls.

1. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet (3 m), with prefabricated corner and tee units, and complying with requirements indicated below:
   a. Wire Diameter for Side Rods: 0.1875 inch (4.8 mm).
   b. Wire Diameter for Cross Rods: 0.1483 inch (3.8 mm).
2. For single-wythe masonry, provide ladder design with single pair of side rods or provide truss design with single pair of side rods:

G. Ties and Anchors, General: Provide ties and anchors that comply with the following requirements, unless otherwise indicated.

1. Wire: As follows:
   a. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating for exterior walls.
   b. PC Panel Reinforcing for glass block walls

H. Adjustable Anchors for Connecting to Structural Frame: Provide 2-piece assemblies as described below, wire diameter as indicated:

1. For Anchorage to Steel Framing: Crimped 1/4-inch- (6.4-mm-) diameter wire anchor section for welding to steel and triangular-shaped wire tie section sized to extend within 1 inch (25 mm) of masonry face.

I. Embedded Flashing Materials: As follows:

1. Copper-Fabric Laminate: Copper sheet weighing 7 oz./sq. ft. (2 kg/sq. m), bonded with asphalt between 2 layers of glass-fiber cloth.
2. Rubberized Asphalt Sheet Flashing: Manufacturer's standard composite flashing product consisting of a pliable and highly adhesive rubberized asphalt compound, 26 mils (0.7 mm) thick, bonded completely and integrally to a high-density, cross-laminated polyethylene film, 4 mils (0.1 mm) thick, to produce an overall thickness of 30 mils (0.8 mm).

J. Miscellaneous Masonry Accessories: As follows:

1. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Type 2, Class A, Grade 1; compressible up to 35 percent; of width and thickness indicated.
2. Preformed Control-Joint Gaskets: Designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated, made from styrene-butadiene rubber complying with ASTM D 2000, Designation M2AA-805.
3. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
4. Weep Holes: Provide the following:

a. Round Plastic Tubing: Medium-density polyethylene, 3/8-inch (9-mm) outside diameter by 4 inches (100 mm) long; or,

b. Wicking Material: Cotton sash cord, in length required to produce 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity between wythes:

5. PC Panel Anchors for attachment of glass block to walls

6. PC expansion strips for spacing between glass block and walls

K. Masonry Cleaners: As follows:

1. Per Split-face Manufacturer's recommendations. Exercise extreme care to cause no staining or discoloration of split face units.

L. Mortar and Grout Mixes: Do not use admixtures unless otherwise indicated. Do not use calcium chloride in mortar or grout.

1. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar indicated below:

a. For masonry below grade, in contact with earth, reinforced masonry, and where indicated, use Type S.

b. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing artitions; and for other applications where another type is not indicated, use Type S.

2. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required.

a. For Portland cement-lime mortar, limit pigments to not more than 10 percent of cement content by weight.

b. For masonry cement mortar, limit pigments to not more than 5 percent of cement content by weight.

3. Grout for Unit Masonry: Comply with ASTM C 476. Use grout of consistency to completely fill spaces intended to receive grout.

M. Foam Insulation - Core-Fill 500 as manufactured by Tailored Foam Products Company.

N. Source Quality Control: The Owner will employ and pay a qualified independent testing agency to perform the following tests:

1. Concrete Masonry Unit Tests: ASTM C 140, for each type of concrete masonry unit indicated

PART 3 - EXECUTION

3.1 DESCRIPTION

A. Cut masonry units with motor-driven saws. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut

surfaces and, where possible, cut edges concealed.

B. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

C. Construction Tolerances: As follows:

1. Variation from Plumb: For vertical lines and surfaces do not exceed 1/4 inch in 10 feet (6 mm in 3 m), nor 3/8 inch in 20 feet (10 mm in 6 m), nor 1/2 inch in 40 feet (12 mm in 12 m) or more. For vertical alignment of head joints, do not exceed plus or minus 1/4 inch in 10 feet (6 mm in 3 m) nor 1/2 inch (12 mm) maximum.
2. Variation from Level: Do not exceed 1/4 inch in 20 feet (6 mm in 6 m) nor 1/2 inch in 40 feet (12 mm in 12 m).
3. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet (12 mm in 6 m) nor 3/4 inch in 40 feet (19 mm in 12 m).
4. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4 inch (6 mm) nor plus 1/2 inch (12 mm).
5. Variation in Mortar-Joint Thickness: Do not vary from bed-joint thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from head-joint thickness indicated by more than plus or minus 1/8 inch (3 mm).

D. Lay out walls in advance for accurate spacing of surface bond patterns and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.

E. Bond Pattern for Exposed Masonry: Lay exposed masonry in the running bond; do not use units with less than nominal 8-inch (100-mm) horizontal face dimensions at corners or jambs.

F. Built-in Work: As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

G. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

H. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness at split face units, all interior joints and exterior standard CMU to receive paint finish. Exterior joints in Standard CMU to receive EIFS to be struck flush.

I. Provide continuous horizontal-joint reinforcement as indicated. Install with a minimum cover of 5/8 inch (16 mm) on exterior, 1/2 inch (13 mm) elsewhere. Lap a minimum of 6 inches (150 mm).

1. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections.

J. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide a 1-inch (25-mm) open space between masonry and structural member, unless otherwise indicated.
2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.

K. Provide masonry lintels where shown. Provide precast lintels matching concrete masonry units in color, texture, and compressive strength and with reinforcement bars indicated or required to support loads indicated.

L. Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated.

1. Extend flashing 4 inches (100 mm) at ends and turn up not less than 2 inches (50 mm) to form a pan.

M. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.

N. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

1. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

O. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Do not exceed the following pour heights for fine grout:
   a. For minimum widths of grout spaces of 3/4 inch (19 mm) or for minimum grout space of hollow unit cells of 1-1/2 by 2 inches (38 by 51 mm), pour height of 12 inches (305 mm).
   b. For minimum widths of grout spaces of 2 inches (51 mm), pour height of 60 inches (1524 mm).
2. Do not exceed the following pour heights for coarse grout:
   a. For minimum widths of grout spaces of 1-1/2 inches (38 mm), pour height of 12 inches (305 mm).
   b. For minimum widths of grout spaces of 2 inches (51 mm), pour height of 60 inches (1524 mm).
   c. For minimum widths of grout spaces of 2-1/2 inches (63 mm) or for minimum grout space of hollow unit cells of 3 by 3 inches (76 by 76 mm), pour height of 12 feet (3.6 m).

P. Insulation – Pump foam insulation in cores of all exterior walls full height of masonry. Point up all pump and vent holes following installation. Cores must be dry prior to pumping.

Q. Field Quality Control: The Owner will employ and pay a qualified independent testing agency to perform the following tests during construction for each 5000 sq. ft. (460 sq. m) of wall area or portion thereof:

1. Mortar Properties: ASTM C 270.
2. Mortar Composition and Properties: ASTM C 780.
3. Grout: ASTM C 1019.
4. Prism-Test Method: For each type of wall construction indicated, masonry prisms will be tested per ASTM E 447, Method B, and as follows: 1 set of prisms at 7 days and 1 set at 28 days.

R. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.

S. Final Cleaning: After mortar is thoroughly set and cured, remove mortar particles with nonmetallic scrapers, and clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Protect adjacent surfaces from contact with cleaner.
3. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
4. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain.

T. Masonry Waste Disposal: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

END OF SECTION

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Miscellaneous steel framing and supports.

1.2 SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details of installation, and attachments to other Work.

PART 2 - PRODUCTS

2.1 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

B. Ferrous Metals:

1. Steel Plates, Angles, and Bars: ASTM A 36/A 36M.
2. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500
3. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.2 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664 and compatible with finish paint systems indicated.

B. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint for regalvanizing welds in steel.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls, of type, grade, and class required by application indicated.

B. Nonshrink, Nonmetallic Grout: ASTM C 1107, factory-packaged, nonstaining, noncorrosive, nongaseous grout.

2.4 FABRICATION

A. Connections, General: Use connections that maintain structural value of joined pieces.

1. Shear and punch metals cleanly and accurately. Remove burrs.
2. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux

immediately. Finish exposed welds smooth and blended.

3. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes.

4. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

B. Loose Bearing and Leveling Plates: Fabricate loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

1. Galvanize plates after fabrication.

C. Loose Steel Lintels: Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

1. Galvanize loose steel lintels located in exterior walls.

D. Miscellaneous Framing and Supports: Fabricate steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work from structural steel of welded construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.

E. Miscellaneous Steel Trim: Fabricate units with continuously welded joints and smooth exposed edges. Miter corners and use concealed splices where possible. Fabricate cutouts, fittings, and anchorages; coordinate assembly and installation with other work.

2.5 FINISHES

A. Finish metal fabrications after assembly. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Shop prime ferrous-metal items not indicated to be galvanized. All stairs, railings, platforms and gratings to be hot dip galvanized as follows:

1. Hot-dip galvanize items indicated to be galvanized to comply with ASTM A 123 or ASTM A 153/A 153M as applicable.

2. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

3. Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Provide anchorage devices and fasteners for securing metal fabrications to in-place construction. Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and

surfaces level, plumb, and true.

1. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
2. Fit exposed connections accurately together. Weld connections, unless otherwise indicated. Do not weld, cut, or abrade galvanized surfaces.

B. Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack with nonshrink, nonmetallic grout.

C. Touch up surfaces and finishes after erection.

1. Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.
2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 05530 - 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

1. Metal fabrication materials shall meet the requirements of the following ASTM Standards and Specifications.
2. Structural steel, plates and shapes A-36
3. Structural bolts, A-325
4. Other Bolts, A-307
5. Steel pipe, A 53.
6. Galvanizing, A123.

B. 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. Provide submittals in accordance with Specification 01 33 00 “Submittals”

B. 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. All pipe supports shall be fabricated with minimum A36 steel.

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.

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 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.

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 nutted on each side of the hanger and support.

C. Pipes shall be supported by steel pipe hangers, clamps, brackets, rods and inserts as required to support the imposed pipe loads. Hangers in general shall be new, manufactured of carbon steel and hot dipped galvanized after fabrication or 304 stainless steel as indicated on the drawings.

D. Pipe Support Spacing

1. All pipe supports shall be installed in locations as indicated on the drawings. The following spacing shall be used if supports are not indicated on the drawings. The more conservative shall apply. This is a maximum spacing and does not take into account valves, fittings, flow meters, risers, drops and other devices. Locations where these are located will require additional supports.

2. Ductile Iron and steel pipe supports shall be spaced in accordance with the following schedule for galvanized and stainless steel pipe:

Pipe sizes (inches)	½ - 3/4	1- 1 1/4	1 ½ - 2	3 – 4
Max spacing (feet)	4	6	8	10

3. Copper tubing pipe supports shall be spaced in accordance with the following schedule:

Nominal tubing size (inches)	1/2 - 3/4	1- 1 1/4	1 1/2 - 2
Max spacing (feet)	4	5	6

4. PVC pipe supports shall be spaced in accordance with the following schedule:

Nominal pipe size (inches)	1/2 - 3/4	1- 1 1/4	1 1/2 - 2	3-4
Max spacing (feet)	2.5	3	4	6

5. Maximum spacing between pipe supports shall be 10 feet for all pipes 6” and above. This is a maximum spacing and does not take into account valves, fittings, flow meters, risers, drops and other devices. Locations where these are located will require additional supports.

6. In addition to the above supports shall be located as per the following:

a. Maximum spacing as indicated above
b. Maximum of 12 inches from all horizontal and vertical changes in direction.
c. On the suction and discharge of pump piping to eliminate pipe stresses on the pump flanges.
d. On the connections to all equipment to eliminate pipe stresses on the equipment connections and allow equipment removal.
e. On the inlet and outlet piping to the water meter to allow the removal of the water meter.
f. At the location of valves, fittings or other devises that cause additions weight to the piping.
g. Additional pipe supports as indicated on the drawings.

E. 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.
3. All threads where used for adjustment of the supports shall be coated with an anti-seize compound.

END OF SECTION

SECTION 09900 - PAINT SYSTEMS

1. GENERAL

1.01 SCOPE

A. Provide all personnel, materials, and equipment necessary for the preparation of surfaces and the application of paint systems to all surfaces specified below and shown on drawings.

1.02 SUBMITTALS

A. The contractor shall be responsible for obtaining from the paint manufacturer product literature giving name, generic type and descriptive information, application recommendations, and maintenance information.

1.03 PRODUCT DELIVERY, HANDLING AND STORAGE

A. All materials shall be delivered to the job site in original, new and unopened containers bearing the manufacturer's name on the label. Labels shall be provided on each container with the following information: Name of material, manufacturer's stock number, manufacturer's name, contents by volume for major pigment and vehicle constituents, thinning instructions and application instructions. The Contractor shall protect all material from freezing or damage and shall store all materials used on the job in a single place. Remove any soiled or used rags, waste trash from storage area every night. Take every precaution to avoid the danger of fire.

2. PRODUCTS

2.01 MATERIALS

A. All materials specified herein are manufactured by the Tnemec Company, Inc., North Kansas City, Missouri or Porter Paint Company, Louisville, KY, and are approved for use on this project.

B. Equivalent materials of other manufacturers may be substituted on approval of the Engineer. Requests for substitution shall include manufacturer's literature for each product giving the name, generic type, descriptive information and evidence of satisfactory past performance.

C. Color of coating shall closely match existing. Prior to beginning work, the Contractor shall furnish sample color chips for all surfaces to be painted.

3. EXECUTION.

3.01 GENERAL

A. All coating shall be applied in accordance with the coating manufacturer's recommendations.

3.02 SURFACE PREPARATION

A. The exterior surface of piping shall be cleaned in the shop in accordance with SSPC-5P6 "Commercial Blast Cleaning" or SSPC-5P8 "Pickling". All mill scale and rust shall be

removed. After blast cleaning, all surfaces shall be thoroughly cleaned of any residue or dust before application of the prime coat.

B. All surfaces to be painted shall be cleaned and primed following manufacturer's recommendations.

3.03 PRIMER APPLICATION

A. All surfaces shall be primed immediately following surface preparation and before any surface rusting occurs or any dust or soil has accumulated.

3.04 FIELD PRIMER APPLICATION

A. Field welds and damaged areas shall be field primed after surface preparation and before any surface rusting or accumulation of dust or soil. Weld seams shall be coated by brushing Curing time shall be in accordance with manufacturer's recommendations.

3.05 INTERMEDIATE AND FINISH COAT APPLICATION

A. In no case shall coating be applied if the relative humidity exceeds 85%. The finish coat shall be applied when the surface temperature is between 50 degrees F. and 120 degrees F. Each day's coating should always be completed will in advance of the probable time of day condensation will occur, and the steel surface temperature is expected to drop below the dew point. Minimum curing time shall be in strict accordance with manufacturer's recommendations.

B. Finish coat shall be uniform in color and sheen without streaks, laps, runs, sags, or missed areas.

3.06 PAINTING SCHEDULE

A. Carbon Steel - Structural Steel, Miscellaneous Metals, Tanks, Pipes, Equipment, and Support Steel

1. Exterior Non-Immersion
   a) Surface Preparation: SSPC-SP6 Commercial Blast Cleaning.
   b) Shop Primer: Verify for compatibility with appropriate steel sections.
   c) First Coat: 69-Color Hi-Build Epoxoline II or PorterMastic 7000 at 4.0-6.0 mils dft.
   d) Second Coat: 74 Color Endura-Shield or PorterThane 9000 at 3.0-5.0 mils dft.
   e) Total Dry Film Thickness: 7.0-11.0 mils dft.

2. Interior, Non-Immersion
   a) Surface Preparation: SSPC-SP6 Commercial Blast Cleaning
   b) Shop Primer: Verify for compatibility with appropriate steel sections
   c) First Coat: 69-Color Hi-Build Epoxoline II or PorterMastic 7000 at 4.0-6.0 mils dft.
   d) Second Coat: 74 Color Endura-Shield or PorterThane 9000 at 3.0-5.0 mils dft.
   e) Total Dry Film Thickness: 7.0-11.0 mils dft.

3. Interior, Moderate Chemical and Dry Exposure (Areas such as machine rooms, equipment maintenance and laboratories).
   a) Surface Preparation: SSPC-SP6 Commercial Blast
   b) Shop Primer: Verify for compatibility with appropriate steel section.
   c) One Coat: 69-Color Hi-Build Epoxoline II or PorterMastic 7000 at 4.0-6.0 mils dft.

d) Total Dry Film Thickness: 4.0-6.0 mils dft

4. Immersion, interior or exterior non-potable or potable water
   a) Surface Preparation: SSPC-SP 10 Near White Blast Cleaning
   b) First Coat: 69-Color Hi-Build Epoxoline II or PorterLine 6000 at 4.0-6.0 mils dft.
   c) Second Coat: 69-Color Hi-Build Epoxoline II or PorterLine 6000 at 4.0-6.0 mils dft.
   d) Total Dry Film Thickness: 8.0-12.0 mills dft

B. Concrete Masonry Unit (CMU)

1. Exterior (For existing block structures and non split-face structures)
   a) Surface Preparation: Surface shall be clean and dry
   b) First Coat: 52-Color Tneme-Crete at 60-80 square feet per gallon (11.0-15.0 mils dft.)*
   c) Second Coat: 52-Color Tneme-Crete at 80-100 square feet/gallon (9.0-11.0 mils dft.)*
   d) Total Dry Film Thickness: 20.0-26.0 mils dft.

2. Exterior (For new split face block structures) – apply two coats of an industrial quality water sealant. Where split face color is not consistent, the paint system indicated in item 1 (above) will be required.

3. Interior
   a) Surface Preparation: Surface shall be clean and dry
   b) First Coat: 130-6601 Envirofill at 75-85 square feet per gallon.
   c) Second Coat: 69-Color Hi-Build Epoxoline II at 4.0-6.0 mils dft.
   d) Third Coat: 69-Color Hi-Build Epoxoline II at 4.0-6.0 mils dft.
   e) Minimum Total Dry Film Thickness: 21.0 mils dft.

3.07 PREFINISHED ITEMS

A. Equipment such as motors, pumps, and other such items which, when installed, become an integral part of a system, and which may be delivered fully factory-finished, that is, having finish coatings in addition to the prime coating, shall be patch painted where damaged, sanded to a dull gloss and then painted two (2) coats of Tnemec Series Hi-Build Epoxo line or PorterGlaze 4000, same color as piping.

3.08 INACCESSIBLE WORK

A. Metal surfaces, which are to be in permanent contact with concrete and masonry or embedded in masonry, shall be given a coat of primer and two (2) coats of asphalt varnish in the field before being made inaccessible. Other metal surfaces which will be inaccessible for painting in the finished work shall be painted two (2) coats of the same material as the priming coat before being made inaccessible and other finish painting of such surfaces will not be required. This does not apply to metal work with bituminous coatings applied in the shop or factory.

3.09 SAFETY PRECAUTIONS

A. Contractor shall strictly adhere to safety data provided by manufacturer.

END OF SECTION

SECTION 11200 - DOMESTIC WATER PACKAGED BOOSTER PUMPS

1. GENERAL

1.01 SUMMARY OF WORK

A. The contractor shall furnish and install two single-stage, double suction, horizontal split case pumping units as specified herein and shown on the contract drawings.

B. The term "pumping unit" or "units" shall be defined as a pump complete with base plate, coupling, coupling guard, motor, and variable frequency drives if applicable.

C. The pump manufacturer shall be responsible for supplying the complete pumping unit as defined above and shall assume complete system responsibility.

1.02 RELATED WORK

A. (Insert applicable sections of specifications and or drawings)

1.03 CODES AND STANDARDS

A. HI (Hydraulic Institute)

B. ANSI (American National Standards Institute)

C. ASTM (American Society of Testing and Materials)

D. ISO 9001 (International Organization for Standardization)

E. AFBMA (Antifriction Bearing Manufacturer's Association)

(Insert other applicable standards as required)

1.04 SUBMITTALS

A. Product Data

1. Prior to fabrication, pump manufacturer shall submit a digital copy of submittal data for review and approval.

2. Submittal shall include shop drawings, electrical ladder logic drawings, warranty information, and support data as follows: Catalog cuts sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor and 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 SCADA System 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 SCADA System circuits to extent necessary to validate function and integration of circuits to form a complete working system.

1.05 QUALITY ASSURANCE

A. To ensure unity of responsibility, the complete pump unit shall be supplied, tested, and warranted by the pump manufacturer.

B. The equipment specified under this section is to be standard pumping equipment manufactured by a company with no less than fifteen year’s experience in the manufacture of such

equipment. Upon request by the engineer, the manufacturer shall provide proof of such experience by providing installation lists, brochures, catalog cuts, etc.

C. The manufacturer of the pump units shall have a quality management system in place and shall be ISO 9001 certified.

D. Pumping units shall be manufactured by Patterson Pump Company or approved equal.

2. PRODUCTS

2.01 GENERAL

A. The centrifugal double suction pumping units provided under this section shall be supplied by one manufacturer. The pump shall be Patterson 4x3 ME-A or approved equal. The motor shall be Weg NEMA three phase TEFC 50 HP motor or approved equal.

B. Each pumping unit shall be provided with a stainless steel nameplate, which shall contain the following information:

1. Manufacturer's name, address, and telephone number
2. Model number
3. Serial number
4. Head, capacity and rpm at rated condition
5. Motor horsepower, rpm and frame size

C. Pumping units within each type of service shall be identical in every respect with all parts being interchangeable.

D. Pump rotating assemblies shall be balanced in accordance with the requirements of ANSI S2.19, G6.3.

E. Vibration, when measured at the pump bearing housing shall not exceed the limitations specified by the Hydraulic Institute Standards.

2.02 HYDRAULIC DESIGN CRITERIA

A. Rated Condition:

1. Capacity = 601 US gpm
2. Head in Feet = 181 ft
3. Minimum Efficiency = 77%
4. Maximum NPSHr = 9 ft

B. Secondary Condition

1. Capacity = 240 US gpm
2. Head in Feet = 199 ft
3. Minimum Efficiency = 54%
4. Maximum NPSHr = 2.93 ft

C. Operating Characteristics

1. Shut-off Head = 201 ft

2. Maximum Brake Horsepower = 59 hp
3. Maximum Operating Speed = 947 rpm

2.03 DETAILS OF CONSTRUCTION

A. Pump Casing

1. Pump casing shall be of close grain cast iron type ASTM A48, class 40, designed for heavy-duty service. The casing shall be horizontally split; single volute type with the suction and discharge flanges cast integrally with the lower half in order that the upper part may be removed for inspection of the rotating element without disturbing pipe connections or pump alignment. Pump mounting feet are to be cast integrally into the lower half casing with the mounting surface completely machined. The joint between halves of the casing shall be heavily flanged and bolted, and provided with dowel pins to insure accurate alignment. The upper half-casing flange shall have tapped holes for jackscrews. The interior shall be smooth and free from surface defects.
2. Thickness, diameter, and drilling dimensions of suction flanges shall be Class (125) ANSI standard. Discharge flanges shall be Class (125) ANSI standard. Pump casings shall have a minimum 4" suction and a 3" discharge. Casings shall be drilled and tapped for vertical priming, gauge, and drain connections. Suitable lifting lugs or eyebolts shall be provided.

B. Impeller

1. Impeller shall be of the double suction enclosed type made entirely of ASTM B584-836 bronze finish smooth all over and of ample strength and stiffness for maintaining the maximum capacity of the unit. Diameter of the impeller shall be 15.5".
2. It shall be statically and dynamically balanced and shall be keyed to the shaft and securely held in axial position on the shaft by means of ASTM B505-954 bronze sleeves extended through the stuffing box. Rotation of the shaft sleeves shall be prevented by the impeller key, which shall extend beyond the impeller hub and into the shaft sleeve on both sides of the impeller. Shaft sleeves shall be held in position by a locking shaft sleeve nut located outside of the stuffing box and shall have an O-ring seal between the sleeve and the nut to prevent entrance of air or liquid between the shaft and sleeve. Sleeves, which are threaded on to the pump shaft, are not acceptable.

C. Wear Rings

1. At the running joint between the suction and discharge chambers, there shall be provided wear rings on both the casing and impeller.
2. The casing rings shall be of ASTM B505-927 bronze, positioned in the casing and locked against rotation by the upper half of the case.
3. Impeller rings shall be of ASTM B505-932 bronze, so fastened that they cannot rotate or become loose when the pump is subjected to reversed rotation. The rings shall be made to limit gauges, so that they may be renewed without fitting.

D. Pump Shaft

1. The shaft shall be of AISI 1141 and of such dimensions that the maximum combined stress due to bending and torsion shall not exceed 8,000 pounds per square inch under the most severe conditions of operation.
2. The shaft shall be accurately machined over its entire length. The first critical speed of the rotating assembly shall occur at not less than 150% of the rated speed.

3. Threads on the pump shaft shall be located outside of the stuffing box.

E. Stuffing Boxes (Mechanically Sealed)

1. Stuffing boxes shall be provided with mechanical shaft seals.
2. Stuffing boxes shall accept packing or mechanical seals without modification to the stuffing box.
3. Mechanical seals shall be furnished with a carbon seal ring, ceramic mating ring, viton elastomers and 316 stainless steel metal parts.
4. Mechanical seals shall be rated for 250 PSIG pressure. The elastomers shall be rated for temperatures ranging from -20 degrees F to 400 degrees F.
5. Pump shaft sleeves shall be furnished with a pre-machined groove designed to accept a setting ring, which shall eliminate the need for set collars or stop collars. Seals requiring stop or set collars with set-screws are not acceptable.
6. The rotating seal ring shall be provided with a 360 degree rubber encasement to provide a positive drive for the seal face without the need for metal drive notches which may cause face distortion or notch wear. The seal rings shall be permanently fixed in place and full flatness maintained by a precision crimp in the outer seal case.
7. The mechanical seal shall be of a convoluted design which permits free movements providing constant adjustment for shaft endplay and seal face wear. Positive face contact with the stationary seat shall be maintained at all times.
8. To insure positive sealing by free movement of the seal head, the seal shall feature a hex style outer shell and drive band which shall absorb start-up and running torque and shall eliminate in stress on the diaphragm. Metal components shall freely engage and shall not be subject to lock down due to friction wear.
9. Suitably valved connecting lines or passages shall be provided on the upper half casing leading from the discharge volute to the stuffing box for lubricating the stuffing boxes with the liquid being pumped.

F. Bearings

1. Bearings shall be of the anti-friction type grease lubricated ball.
2. The bearing configuration shall consist of one single row deep grooved anti-friction bearing on the inboard side and two single row deep grooved anti-friction bearings mounted back to back on the outboard side. The inboard bearing shall be designed to take the radial thrust loads. The outboard bearings shall be designed to take a combination of loads, both radial and axial; and hold the rotor in axial alignment.
3. Bearings shall have a minimum rated service life of 40,000 hours in accordance with the standards of the Bearings Manufacturers Association throughout the specified operating range. Bearings shall be mounted in dust tight housings shall be rigidly supported by suitable brackets, which shall be cast with integrally with the lower half or the pump casing. Bearing housings or bearing housing supports, which are bolted to the side of the pump casing, are not acceptable.
4. A deflector made of Aluminum shall be provided on the inboard and outboard ends of the pump shaft to prevent product from entering either bearing housing.

G. Pump Base

1. The pump and motor shall be mounted on a common base of fabricated ASTM A36 steel. Bent metal or formed bases are not acceptable.
2. The base shall be provided with a coupling guard, and ample grout holes. (Drip lip rim available on request.)
3. All mounting surfaces shall have a machined finish.

H. Couplings

1. The coupling shall be Martin Quadra-flex or approved equal with type S flanges and elastomeric sleeves of Hytrel, EPDM or similar material.
2. Sized to transmit the maximum required horsepower with a 1.5 service factor.

I. Motor

1. The motor shall be a heavy-duty squirrel cage induction type, inverter duty rated, minimum NEMA Class F insulation, 1,800 RPM horizontal hollow shaft motor, equipped with Martin quadra-flex coupling sleeve to protect shaft in the event of reverse rotation. A thrust bearing of ample capacity to carry the weight of all rotating parts plus the maximum hydraulic thrust load under all conditions of operation shall be provided. The calculated L10 life shall be no less than 8,800 hours. Provision shall be made for momentary upthrust equal to 30% of the rated down thrust. The motor shall be premium efficiency, 1.15 service factor, power factor greater than 0.8, and suitable for use on 460 volt, three phase, 60 Hz electric service. The stator winding and lead shall be insulated with moisture-resistant Class H insulation for inverter duty in 40°C. The motor shall be designed as inverter duty rated capable of ten starts per hour. Automatic reset, normally closed thermal overloads shall be imbedded in the motor winding to provide overheating protection. Motor winding thermostats must be connected to an electric controller per local and state codes and the NEC.
2. Motor shaft shall be a one-piece 416 stainless steel construction. Carbon steel shafts or shaft sleeves are not acceptable. Rotor is to be dynamically balanced to meet NEMA vibration limits. All external hardware is to be stainless steel.
3. Cable leads are to enter at the top of the motor and allow the cable-to-motor connection to be accomplished in the field without soldering. All power and control lead wires are to be double sealed as it enters the motor to prevent cable-wicking. Sealing system shall consist of a rubber grommet followed by epoxy that is high in adhesive qualities and a low coefficient of expansion. Each cable wire will have a small section of insulation removed to establish an area of bare wire and will be untwisted and surrounded by epoxy potting material. Cable sealing system shall be capable of withstanding an external pressure test of 1200 psi and a cable assembly pull test as required by UL. Singular grommet or other similar sealing systems are not acceptable. Motor shall be supplied with a sufficient amount of contractor specified multi-conductor type "SOW-A" or "W" power cable and control cable. Cable sizing shall conform to NEC specifications and be UL Listed.
4. Power and control leads shall be terminated on a sealed terminal board. The terminal board and its bronze lugs shall be O-ring sealed.
5. The motor cooling jacket on the D75P2E ODP Series (365T Frame) or approved equal shall be sealed to the motor housing with O-rings. The motor cooling jacket shall be oil filled.
6. Motor shall be equipped with a motor over temperature switch embedded in the motor windings.

7. Each motor shall meet the following requirements:
   a) Rating
      i. Voltage - 460V, for operation in a variable frequency drive arrangement. The motor shall be capable of operating in a nominal 460 volt, 3 phase, 60 hertz system.
      ii. Size - 50 horsepower, inverter duty rated, at 1800 rpm nominal full load speed
      iii. Maximum Full Load Current at rated voltage: 59 Amperes
      iv. NEMA Design - B
      v. Insulation - Class F
      vi. Service Factor - 1.15
      vii. Power Factor - minimum 80% at full load
      viii. Premium Efficiency Design - in accordance with IEEE Standard 112 testing method B
      ix. Frame - 326T

2.04 FACTORY TESTING

A. Each pump shall undergo a certified hydrostatic test at 150% of the pressure developed at shut-off head.

B. A certified performance test shall be performed on each unit utilizing its specified drive. If variable frequency drives are specified, one drive of each rating shall be shipped to the pump manufacturer's plant for testing as a complete unit.

C. All tests shall be performed in accordance with the Hydraulic Institute Test Standards for Centrifugal Pumps - 1.6 (1988).

D. Six evenly spaced test points shall be taken and shall include conditions at shut-off (zero flow) and the operating points specified herein. Preliminary test data must be submitted to the owner seven days prior to the actual test date.

E. The engineer and/or a representative of the owner shall be given sufficient notice of the testing dates and shall have the opportunity to witness these test.

2.05 WARRANTY

A. The manufacturer of the pumping units shall provide a written warranty covering the entire pumping unit.

B. The warranty shall be in effect for a period of one year after substantial completion. 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, and shall be acceptable to the Owner.

3. EXECUTION

3.01 EXAMINATION

A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Manufacturer shall provide written instruction for proper handling. Immediately after off-loading, contractor shall inspect pumping unit for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all serial numbers and parts lists with shipping documentation. Notify the manufacturer's representative of any unacceptable conditions noted with shipper.

3.02 INSTALLATION

A. Install, level, align, and lubricate motor. Use shims and provide non-shrink grout packing of frame to achieve and maintain level and alignment. Contractor shall perform a laser alignment of motor to align shaft with the new pump shaft. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery. The horizontal and vertical tolerances for laser alignment shall be 0.003".

B. Pump and motor assembly shall be mounted on concrete block as specified in the drawings. Contractor shall furnish and install all piping and connections necessary. The Contractor shall be responsible for ensuring material compatibility and proper alignment of all connections.

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. The pump and motor assembly shall be connected to the motor control center (MCC). Refer to electrical specifications for suggested sequence of construction.

E. 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.

3.03 FIELD TEST

A. Prior to acceptance by owner, the contractor shall perform an operational test of new motor and pump by operating the motor and pump assembly for a period of 72 hours. During the 72-hour operational test, current and voltage of all phases shall be monitored and recorded, and the results presented to the owner for acceptance. The new motor shall also go through at least 6 start-stop iterations to ensure proper operation of all controls.

B. 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.

3.04 FACTORY FIELD SERVICE

A. The manufacturer of the pumping unit shall provide, at no additional cost to the owner, the services of a field service representative for a period of 2 days.

B. The time specified shall require at least two trips to the project site. One trip for supervision during the installation of the units and one trip for operator training shall be provided.

END OF SECTION

SECTION 11340 - CHEMICAL FEED EQUIPMENT

1. GENERAL

1.01 This section specifies the chemical feed system including pumps, tanks, valves, piping and combination emergency shower and eyewash.

1.02 In addition to manufacturer's general data sheets, submit the following:

A. Detailed dimensional drawings for all equipment and piping.

B. Detailed electrical data for all equipment.

C. Material data for tanks.

D. Pump performance curves.

E. Control diagrams.

2. PRODUCTS

2.01 Chemical feed pumps: Chemical feed pumps shall be hydraulically operated, positive displacement, diaphragm pumps.

A. Pump shall be a complete unit as supplied by a single manufacturer, including motor, drive arrangement, base, and control panel. Assembly by the Contractor of components supplied by various manufacturers will not be acceptable.

B. Pump shall have the following materials of construction:

1. Housing - Cast iron

2. Diaphragm - Teflon

3. Liquid end materials – 316 Stainless Steel

C. Pump shall have a capacity of 0-to-33 gallons per hour. Pump capacity shall be continuously adjustable from 0-to-100 percent while pump is running by either manual or automatic control. In the automatic mode, the pump shall be capable of tracking a 4-20 ma analog signal to the pump controller for control of pump discharge.

D. Pump motor shall meet the requirements of Division 16 - Electrical and shall be of the voltage and phase shown on the electrical Drawings. Motor shall be capable of operating continuously under specified conditions. Motor shall be TEFC. Motor shall be sized to prevent overloading at any point on the operating curve.

E. Each chemical feed pump control panel shall be fully tested prior to installation. The control panel shall be NEMA 4X construction, disconnect with lockout capabilities, red power-on light, hand-off-auto selector switch, motor fault and run verify Form-C contacts, and UL labeled.

F. Chemical feed pumps shall be Pulsafeeder model 25HJ with DLCM, or approved equal.

2.02 Chemical tank

A. The material used shall be virgin polyethylene resin as compounded and certified by the manufacturer. The material shall be made from crosslinked polyethylene resin

B. The polyethylene resin material shall contain a minimum of a UV 8 stabilizer as compounded by the resin manufacturer.

C. Mechanical properties of tank resin material:

Property	ASTM	Value
Density	D1505	0.938-0.946 g/cc
Tensile (Yield Stress 2"/min)	D638	3000 PSI
Elongation at Break (2"/min)	D638	>300%
ESCR (100% lgepal, Cond A, F50)	D1693	>1000 hours
ESCR (10% lgepal, Cond A, F50)	D1693	>1000 hours
Vicat Softening °F Temp.	D1525	250
Flexural Modulus	D790	100,000 PSI

D. The minimum required wall thickness for the cylinder straight shell must be sufficient to support its own weight in an upright position without any external support. Secondary containment tank shall be designed per SII standard containment thickness requirements. The secondary containment shall be configured to allow shipment of the primary tank inside the secondary tank. The shipment shall be done without the aid of additional spacer blocks which can be lost during shipment causing tank damage.

E. Wall thickness shall be coordinated by the tanks manufacturer, considering tank dimensions, chemical to be stored, and any other parameter deemed integral to appropriate tank design. These calculations shall be submitted to Engineer for approval as part of a submittal shop drawing package.

F. The top head must be integrally molded with the cylinder shell. The minimum thickness of the top head shall be equal to the top of the straight wall. The primary tank top shall be configured to prevent rain water from entering the secondary containment tank. The top head of the tank shall be designed to provide a minimum of 1300 square inches of flat area for fitting locations. The primary tank shall be keyed to the secondary tank preventing primary tank rotation. The secondary containment shall have 115% of the normal fill capacity of the primary tank.

G. Tank shall have a minimum of three (3) lifting lugs integrally molded into the top head. The lifting lugs shall be designed to allow erection of empty primary and secondary tanks. Tanks shall be capable of being lifted into position as a unit (primary and secondary tank).

H. The tank shall be designed to provide a minimum of four (4) tie-down lugs integrally molded into the top head. The tie-down lugs shall be designed to allow tank retention in wind and seismic loading situations without tank damage. The primary/secondary tank unit shall be configured to allow direct primary tank base retention for seismic load conditions. The base retention unit shall be anchor bolted to the floor slab and not require additional spacer blocks. Tie-down system shall be designed to withstand 110 MPH wind loads, and meet seismic zone 4 requirements per UBC 1997 code, and be comprised of painted mild steel. Mild steel parts shall be deburred and painted with chemical resistant paint.

I. The finished tank wall shall be free, as commercially practicable, of visual defects such as foreign inclusions, air bubbles, pinholes, pimples, crazing, cracking and delaminations that will impair the serviceability of the vessel.

J. All cut edges, performed by the manufacturer, where openings are cut into the tanks shall be trimmed smooth.

K. Threaded bulkhead fittings shall be installed by manufacturer, and coordinated with Contractor. Fittings must be placed away from tank knuckle radius and flange lines.

L. Bolted double flange fittings (150 lb) shall be utilized for below liquid level installations. Fittings shall be placed away from tank knuckle radius and flange lines. Flange fitting shall be constructed with 2 ea. 150 lb flanges, 2 ea. 150 lb flange gaskets, and the correct number and size of all-thread bolts for the flange specified by the flange manufacturer. The flanges shall be constructed of PVC Type I, Grade I. Gaskets shall be a minimum of ¼" thickness and constructed of 40-50 durometer EPDM. There shall be a minimum of 4 ea. full thread bolts. The bolts may have gasketed flanged metal heads or bolt heads encapsulated in Type II polyethylene material. The encapsulated bolt shall be designed to prevent metal exposure to the liquid in the tank and prevent bolt rotation during installation. The polyethylene encapsulation shall fully cover the bolt head and a minimum of ¼" of the threads closest to the bolt head. The polyethylene shall be color coded to distinguish bolt material. Each encapsulated bolt shall have a gasket to provide a sealing surface against the inner flange. Standard orientation of bolted double flange fitting shall have bolt holes straddling the principal centerline of the tank in accordance with ANSI/ASME B-16.5, unless otherwise specified.

M. Tank shall be provided with integrally molded flanged outlet located at the lowest level of the tank to allow for complete draining of the tank. The outlet shall provide a flexible containment seal between the inner primary tank and the outer secondary containment tank.

N. The tank shall be provided with an ultrasonic level detection system, including sensors and level control panel, and back-up level floats for high and low levels. The control panels shall provide for digital level indication, alarm level enunciation, and 4-20 mA signal pickup by an external PLC device. An outside level indicator shall be provided to indicate tank level, and to visually and audibly repeat alarms from the inside panels. All audible alarms shall contain a push-button horn silencer.

O. A leak detection unit shall be provided with tank unit. Unit shall provide for a 4-20 mA signal pickup by an external PLC device.

P. A 24" threaded, vented manway shall be provided with tank.

Q. Tank shall be marked to identify the product, date of manufacture, capacity, and serial number.

R. The proper caution of warning signs as prescribed by OSHA standard 29 CFR 1910.106, and coordinated by Contractor.

S. Tank dimensions shall be such that it, along with any of its integrally molded fittings, may be lifted vertically through the roof hatch as indicated in the Contract Documents, without any disassembling of tank, or any of its integrally molded fittings.

T. Tank shall be supplied by Snyder Industries, Inc. or approved equal.

2.03 Chemical Piping, Valves, and Accessories

A. Chemical piping and fittings shall be schedule 80 polyvinyl chloride (PVC), conforming to ASTM D 1785 and ASTM D 2467 with socket-weld connections. Connections to valves shall be made with socket-welded flanges and elastomeric gaskets suitable for the piped fluid. The flanges shall be constructed to the same PVC materials as the pipe and thickness necessary to provide 150 psig minimum pressure rating. Primers and solvents shall conform to ASTM F 656 and ASTM D 2564. Solvent cement shall be compatible with the piped fluid.

B. Valves

1. Diaphragm valves shall be used for pump isolation valves, tank suction lines, and isolation valve on calibration cylinders. Diaphragm valves shall be the weir type diaphragm valve. All valves shall be equipped with bodies that carry a 150 psi rating at 160 degrees F. All valves shall be equipped with a handwheel operator and indicating bonnet. Valve shall have PVC bodies and EPDM diaphragms. Diaphragm valves shall be manufactured by ITT, or approved equal.

2. Ball valves shall be used for tank drain and shut off and tank fill lines. Ball valves shall be PVC with true union ends, EPDM rings and seals, and Teflon seats. Material shall meet the requirements of ASTM D 1784. All valve bodies shall carry a 150 psi rating at 100 degrees F.

C. Pulsation damper shall be as manufactured by Pulsafeeder, or approved equal. Maximum oscillation of flow shall be 2 percent of mean. Bottom product chamber shall be 316 stainless steel, top air chamber shall be 316 stainless steel, and diaphragm shall be Viton.

D. Backpressure valve shall be manufactured by Pulsafeeder, or approved equal. Valve shall have a PVC body, tee diaphragm and a cast steel bonnet.

E. Calibration cylinder shall be constructed of molded polypropylene and graduated for each 100 cc and each ounce. The cylinder shall be sized and supplied by Pulsafeeder, or approved equal.

2.04 Install unions on each side of all accessories, and similar items so that such equipment may be readily disconnected and removed. Unions shall not be placed in a location which will be inaccessible after completion of the building.

2.05 Emergency Shower and Eyewash

A. Must comply with ANSI Z358.1-1998

B. Floor mounted 84” tall combination emergency shower and eyewash with ABS plastic bowl and shower head, galvanized piping, and stainless actuators. ABS plastic float-off covers secured with stainless steel chains.

C. Shower spray pattern shall have a minimum diameter of 20” at 60” above the floor. Shower flow rate shall equal 20 gallons per minute (gpm) of flushing fluid at a velocity low enough to be non-injurious to the user. The center of the spray pattern shall be located at least 16” from any obstruction.

D. Eyewash flow rate shall equal 0.4 gpm at 30 psi.

E. Valves shall activate in one second or less, shall be stay-open type (no use of hands) and remain open until the user shuts it off.

F. Emergency shower and eyewash shall be installed at locations shown on the plans. Externally mounted unit shall be freeze proof type with all piping enclosed in form fitted, plastic molded insulation and have heat tracing.

3. EXECUTION

3.01 Undimensioned drawings are intended to indicate the general arrangement of piping systems and are not intended to convey precise location Information. Unless otherwise indicated, run horizontal piping level and parallel to the walls and run vertical piping straight and plumb.

3.02 NO FIELD CUTTING will be allowed on the chemical tank. All connections shall use the factory-installed fittings.

3.03 Except where flanged connections are specified, all PVC piping and fittings shall be joined by solvent welding.

3.04 Support above ground piping. Supports shall not clamp pipe tightly, but shall permit axial movement.

3.05 Testing piping in the presence of the owner or his representative. Supply necessary pumps and gages to perform the tests. After piping is complete fill the system eliminating all air. Provide temporary valves, blinds, plugs, or caps as needed to isolate and vent sections. Raise pressure to 50 psi and maintain for one hour. If pressure cannot be maintained determine the cause and repair. No leakage will be allowed.

END OF SECTION

SECTION 13500 - PRECAST BUILDINGS

1. GENERAL

1.01 SUMMARY

A. Contractor to furnish and install complete all precast buildings and appurtenances shown on the Contract Drawings and as described herein. Precast buildings shall be as manufactured by the Smith-Midland Company, or approved equal.

1.02 RELATED SECTIONS

A. Intent: The provisions and intent of the AGREEMENT, including the General Conditions, Supplemental Conditions, and other requirements of the Contract Documents apply to the WORK as specified in this Section. WORK related to this Section is described throughout the Specifications.

1.03 DIMENSIONS AND DESIGN LOADS

A. Dimensions:
   1. Pump Station Building
      a. Exterior: 40'-0" x 20'-0" x 11'-4"

B. Roof (Gray Standing Seam Metal Roof): Roof panel shall slope 1:12 from front to back in long-sided direction. The roof shall extend a minimum of 2 ½" beyond the wall panel on each side and have a turndown design which extends ½" below the top edge of the wall panels to prevent water migration into the building along top of wall panels.

C. Roof, and wall panels must each be produced as single component monolithic panels. No roof, floor, or vertical wall joints will be allowed, except at corners. Wall panels shall be set on top of floor panel.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Comply with the requirements of the following codes and standards, except as herein modified:

1. ACI-318-02, "Building Code Requirements for Reinforced Concrete". Concrete Reinforcing Institute, "Manual of Standard Practice".

2. ANSI/ASCE-7-02 "Building Code Requirements for Minimum Design Loads in Buildings and Other Structures".

3. Fabricator must be producer member of National Precast Concrete Association (NPCA) and participate in its Plant Certification Program.

4. Fabricator must be a certified producer/member of The Precast/Prestressed Concrete Institute (PCI), National Precast Concrete Association (NPCA) or equal.

5. Building fabricator must have a minimum of 5 years' experience manufacturing and setting transportable precast concrete buildings.

2. PRODUCTS

2.01 CONCRETE

A. Steel-reinforced, Polypropylene Fiber reinforced, 5000 PSI minimum 28-day compressive strength, air entrained (ASTM C260).

2.02 REINFORCING STEEL

A. ASTM A615, grade 60 unless otherwise indicated.

2.03 REINFORCING FIBER

A. Polypropylene fiber, Fortafiber @ 1.6 pounds per cubic yard, or equal.

2.04 POST-TENSIONING STRAND

A. Modules shall be post-tensioned in field after grout keyway is filled and has cured to required PSI strength. Post-tensioning cable shall be 41K polystrand CP50, .50", 270 KSI, 7-wire strand, greased plastic sheath, (ASTM A416). Tendons shall be greased and enclosed within a sheath. There will be a minimum of three post-tensioning cables connecting module roofs together to provide watertight joint.

B. Post-tensioning Strand: 41K Polystrand CP50, .50, 270 KSI, 7-wire strand, enclosed within a greased plastic sheath, (ASTM A416). Roof and floor each to be post-tensioned

by a single, continuous tendon. Said tendon shall form a substantially rectangular configuration having gently curving corners wherein the positioning of the cable member results in a pattern of one or more loops and a bisecting of the loop(s). The cable member starts from one corner of the concrete building panel, forms a gentle perimeter loop(s) returning to a point where the cable member entered the concrete building panel. The tendon then turns 90° and follows the cable member(s) to a point midway along the "Y" axis of the concrete building panel and then turns 90° along the "X" axis of the concrete building panel. This bisects the concrete building panel and crosses the opposite parallel portion of the cable member and exits from an adjacent side of the concrete building panel.

1. If post-tensioning is not used in the roof panel, the following guidelines must be followed to ensure a watertight roof design.
   a) The entire precast concrete roof panel surface must be cleaned and primed with a material that prepares the concrete surface for proper adherence to the coating material.
   b) The entire precast concrete roof panel surface shall be sealed with a .045 EPDM continuous membrane cemented to the concrete with a compound designed for this purpose.

2.05 PANEL CONNECTION

A. Monolithic structure shall be attached to precast floor slab with 3/8" thick steel brackets. Steel is to be of structural quality, hot-rolled carbon complying with ASTM A283, Grade C and hot dipped galvanized after fabrication. All fasteners to be ½" diameter bolts complying with ASTM A307 for low-carbon steel bolts. Cast-in anchors used for panel connections to be Dayton-Superior #F-63 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 floor slab with 4" expansion anchors by manufacturer.

2.06 DOORS AND FRAMES

A. All doors and frames shall comply with Steel Door Institute "Recommended Specifications for Standard Steel Doors and Frames" (SDI-100), and as herein specified. The buildings shall be equipped with doors single and/or double doors at locations shown on the Drawings. Double doors shall be 3'-0" x 7'-8" and mandoors shall be 3'-0" x 6'-8". Doors and frames shall be as specified in Division 08.

B. Hardware: Hardware to be as specified in Division 08:

2.07 CAULKING

A. Joint between building and floor slab shall be caulked on the exterior and interior surface of the joints. Caulking shall be SIKAFLEX-1A elastic sealant or equal. Exterior caulk joint to be 3/8” x 3/8” square so that sides of joint are parallel for correct caulk adhesion. Back of joint to be taped with bond breaking tape to ensure adhesion of caulk to parallel sides of joint and not the back.

2.08 VENTS

A. Provide number and sizes of openings for exhaust fan, intake louvers, and roof-vents as shown on the Drawings.

2.09 OPENINGS

A. Provide number and sizes for all openings shown on plans.

2.10 FINISH

A. A. A smooth steel form finish shall be provided on all interior surfaces.

B. B. Exterior wall surfaces shall have simulated brick imprint finish. Color to be selected by the Owner.

3. EXECUTION

3.01 INSTALLATION

A. Building to be installed in accordance with manufacturer's written instructions.

END OF SECTION 13500

SECTION 14600 – A-FRAME CRANE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all labor, materials, equipment, and services necessary, for and incidental to, the complete and satisfactory installation of hoist, trolley and crane equipment as specified herein and as shown on the Contract Drawing. General orientation and capacity shall be as shown on the Contract Drawings.

B. Provide one complete portable A-frame crane system.

1.02 SHOP DRAWINGS

A. Shop drawings shall be submitted for all items specified herein as specified under section, SUBMITTALS.

1.03 MANUFACTURER'S CERTIFICATE

A. The Contractor shall furnish the Engineer with a Manufacturer's Certificate, as specified under section SUBMITTALS certifying the hoists and cranes have been installed in a complete and satisfactory manner ready for operation.

1.04 STANDARDS

A. The specifications of the American Institute of Steel Construction, current edition, shall be followed in designing all equipment of structural steel construction. Other parts such as forgings, stampings, and castings, shall be designed with a factor of safety based on the ultimate strength of the material of not less than 5. The standards of the American Welding Society shall be followed in designing supporting steel or equipment which is manufactured by welding operations.

PART 2 - PRODUCTS

2.01 TROLLEY-MOUNT HAND CHAIN HOIST

A. The hoist shall be chain type, parallel mounted on a trolley with a minimum capacity of 1 ton. The hoist and trolley shall be of same manufacturer as, and compatible with, the a-frame, or packaged for compatibility.

B. The trolley shall be geared and constructed of welded steel and of suitable load carrying capacity. Trolley wheels shall be drop forged steel or cast iron singled flanged. The trolley and hoist shall be low profile to maximize the distance be-

tween the bottom of the trolley and the floor.

C. The unit shall be provided with a mechanical brake capable of stopping the rated load of the hoist while in motion.

D. The unit shall meet the following specifications: ASME B30.16, ASME HST-2, CSA B167.

E. The hoist and geared trolley shall be ACCO, Yale, Robbins & Myers, or approved equal.

2.02 A-FRAME

A. The crane shall be an adjustable A-frame gantry crane that can be broken down into three pieces for transport and storage and have a 1-ton capacity.
B. The vertical clearance shall be adjustable with a height of at least 10-feet from the floor to the bottom of the cross-member beam, and at least a 10-foot span.
C. Crane shall include a trolley that slides along the beam and has a mounting hole for the hoisting device.
D. Shall meet specifications of CMAA Specification No. 74.

2.03 ACCESSORIES

A. Two pairs of 10’ hoisting straps shall be provided. Hoisting straps shall be of the same capacity as the hoist.

2.04 PAINTING

A. Painting shall be in accordance with Division 9, HIGH PERFORMANCE COATINGS. Field painting will not be required except where finish is damaged by handling, weather, or other reasons. The damaged portion shall be field-primed and finished with sufficient finished coats to give a smooth, unmarred appearance, with primer and finish being the same type and color as originally used in the factory application.

B. The maximum lifting capacity of the trolley hoist shall be neatly stenciled in a contrasting color with 6” tall letters on both sides of the monorail beam.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the hoists and cranes in accordance with the manufacturers’ recommendations.

3.02 TESTING

A. After erection and prior to final inspection the hoist and cranes shall be given a full load test to demonstrate their fitness for the service they must perform and to check the performance of all essential points. The test shall consist of loading the units to their respective rated capacities and raising and lowering the hooks the full limit of their travel.

B. With the full load of the units, hoists and cranes shall be run through all sections of the railing at least three times. The hoist shall be raised and lowered the full length of their travel at any point along the rails that the Engineer requests.

C. The above tests shall be performed to the satisfaction of the Engineer. In the event the equipment does not satisfactorily meet the specifications, such changes as may be required shall be made and the test repeated until complete satisfaction is obtained at no additional cost to the Owner.

D. Weights to perform the above tests shall be provided by the contractor.

3.03 USE OF HOISTS

A. The Contractor may use the new hoists for his purposes. Any damage which may occur by such use, however, shall be corrected by the Contractor prior to final acceptance and at no additional cost to the owner.

END OF SECTION

SECTION 15010 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 15.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

1. Submittals.
2. Coordination drawings.
3. Record documents.
4. Maintenance manuals.
5. Rough-ins.
6. Mechanical installations.
7. Cutting and patching.

1.3 SUBMITTALS

A. General: Follow the procedures specified in Division 1 Section "Submittal Procedures."

B. In addition, the Contractor is to provide three (3) sets of submittals (owners set, engineers set, and the field set) in a three (3) ring binder. The binder shall be a minimum of 2-inches wide with style "D" rings and double lock locking mechanism. Submittals are to be labeled with tabs (in numerical order) according to the specification number.

C. **Each submittal cover sheet shall have a blank 5”x5” space to allow for engineer submittal stamp and notes.**

1.5 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements of project closeout. In addition to the requirements specified in Division 1, indicate the following installed conditions:

1. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.
2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.6 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1. In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

3.2 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
12. MECHANICAL CONTRACTOR IS RESPONSIBLE FOR FURNISHING MOTOR STARTERS/VARIABLE FREQUENCY DRIVES/DISCONNECT SWITCHES FOR ALL MECHANICAL EQUIPMENT. Refer to division 16 specification sections for starters, disconnects, variable frequency drives, electrical devices, and wiring requirements. The mechanical contractor shall install starters/variable frequency drives/disconnect switches. The mechanical

contractor is responsible for making final connections from junction boxes provided by electrical contractor to motor starters/variable frequency drives/disconnect switches and to mechanical equipment supplied. If a junction box is not provided by the electrical contractor, the mechanical contractor is responsible for making final connection from the disconnect switch through the mechanical equipment.

13. Duct smoke detectors are to be furnished by electrical contractor, installed in duct by mechanical contractor, and wired by electrical contractor.
14. Controls contractor is responsible for final power connections to control panels, dampers, etc, from junction boxes provided by Electrical contractor.
15. Controls contractor is responsible for all wiring required for controls and instrumentation not indicated on the drawings.

3.3 CUTTING AND PATCHING

A. General: Perform cutting and patching as follows:

1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

C. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

D. Patch finished surfaces and building components using new materials, specified for the original installation and experienced Installers.

END OF SECTION 15010

SECTION 16010 - ELECTRICAL BASIC REQUIREMENTS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope: The electrical work covered by this Section applies to all other sections of Division 16 except as specified otherwise in the individual sections.

B. Refer to the Contract and Division 16 of the Specifications for additional electrical requirements including:

1. Summary of the work.
2. Project Coordination.
3. Definitions and Standards.
4. Submittals.
5. Schedules and Reports.
6. Temporary Facilities.
7. Products.
8. Testing and Final Acceptance.
9. Project Closeout.

B. The word provide, as used hereinafter, shall be defined to mean the furnishing of all labor, materials, equipment and services necessary for the work described.

1.02 QUALITY ASSURANCE

A. References: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. American National Standards Institute (ANSI)
   a. ANSI C12.1 - (1995) Code for Electricity Metering
   b. ANSI C12.4 - (1984; R 1996) Mechanical Demand Registers
   c. ANSI C12.10 - (1987) Electromechanical Watthour Meters
   d. ANSI C12.11 - (1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL Through 350 kV BIL (0.6 kV NSV Through 69 kV NSV)
   e. ANSI C39.1 - (1981; R 1992) Requirements for Electrical Analog Indicating Instruments

2. American Society for Testing and Materials (ASTM)
   a. ASTM B 8 - (1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
   b. ASTM D 709 - (1992) Laminated Thermosetting Materials

3. American Society of Mechanical Engineers (ASME)
   a. (1996) Boiler and Pressure Vessel Code Industrial, Scientific, and Medical Equipment

4. Institute of Electrical and Electronic Engineers (IEEE)
   a. IEEE ANSI/IEEE C57.13 – (1993) Instrument Transformers

5. National Electrical Manufacturer Association (NEMA)

a. NEMA 250 - (1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
b. NEMA AB 1 - (1993) Molded Case Circuit Breakers and Molded Case Switches
c. NEMA FU 1 - (1986) Low Voltage Cartridge Fuses
d. NEMA ICS 1 - (1993) Industrial Control and Systems
e. NEMA ICS 2 - (1993) Industrial Control and Systems Controllers, Contactors, Overload Relays Rated Not More Than 2,000 Volts AC or 750 DC
f. NEMA ICS 3 - (1993) Industrial Control and Systems Factory Built Assemblies
g. NEMA ICS 6 - (1993) Industrial Control and Systems Enclosures
h. NEMA MG 1 - (1993; Rev 1; Rev 2; Rev 3) Motors and Generators

6. National Fire Protection Association (NFPA)
   a. NFPA 70 - National Electrical Code (Latest Revisions)
   b. NFPA 70E - Electrical Safety in the Workplace (Latest Revisions)

7. Underwriters Laboratories (UL)
   a. UL 50 - (1995; Rev Oct 1996) Enclosures for Electrical Equipment
   b. UL 83 - 1996) Thermoplastic-Insulated Wires and Cables
   c. UL 198B - (1995) Class H Fuses
   d. UL 467 - (1993; Rev thru Aug 1996) Grounding and Bonding Equipment
   e. UL 486A - (1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors
   f. UL 486E - (1994; Rev thru Feb 1997) Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
   g. UL 489 (1996; Rev May 1997) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
   h. UL 508 - (1993) Industrial Control Equipment
   i. UL 510 - (1994) Insulating Tape
   j. UL 512 - (1993; R Dec 1995) Fuseholders
   k. UL 845 - (1995; Rev Feb 1996) Motor Control Centers
   l. UL 854 - (1996; Rev May 1996) Service-Entrance Cables
   m. UL 1004 - (1994; Rev thru Feb 1997) Electric Motors

B. Current Models:

1. Manufactured items furnished shall be the current, cataloged product of the manufacturer. No more than 12 months old.
2. Replacement parts shall be available.

C. There shall be a permanent service organization maintained or trained by the manufacturer to provide satisfactory service.

D. Experience: Manufactured items shall have been installed and used without modifications, renovation or repair, on other projects for not less than three (3) years prior to the date of bid opening for this project.

1.03 SHOP DRAWINGS AND ENGINEERING DATA

A. Submit shop drawings and engineering data on equipment and materials to be used in the work of this project to the Owner for approval.

B. The submittals shall be properly identified and referenced as to the applicable specification paragraph

heading or drawing number which applies, and shall establish that each item meets the requirements of the specifications with regard to dimension, arrangement and other pertinent characteristics. Individual items within each submittal shall be marked accordingly.

C. Submittal data shall be in the form of shop drawings for major and specially constructed equipment and catalog or other engineering data on items normally considered as stock items.

D. Submittals shall include complete wiring diagrams, performance curves, installation instructions and all other applicable information necessary to the proper installation of the equipment.

E. The shop drawings and submittal data will be reviewed only for conformance with the project design concept and compliance with information in the Contract Documents. The checking of dimensions and quantity of materials shall remain the responsibility of the Contractor.

F. The Contractor shall notify the Owner of any deviations from the requirements of the contract or intent of the contract documents in accordance with the General Provisions.

G. If variations and/or deviations are not marked on submittal, the Contractor will not be relieved of responsibility for furnishing equipment and executing work in strict accordance with Contract Documents, even though shop drawings have been approved.

H. In checking shop drawings, the Owner will make every effort to detect and correct errors, omissions and inaccuracies; the reviewer's failure to detect errors, omissions and inaccuracies shall not relieve the Contractor of responsibility for proper and complete installation in accordance with intent of the Contract Documents.

I. As a minimum the following shall be submitted for approval:

1. Service Entrance Equipment
2. Conduits and Fittings
3. Wiring Devices and Plates
4. Electrical Boxes
5. Conductors: Wires, Cables and Grounding Equipment
6. Panelboards
7. Circuit Breakers
8. Safety Switches
9. Selector Switches
10. Indicator Lights
11. Light Fixtures
12. Motor Control Center
13. Motor Controls and Drives
14. Instrumentation: Flow Meter, Pressure Transducer, Thermostat
15. Programmable Logic controller and PLC Enclosure
16. Name Plates
17. Transient Voltage Surge Suppressor
18. Emergency Generator and Weatherproof Enclosure
19. Automatic Transfer Switch
20. Others as required by the respective specification section

J. Shop Drawings for Control Panels shall include (if applicable), but not limited to, the following:

1. Overall dimensions, front view and sectional view, metal gages.

2. Bus arrangements, including dimensions and ampere rating of all bus bars.
3. Voltage and current ratings.
4. Type and spacing of bus supports.
5. Maximum short circuit bracing.
6. Switch or starter type, interrupting rating.
7. Lug size.
8. Provisions for future modifications.

1.04 STORAGE AND HANDLING

A. Storage: Materials stored at the project site which become soiled with construction dirt, concrete, paint, etc. shall be washed, cleaned and dried or removed from the project site and replaced with new. Do not install soiled material.

B. Cleaning: Clean and wipe the interior of conduit, pull boxes and panelboard backboxes, soiled by masonry trades, before proceeding with wiring.

C. Do not install damaged, broken or marred material or products, replace with new, unless otherwise approved by the Owner in writing.

1.05 LABELS AND NAMEPLATES

A. Manufacturer's Nameplates: Nameplates on manufactured items shall be aluminum or type 304 stainless steel sheet, not less than 20 USG, secured to the manufactured item, with nameplate data engraved or punched to form a non-erasable record of equipment data.

B. Field Installation: Field-installed nameplates shall be as per Section 16195 – Electrical Identification.

C. All panels, switches and circuits are to be marked per Article 110 of the NEC.

1.06 TEMPORARY FACILITIES

A. The Contractor is responsible for all temporary facilities as required during construction as set forth in the Contract Documents.

1.07 SIZING

A. Capacity: Provide equipment and material of sizes, capacities, horsepowers, power ratings and dimensions indicated on the drawings, in the schedules and as specified.

B. Fit and Clearance: Equipment and material of greater or larger power dimensions, capacity and ratings may be furnished provided such proposed equipment is approved in writing and feeders, circuit breakers, conduit, motors, bases and equipment spaces are increased by the Contractor at no additional cost, to the contract cost.

1.08 COORDINATION

A. Coordinate electrical work with that of other trades so that:

1. Interference between general construction, mechanical, electrical, structural and other specialty trades is avoided.
2. Maintain clearances and advise other trades of clearance requirements for operation, repair,

removal and testing of electrical equipment.

3. All electrical materials and equipment shall be kept as close as possible to ceiling, walls, and columns to occupy the minimum amount of space.
4. Furnish and install all offsets, fittings and similar items necessary to accomplish the requirements of coordination, without additional expense.
5. Coordinate electrical requirements for equipment provided by Mechanical Contractors to assure proper compatibility with equipment provided.

B. Other divisions of these specifications and drawings shall be carefully examined to determine the requirements of the project as a whole and to determine interconnecting points between the various trades. All such interconnections shall be properly made and with due regard for correct arrangements suited to the equipment or material concerned.

C. Provide power wiring and final power connections to equipment installed by other trades which requires electrical power. Other trades will supply power characteristics and roughing-in data to ensure the proper power wiring of their equipment.

D. Provide disconnect switches for equipment of other trades when required, and specifically for motors which are out of sight of their controllers, unless switches are provided integrally mounted on the equipment.

E. All control wiring for other trades will be performed under another Division of these specifications unless otherwise noted. Control wiring shall be considered as that wiring, low or high voltage, which is required for devices such as pushbuttons, thermostats, valves and control switches for starters, interlocking of starters and any other wiring required by similar control devices and is not included in this division, except as noted.

1.09 CODES, PERMITS AND FEES

A. All work performed and all material installed under this Division shall conform to the latest editions of BOCA including the latest edition of NFPA No. 70 (NEC), NFPA 70E and other applicable standards of the NFPA and all laws, ordinances and all governing authorities. The Contractor shall procure and pay for all licenses, permits, fees, etc., necessary to install and complete the work.

1.10 MANUFACTURER'S RECOMMENDATIONS

A. Where installation procedures or any part thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations as part of the shop drawing submittal prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.

PART 2 – PRODUCTS

2.01 MATERIALS AND WORKMANSHIP

A. It is the intent of these specifications to establish quality standards for all material and equipment incorporated in the work of this division. All materials and equipment installed hereunder shall be new and shall be the best of each respective kind and type. Proper care shall be exercised in handling all materials and equipment herein specified so as not to injure or mar finished surfaces and to ensure that the work is acceptable in every respect upon completion.

B. The installation shall be as indicated on the drawings and in accordance with the manufacturer's recommendations as approved by the Owner. The installation shall be accomplished by workmen skilled in their respective trades.

C. No products shall contain asbestos or other hazardous substances.

D. As far as practicable, use a common manufacturer for similar products. These products are to be selected to maximize component interchange ability.

E. Provide all necessary accessories and appurtenances required for a complete installation even if not called out specifically on the drawings or indicated herein.

PART 3 – EXECUTION

3.01 INTENT OF DRAWINGS

A. The Drawings are diagrammatic, intending to show general runs and locations of equipment and specialties, and not necessarily showing all required offsets, etc. Carefully study the various runs of conduit and make such adjustments in exact routing as may be necessary to fit conduits into space available and to avoid conflict with other trades.

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.

3.02 PAINTING AND FINISHING

A. Damage and Touch-Up: Repair all marred or damaged factory painted finishes with materials and procedures to match original factory finish and as specified in Section 09900 – Painting and Coatings.

3.03 WIRING FOR SPECIAL EQUIPMENT

A. Provide all wiring, outlets and connections for connecting all equipment. All outlets and connections shall be verified and coordinated with equipment manufacturer's roughing-in drawings before installation and all adjustments shall be made to satisfy the manufacturer's requirements. All equipment shall be connected and ready for use.

3.04 MOTOR, EQUIPMENT AND APPARATUS CONNECTIONS

A. Provide all necessary electric power connections and disconnect switches as required for all equipment requiring such connections. This Contractor shall coordinate his work with roughing-in drawings provided by manufacturer or Party furnishing equipment.

B. All motors shall conform to the latest applicable NEMA standards for type, size and duty, as specifically applied. All motors shall be suitable for operation on 60 cycle a.c. and with voltage and other characteristics as specified in other Divisions of these Specifications.

C. Motor controller furnished 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 line not to exceed 125 percent of the motor full load current rating and shall be provided with a

manual reset type pushbutton on outside of housing. Magnetic starters shall be equipped with 115 volt holding coils, control transformers having 115 volt fused secondaries and necessary number of auxiliary contacts.

D. Magnetic controllers shall provide under voltage protection when used with momentary contact control devices and under voltage released when used with maintained-contact control devices. Manual type controllers shall provide thermal overload protection not to exceed values listed above, plus the actual current drawn by auxiliary controls and shall be approved for group fusing when more than one motor is served by the same branch circuit.

E. Provide disconnect switches as required conforming to the latest applicable NEMA standards for Type HD safety switches enclosed in NEMA Type 1 or 3R enclosures or as indicated and as required. Any motor out of sight of its controller and any controller out of sight of its branch circuit breaker shall be provided with disconnecting switch in accordance with Article 430 of NEC.

F. 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 different equipment, more up-to-date controls or safety devices, so that the equipment operates as required. Control voltage shall not exceed 120 volts unless indicated otherwise on the Drawings.

G. 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.

H. All motor control circuits and wiring to conform to Article 430 of NEC.

I. All motors connected to VFD's shall be inverter duty rated.

3.05 CUTTING AND PATCHING

A. Cutting: Provide cutting, channeling, chasing and drilling of floors, walls, partitions, ceilings and other surfaces necessary for installation of electrical work. All cutting shall be performed by skilled mechanics of the trades involved.

B. Patching: Repair cut surfaces to match adjacent surfaces.

3.06 CLOSING OF OPENINGS

A. Firestopping: Unused slots, sleeves and other penetrations in floors, walls or other general construction shall be closed and sealed with an approved firestopping material per UL 1479.

B. Conduit: The annulus between exposed conduit and walls or floors in finished spaces shall be filled, sealed, and painted to match adjacent surfaces.

C. Future Slots: Identify unused sleeves and slots for future use by permanently anchored brass nameplates identifying size and purpose of the covered slot.

3.07 CONCRETE EQUIPMENT SLAB

A. All floor mounted panels, transformers, motor control center, automatic transfer switch, etc. shall be mounted on a 4" concrete equipment slab.

3.07 SYSTEM TEST

A. Prior to final site visitation, field testing and acceptance testing, the Contractor shall conduct an operating test of the complete electrical system. System shall test free from grounds, shorts and other faults. All connections as possible shall be thoroughly checked for positive mechanical and electrical connection and continuity. All equipment shall be demonstrated to operate in accordance with the requirements set forth in these specifications and shown on the drawings.

B. Perform all tests in the presence of the Owner or his duly authorized representative. The Contractor shall furnish all personnel and test instruments for use in the test.

3.08 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall provide the Owner with a copy of the Operation and Maintenance manuals for all electrical equipment 30 days prior to project close-out for approval. Operation and Maintenance manuals shall be prepared in accordance with Section 01020 – Operation and Maintenance Data/Manual.

B. The material included in the Operation and Maintenance Manual tabs shall have included:

1. Approved shop drawings with model numbers including:

    a. Light fixtures
    b. Receptacles
    c. Switches
    d. Panelboards
    e. Transformers
    f. Disconnect switches
    g. Wire and cables
    h. Conduit, raceways, and pathways

2. The following shall be included:

    a. All Test Reports
    b. All warranty information

C. Separate Operation and Maintenance Manuals including shop drawings, warranties and diagrams to be included shall be as follows:

1. Motor Control Center
2. Motor Starters
3. Pump Control Panel
4. PLC
5. Variable Frequency Drives

3.09 RECORD DRAWINGS (AS-BUILTS)

A. The Contractor shall maintain and deliver Record Drawings in accordance with the requirements of Section 01030 – Record Documents.

B. The Contractor shall maintain at the job site one set of blue line or black line prints of the drawings

approved by the Owner. The Contractor shall record thereon all changes in the location, sizing, and arrangement that may be made for any reason in the work during the course of construction including Addenda and Change Orders work so as to reflect the installation "as-built". Upon completion of the project, "as-built" drawings, including interconnection diagrams, shall be prepared and submitted to the Owner in accordance with the requirements of Section 01030 – Record Documents.

3.10 FINAL SITE VISITATION

A. When the work on the entire project has been completed and is ready for final review, a visit will be made by the Owner or his duly authorized representative, at which time the Contractor shall demonstrate that the requirements of the Contract have been carried out and that the system has been adjusted and operates in accordance therewith.

3.11 GUARANTEE

A. Contractor shall warrant and guarantee all work in accordance with the Contract Documents and as may be further specified herein.

END OF SECTION

SECTION 16020 - UTILITY SERVICE AND SERVICE ENTRANCE

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work required under this heading covers the equipment necessary to provide power for all loads for a complete working installation.

1.02 ELECTRICAL SERVICE

A. Service Entrance Equipment: Service entrance equipment shall be in accordance with UL 869 and shall be suitable for use as service equipment.

B. Electrical service shall be as shown on the drawings and as specified herein.

C. All service work shall be coordinated with the local Power Company and National Electrical Code.

D. Electrical service shall be 480Y/277V, three phase, 4-wire.

E. Verify complete electrical service installation with Power Company before start up.

F. If required, the Contractor shall coordinate with local Power Company regarding the location of the pad mounted transformer and prefabricated bases. The Contractor shall provide finish grade for power company work.

G. Make application with electrical utility company for electric service in a manner to permit utility company to provide service prior to completion of work under this contract.

H. Complete and file all forms required by the electric utility company in connection with application for electric service. Pay for all required licenses, permits, fees, etc. necessary to obtain electric service. Power Company charges required to perform work to provide service to the facility will be paid directly by the Owner and will not be part of this contract.

I. Provide underground conduits and conductors from utility company transformer to main service equipment.

J. Install sealable meter compartment furnished by local Power Company.

K. Furnish and install interconnecting conduits between metering transformers and revenue meter. Install all equipment in conformity with utility company's requirements.

PART 2 – PRODUCTS

Not applicable to work in this section.

PART 3 – EXECUTION

Not applicable to work in this section.

END OF SECTION

SECTION 16035 - ELECTRICAL TESTING AND PLACING IN SERVICE

PART 1 – GENERAL

1.01 DESCRIPTION

A. The Contractor shall perform electrical testing in the presence of the Owner prior to Initial Field Testing and Final Acceptance Testing.

B. Provide all material, equipment, labor and technical supervision to perform and complete the electrical acceptance test in accordance with the requirements of this Section for equipment furnished by the Contractor. Notify Owner at least seven (7) days in advance of tests. The contractor shall supply the Owner a summary of the test results.

C. Perform tests on the following equipment:

1. Grounding.
2. Power cables, 600 volts and lower.
3. Rotating equipment.
4. Panelboards
5. Motor Control Center
6. PLC/Pump Control Panel
7. SCADA System Control Panel
8. Emergency Generator System
9. Automatic Transfer Switch
10. As required by other specification sections

D. Perform electrical testing as required by other Divisions 16 specifications for specific equipment including:

1. Section 11210 – Booster Pumps
2. Section 16400 – Electrical Work
3. Section 16461 – Dry Type Transformers
4. Section 16470 – Panelboards
5. Section 16612 – Emergency Generator System
6. Section 16690 – Variable Frequency Drives (Programming and Start-Up shall only be performed by factory/manufacturer authorized service technician)
7. Section 16950 – Description of Operation

1.02 QUALITY ASSURANCE

A. Final acceptance will depend upon successful completion of specified testing.

B. Perform all tests in accordance with manufacturer's recommendations. Should manufacturer's recommendations conflict with these specifications, notify Owner. Do not proceed with tests until directed by the Owner.

C. Material or equipment failing tests shall be repaired or replaced at the Contractor's expense.

D. The Contractor shall be responsible for all test and test records. Testing shall be performed by or under the immediate supervision of the Contractor, and in the presence of the Owner or Owner's representative.

E. Inspect the equipment prior to energizing.

F. The Contractor shall coordinate with certified manufacturer's representatives for those items specified as requiring representation during start up and testing.

1.03 SUBMITTALS

A. Electrical Testing Reports: Results of testing shall be fully documented including dates of testing, equipment utilized, person performing tests, tests made, comparative acceptable test results and reference standards, actual test results, corrections made and results of retesting for each piece of equipment or component tested. Submit test results neatly bound and organized in three ring binders with divider pages separating each set of tests, a complete table of contents, and listing of testing equipment including calibration certifications.

B. Certificates: The contractor shall provide a written certification that the electrical testing was completed successfully, all deficiencies corrected, and initially deficient equipment and or components were retested successfully.

C. The Contractor shall provide the Owner with one copy of the building regulation certificate of inspections, including any failing inspections.

PART 2 – PRODUCTS

2.01 TESTING DEVICES

A. The Contractor shall employ all testing devices and personnel trained in their use, required for testing as specified herein.

PART 3 – EXECUTION

3.01 TESTING AND MEASUREMENTS

A. Measure and record secondary voltages, at all panelboards or transformers

B. Each power and convenience outlet shall be subjected to tests for polarity, open wiring and continuous ground.

3.02 GROUND SYSTEM TESTING

A. Upon completion of installation of the electrical grounding and bonding systems, test the existing ground resistance with a ground resistance tester. Where tests show resistance-to-ground is over 10 ohms, take appropriate action to reduce the resistance to 10 ohms, or less, by driving additional ground rods. Then retest to demonstrate compliance.

3.03 CABLE CONTINUITY AND PHASE IDENTIFICATION

A. Check cable continuity and phase identification.

3.04 FEEDER INSULATION RESISTANCE TESTING

A. All current carrying phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. This shall be done with a 500 volt megger. The procedures listed below shall be followed:

1. Minimum readings shall be one million (1,000,000) or more ohms for #6 wire and smaller, 250,000 ohms or more for #4 wire or larger, between conductors and between conductor and the grounding conductor.

2. After all fixtures, devices and equipment are installed and all connections are installed and all connections completed to each panel, the contractor shall disconnect the neutral feeder conductor from the neutral bar and take a megger reading between the neutral bar and the grounded enclosure. If this reading is less than 250,000 ohms, the Contractor shall disconnect the branch circuit neutral wires from this neutral bar. The Contractor shall then test each one separately to the panel until the low readings are found. The Contractor shall correct troubles, reconnect and retest until at least 250,000 ohms from the neutral bar the grounded panel can be achieved with only the neutral feeder disconnected.

B. The Contractor shall send a letter to the Owner certifying that the above has been done and tabulating the megger readings for each panel. This shall be submitted at least four (4) days prior to final inspection.

C. At final inspection, the Contractor shall furnish a megger and show the Owner that the panels comply with the above requirements. He shall also furnish a hook-on type ammeter and voltage readings as directed by the representatives.

3.05 DOCUMENTATION

A. All tests specified shall be completely documented indicating time of day, date, temperature and all pertinent test information.

B. All required documentation of readings indicated above shall be submitted to the Owner prior to, and as one of the pre-requisites for, Initial Field Testing and Final Acceptance Testing.

END OF SECTION

SECTION 16100 - MOTOR CONTROL CENTER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish all labor and materials required for a complete motor control center including required number of vertical sections, motor starters, circuit breakers, transformer, filters, forced air cooling, magnetic relays, switches, push buttons, pilot lights, control transformers and special controls. Refer to Drawings for layouts and hardware sizes (starters and breakers).

B. Related Work specified elsewhere includes:

Section 16010 – Electrical Basic Requirements
Section 16400 – Electrical Work

1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

N.E.C. - National Electrical Code
U.L. - Underwriters' Laboratories Inc.
N.E.M.A. - National Electrical Manufacturers Association
A.N.S.I. - American National Standards Institute

All internal conductors are to be of sufficient cross-sectional area copper to carry the rated ampere load and not exceed the maximum heat rise above ambient temperature specified by U.L. and N.E.M.A.

B. Quality Control: The motor control centers shall be new and limited to products regularly produced and recommended for service ratings in accordance with engineering data or other comprehensive literature made available and in effect at time of bidding. In all cases where device, or devices, or part of equipment is herein referred to in singular, reference shall apply to as many items as required to complete installation.

C. Qualification: When more than one name of manufacturer is listed in the specifications, the first manufacturer determines the quality.

1.03 SUBMITTALS

A. Shop Drawings: Submit in accordance with the General Requirements of the Contract. Shop drawings shall be complete in all respects and shall indicate all dimensions, installation methods, size, weight, capacity, ratings, integral controls and types of materials, elevations, and sections. Shop drawings shall include complete control diagrams and nameplate schedules. Shop drawings shall be submitted for, at least, the following:

1. Freestanding Vertical Sections
2. Main Service Entrance Rated Breaker
3. Phase Protection
4. Phase Monitor
5. Phase Reversal Protection
6. Surge Protection
7. Relays
8. Variable Frequency Drives

9. PLC
10. Distribution Circuit Breakers
11. Distribution Circuit Breakers (Motor Circuit Protector Type)
12. Timers
13. Selector Switches
14. Push Buttons
15. Pilot Lights
16. Running Time Meter
17. Control Transformers
18. Standard N.E.M.A. Schematic Control Diagrams and Connection Diagrams
19. Nameplate Schedules

B. Operating and Maintenance Data: Submit in accordance with Section 01020 – Operation and Maintenance Data/Manual and Section 16010 – Electrical Basic Requirements.

1.04 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Product Handling: Deliver all materials in good condition. Store in dry place, off ground, and keep dry at all times.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers: Equipment shall be as manufactured by Allen-Bradley, Cutler-Hammer or Square D.

B. Motor Control Center Structure and Configuration: The motor control center shall be NEMA 12 type with neoprene gasketed doors. Motor starter units shall be mounted front of board. Wiring shall be rated at 277/480 volts, 3 phase, 60 Hz. Wiring shall be Class II, Type B. Provide a ground bus in the motor control center.

Control voltage shall be 120 volts.

Horizontal and vertical bus bars shall be braced for 65,000 rms symmetrical amperes. Incoming line feeder conductors shall consist of cables. Vertical sections shall be formed of 12 gauge hot rolled steel with uniform blemish-free surfaces. Top and bottom structural parts shall be 10 gauge. End closing plates shall be 12 gauge and unit parts and doors shall be 14 gauge. Base channels shall be provided constructed of rugged steel to easily withstand the stress of transit and moving the control center into position. Bolt holes in the base channels shall be provided in all sections for the purpose of bolting the control center to the floor. Steel removable lifting angles shall be provided on the top of the sections for convenience in handling the control center.

Each section, to comply with standards of N.E.M.A., shall be approximately 90" high excluding lifting angles and base channels. It shall be approximately 20" deep by 20" to 30" wide, as indicated on Drawings.

The top plate shall be of a removable one-piece construction for added convenience in cutting conduit holes. Removable blank plates flanged on all 4 sides and having captive screws shall cover all unused unit spaces.

Provide a 3-phase monitor and phase reversal protection in the motor control center to monitor the incoming power and to sense a loss of any one of three phases. The monitor shall be surface mounted

and shall be wired ahead of the pump circuit breakers. The three-phase monitor shall be Diversified Electronics SLA series.

Provide a transient voltage surge suppressor in the pump control panel to protect the panel components from damage which may occur from transient voltages caused by lightning or surges on the incoming power line. The surge suppressor shall have an indication light to indicate the unit is functioning. Surge suppressor shall be Innovative Technologies Model HS-P-SP-120-30A-RJ.

Provide an UPS system to backup all 120V control, communications, etc.in the motor control center. The UPS system shall be powered by a 120V outlet in the motor control center. An SO cord and plug shall bused to power the UPS system. The UPS shall provide surge and transient voltage protection and be of sufficient wattage to provide backup power to the main control circuit for 30 minutes. The UPS shall be model MINUCPE1000, 1000VA/750W tower as manufactured by Minuteman.

C. Main Circuit Breaker: Main circuit breaker shall be thermal-magnetic molded case type, individually mounted and identified. Main circuit breakers shall have quick-make, quick-break mechanism and shall visually indicate whether the breaker is closed, open or tripped. The main breaker shall have sufficient interrupting capacity to properly close against and interrupt instantaneously, without damage, the maximum short circuit current available at the breaker. Minimum interrupting capacity shall be 42,000 amperes symmetrical at 480 volts.

Provide three phase voltage loss/sequence monitor and relaying, to be connected on the load side of the automatic transfer switch. In the event of a loss of incoming phase, relay shall open motor starters to all pumps and fans.

It shall have a separate adjustable phase reversal relay. Relay shall be adjustable from 0 to .5 second. Set relay at .05 second. It shall open the motor starters in the event of a phase reversal.
Monitor shall be manufactured by Diversified Electronics.

The main breaker section shall include door mounted digital customer metering. Provide 240kA surge suppressor in the main breaker section. The main circuit breaker shall be LSI and shall have all adjustments necessary for Arc Flash compliance.

D. Horizontal Wireways: Adequate conduit entrance spaces and wire entry room shall be provided at both the top and bottom of each section. A bottom horizontal wireway shall extend through the length and depth of the control center section with openings between sections. Covers over these wireways shall be equipped with captive type screws to prevent loss of hardware during installation. These wireways shall be isolated from the bus bars.

E. Vertical Wireways: A vertical wire trough located on the right-hand side of each standard section and having a cross-sectional area of not less than 19 sq. in. shall extend from the top horizontal wire trough to the bottom horizontal wire trough for the purpose of routing user's motor and control wires to the control units. The wire trough shall be isolated from the bus bars to guard against accidental contact. A separately hinged door having captive type screws shall cover the vertical wire trough for safe and easy access to wiring without disturbing control units.

Wire ties shall be furnished in the vertical wire trough to group and securely hold wires in place for a neat, orderly installation.

Where wires access ports between unit spaces and vertical wire trough are open, snap-in block-offs shall be provided to prevent items, such as a fish tape, from accidentally entering the unit space. Snap-in wire grommets shall be-provided in wire access ports for size 2 units and smaller for isolation and added

protection of small wires. For larger units, snap-in wire guards shall be provided for added protection of larger wires.

F. Vertical Sections: Each vertical section shall be divided into compartments as indicated on the Drawings. Power shall be provided to these compartments from the main bus by bus bars extending the full height of the unit. Sections shall also be provided with horizontal spaces at the top and at the bottom, which shall line up with adjacent section to-form horizontal wiring raceways along the entire length of the control center. Vertical wiring space between the starter cell and the side sheets, isolated from the vertical bus bars and equipped with cable tie supports to hold cables and wiring in place, shall also be provided.

G. Compartments: Each compartment shall-be enclosed and effectively baffled to isolate any fault which may occur and shall be covered by an individual door fixed to the structure with a continuous full length piano hinge or two (three for doors over 36" high) semi-concealed, heavy-duty, pin type hinges. Doors shall be secured with captive, quick acting machine screw fasteners and shall be arranged to completely cover all live parts whether the draw out unit is present or not.

H. Bus Bars: Main horizontal bus bars rated as indicated on Drawings but not less than 600 amperes shall be provided at the top or center of the control center and extend its entire length, except when-cut and supplied with splice bars to divide the control center for ease in handling or when section is indicated on Drawings to be furnished without bus.

Horizontal bus bars of copper shall be mounted edge-to-edge to provide greater mechanical strength.

Vertical copper bus bars shall be rated not less than 400 amperes for adequate current carrying capacity in a variety of plug-in applications.

Horizontal and vertical bus bars shall be electrolytically tin plated copper. Connections between horizontal and vertical busses shall be joined by bolts, conical spring washers for constant pressure joints and self-clinching nuts to allow joint maintenance from the front.

High strength glass reinforced alkyd insulators shall be used as bus supports and as unit plug-in insulators. Bus and plug-in insulators shall be red to indicate the proximity of energized bus parts.

The temperature rise, above ambient temperature outside the enclosure, of bus bars and connections shall not exceed 50°C and that of connections to insulated cable shall not exceed 45°C when operated continuously at rated current. Buswork, wiring and equipment shall be rated to withstand short circuits of 65,000 rms symmetrical amperes at 480 volts or as noted on the Drawings.

A copper ground lug shall be provided in each incoming line vertical section capable of accepting a #600 to #750 MCM cable. A horizontal copper ground bus shall be provided in each section of the motor control center. Horizontal ground bus shall run continuously throughout the control center except where splits are necessary for ease of shipment and handling; in which case, splice bars shall be provided. Ground bus shall be tinplated copper and have a cross-sectional area of equal to 28% of the main horizontal bus cross-sectional area. Horizontal ground bus shall be located at the bottom of the motor control center.

I. Bus Barriers: Insulated horizontal and vertical bus barriers shall be furnished to reduce the hazard of accidental contact. These barriers shall have a red color to indicate proximity to energized busses. Vertical bus barriers shall have interlocking front and back pieces to give added protection on all sides and shall segregate the phases from each other. Small, separate openings in the vertical bus barriers shall permit unit plug-in contacts to pass through and engage the vertical bus bars.

Bottom bus covers shall be provided below the vertical bus to protect the ends of this bus from contact with fish tapes or other items entering the bottom of the enclosure

J. Unit Doors: Each unit shall have a door securely mounted with hinges which allow the door to swing open a minimum of 112 degrees. Unit doors shall be fastened to the stationary structure so they can be closed to cover the unit space when the units have been temporarily removed. Unit doors shall be held closed with captive type screws which engage self-aligning cage nuts. These screws shall provide at least 2 threads of engagement to help hold unit doors closed under fault conditions. Removable door panels held captive type screws shall be provided on starter unit doors for mounting push buttons, selector switches or pilot lights. Blank door panels capable of accepting future push button devices shall be furnished when push button devices are not originally specified for starter units. Starter units shall have an external low profile overload reset button.

   Pilot devices and instruments, including push buttons, reset buttons, indicating lights, process meters, run time meters and ammeters, shall be flush mounted in the compartment doors. All equipment within the unit shall be arranged to provide ample electrical clearances and easy access for maintenance. Only those items which are common to a starter shall be mounted in the same unit. Special sequencing relays, timers or other devices shall be located in a special relay compartment through extra terminal blocks.

K. Disconnect Operator: A flange mounted operator handle shall be supplied for each breaker. To prevent false circuit indication, this mechanism shall be engaged with the breaker at all times regardless of unit door position, The operator handle shall have a conventional up-down motion with the down position as "OFF". It shall be possible to lock this handle in the "OFF" position with up-to three 3/8" diameter shackle padlocks. The operator handle shall be color coded to display red in the "ON" position and black in the "OFF" position. The disconnect shall not affect the Arc Flash compliance All equipment shall be rated at 8 calories/cm^2 or below.

   The operator handle shall be interlocked with the unit door so the disconnect cannot be switched to the "ON" position unless the unit door is closed. It shall be possible to defeat this interlock by a deliberate act of an electrician should he desire to observe the operation of the operator handle assembly. This interlock shall also prevent opening the unit door unless the disconnect is in the "OFF" position. A defeater for this action shall also be provided in the event an electrician must gain access to the unit without interrupting the service.

L. Starter Units: Starter units shall be bolt-in type.

   Pilot devices shall be mounted on the unit to avoid any necessity for across-the-hinge wiring. All starter units shall be rated to withstand short circuits of 65,000 rms symmetrical amperes at 480 volts or as noted on the Drawings.

   Circuit Breakers (Thermal Magnetic Type):

   Thermal magnetic circuit breakers shall have quick-make, quick-break mechanisms and shall visually indicate whether the breaker is closed, open or tripped. All breakers shall be supplied with the necessary adjustments for Arc Flash compliance. All equipment shall be rated at 8 calories/cm^2 or below.

   All breakers shall have sufficient interrupting capacity to properly close against and interrupt instantaneously, without damage, the maximum short circuit current available at the breaker. Minimum interrupting capacity of breakers shall be 42,000 amps rms symmetrical at 480 volts or as noted on the Drawings. Provide auxiliary contacts on breakers where indicated.

M. Circuit Breakers (Motor Circuit Protector Type): Motor circuit protector type circuit breakers shall be used for all branch circuit breakers for motor circuits. Breakers shall be instantaneous trip, magnetic only

type. Each breaker shall be furnished with a single magnetic trip adjustment which simultaneously sets the magnetic trip level of all poles. Adjustment shall be continuous throughout the trip range. Minimum interrupting capacity of breakers shall be 42,000 amps rms symmetrical at 480 volts. Provide auxiliary contact's on breakers where indicated.

N. AC Magnetic Relays - 600 Volts - Convertible Contacts:

General: All 600 volt ac magnetic relays shall have convertible contacts and shall be rated for 0 - 600 volts, inductive, 60 ampere make, 6 ampere break-, 10 ampere continuous, with a minimum of 4 poles and provision to add up to 4 poles making a total of 8.

Contacts: Contacts shall be double break, silver. Contacts shall be convertible from normally open to normally closed or vice versa, without removing the relay from the panel or enclosure. Contacts shall be color coded or engraved with respective normally open or closed symbol to indicate status.

Coils: Coils shall be molded construction and continuous duty rated.

Terminals: Terminals shall be provided with pressure wire connectors.

O. Variable Frequency Drive (VFD): Variable frequency drives shall be Toshiba G9 or equal with input contactors, line reactors, emi/efi filters, and long lead filters as required. Filters shall be as manufactured by Trans-coil Inc., KLC series. Forced air cooling shall be furnished in the VFD compartment.

P. Electrical Interlocks: All starters shall be furnished with the maximum number of external electrical interlocks capable of being installed. Arrangements shall be convertible from normally open to normally closed, or half of each type shall be furnished if contacts are not convertible. If description of operation indicates more contacts are required than are physically possible to install, separate auxiliary relays shall be furnished as required.

Q. Selector Switches: Selector switches shall be non-illuminated. Switches shall be heavy-duty, oil tight. Contacts shall be double break. Contact tips shall be silver. All switches shall be maintained contact type unless otherwise indicated on Drawings or required by description of operation.

R. Push Buttons: Push buttons shall be non-illuminated. They shall be heavy-duty, oil tight. Contacts rated for 10 amps minimum. Push buttons shall be momentary contact type unless otherwise noted. All "emergency stop" push buttons shall be maintained contact type.

S. Pilot Lights: Pilot lights shall be transformer type. Voltage rating shall be 120 volts. Color caps shall be in accordance with section 16195. They shall be heavy-duty, oil tight.

T. Control Transformers: Provide a control transformer for each motor starter control circuit. Control transformers for motor starter individual control circuits shall be 480 volts to 120 volts and shall be protected according to code. Size shall be as required.

U. Running Time Meter: Running time meter shall be time totalizer. It shall have a synchronous motor which shall drive a set of digit read out wheels to indicate the total time the unit is energized. Read out shall be 5 digit including 1/10 digit. Voltage shall be 120 volts. Range shall be 0 to 9999.9 hours.

V. Process Meters: Process meters shall be LED displays, Precision Digital #PD603-6R0-0.

W. MCC Metering: Metering compartment shall include door mounted panel type analog ammeter with ammeter switch and two current transformers, panel type analog voltmeter with voltmeter switch and two fused potential transformers. Ammeter shall have 5 amp movement, 3-1/2" scale, 102, deflection and 2%

of full scale accuracy. Voltmeter shall have 120 volt movement, 3-1/2" scale, 102, deflection and 2% of full scale accuracy.

PART 3 - EXECUTION

3.01 CONNECTION AND INSTALLATION DIAGRAMS

A. Diagrams and Tests:

1. Furnish detailed connection and installation diagrams. Provide the services of a manufacturer's representative to start-up, test and adjust the system. All motor control center operations including alarms and system I/O requirements as outlined in the description of operation in section 16950 shall be demonstrated.

2. All start-up and testing shall be performed in the presence of JCSA and the Engineer.

B. Identification: A motor control center identification number nameplate describing section catalog numbers and characteristics shall be fastened on the-vertical wire trough door of every section. Each control center unit shall have its own identification number nameplate giving unit catalog number fastened to the unit saddle near the upper left-hand corner. These nameplates shall also have suitable references to factory records for efficient communication with supplier. Each control center unit shall also have engraved bakelite nameplate fastened to the outside of the unit door and instrumentation as indicated on the drawings.

3.02 WORKMANSHIP

A. Workmanship: Install all materials in a thorough, workmanlike manner.

3.03 INSTALLATION

A. Wiring: The motor control center shall be wired in accordance with N.E.M.A. class and type previously specified and shall be furnished to be interconnected with a distributed control system.

Conventional track mounted terminals shall be mounted on lift-out brackets in the units.

B. Finish: All painted parts shall undergo a phosphatizing prepainting treatment for rust resistance and good paint bond. All painting shall be with enamel which shall be baked for a durable, hard finish. Unit saddles shall be painted white for easy interior visibility. Removable push button plates, flange mounted operator handles and trim plates, and top horizontal wire trough cover plates shall be painted a contrasting light gray. Other painted parts shall be painted ANSI-49 medium light gray.

C. Concrete Base: Motor control center shall be installed on a 3" tooled edge concrete pad to extend 3" beyond sides and front or as indicated on Drawings.

D. Safety Mats: Safety mats shall be constructed of a corrugated all-rubber insulating matting specially compounded for use as a floor covering for protection of workers. Color of safety mats shall be black.

Safety mats shall conform to ANSI/ASTM D178-77, Type 1, Class 2 requirements and OSHA regulations. Mats shall be proof tested at 20,000 volts ac with a recommended use voltage of 17,000 volts and with a dielectric strength of 30,000 volts ac. Mats shall be a minimum 36" wide.

Safety mat shall be provided for the complete length of each motor control center in front from end to end.

END OF SECTION

SECTION 16110 - RACEWAYS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope: Extent of raceway work is indicated on the drawings, by the requirements of this Section, and Section 16010 – Electrical Basic Requirements.

B. Types: Types of raceways in this Section include the following:

1. Flexible steel conduit
2. Rigid Galvanized Steel Conduit
3. Liquid-tight flexible metal conduit
4. Rigid metal conduit
5. Wireway
6. Plastic / PVC

1.02 QUALITY ASSURANCE

A. National Fire Protection Association (NFPA): Comply with NFPA 70, "National Electrical Code", for application, size, location and installation of each type of raceway used.

B. Provide products specified in conformance with the indicated standards.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's data for each type of raceway.

1.4. HAZARDOUS LOCATIONS

A. Raceway in designated hazardous or explosion proof locations shall conform to NFPA 70 requirements for installation.

PART 2 – PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Each length of conduit shall bear the manufacturer’s stamp and UL label.

2.02 METAL CONDUIT AND TUBING

A. Rigid steel conduit zinc coated shall conform to American National Standards Institute (ANSI) C80.2, "Rigid and Steel Conduit".

B. Flexible metal electrical conduit shall conform to UL 1, "Flexible Metal Conduit".

2.03 NONMETALLIC CONDUITS AND RACEWAYS

A. Electrical plastic conduit, PVC Type, shall conform to NEMA TC 2, “Conduit (EPC-40 and EPC-80)”.

B. Provide in conformance with ANSI 870, “Wireways, Auxiliary Gutters, and Associated Fittings”.

2.04 METAL AND PLASTIC CONDUIT AND RACEWAY FITTINGS

A. Fittings for conduit and outlet boxes shall conform to UL 514B, “Fittings for Conduit and Outlet Boxes”.

B. PVC fittings for use with rigid PVC conduit and tubing shall conform to NEMA TC 3, “PVC Fittings for Use with Rigid PVC Conduit and Tubing”.

C. Nonmetallic conduits and raceways.

D. Raceway seals.

PART 3 – EXECUTION

3.01 MINIMUM SIZE

A. Size conduit and raceway in accordance with NFPA 70 unless otherwise specified or shown on the drawings. Minimum size 3/4-inch for interior work and 1-inch for exterior work.

3.02 EQUIPMENT GROUND CONDUCTOR

A. Raceways sizes shall be adequate to include the circuit conductors, an equipment ground conductor and a neutral conductor in accordance with percentage of fill requirements by NFPA 70. Size all conduits supplying motors and associated control equipment to include grounding conductor sized per NFPA 70 whether or not shown on the drawings or specified.

3.03 CONDUIT

A. All conduit between VFD’s and motors shall be rigid galvanized steel.

B. Rigid galvanized steel conduit buried in concrete shall be field coated with asphalt before installation.

C. Rigid galvanized steel conduit shall be plastic coated for slab transitions.

D. Exposed conduit shall be rigid galvanized steel.

E. Conduit encased within concrete may be Sch 80 PVC or rigid galvanized steel, unless required otherwise.

F. All conduit buried in earth shall be Sch 80 PVC.

G. All conduit in Chemical Rooms shall be Sch 80 PVC.

H. All AC and DC circuits shall be run in separate conduits. No exception.

I. Control and power circuits shall be run in separate conduits.

J. All flexible conduit shall be liquid-tight flexible steel conduit.

3.04 LIQUID-TIGHT FLEXIBLE STEEL CONDUIT

A. Use for all locations.

B. Sizes 1-1/4-inch and smaller, provide with continuous copper bonding conductor wound spirally between convolutions.

C. Sizes 1-1/2-inch and larger, provide with an internal grounding conductor and grounding bushings.

3.05 WIREWAYS, AUXILIARY GUTTERS

A. May be used to facilitate installation and future changes in wiring between panelboards, safety switches in close proximity to each other on same or adjacent walls or in same electrical equipment room or area.

B. Provide weatherproof enclosure where outdoors or subject to moisture and similar elements.

C. Use where shown on drawings or specified.

D. Shall be completely accessible.

3.06 RACEWAY FITTINGS, COUPLINGS AND CONNECTORS

A. Use fittings listed and approved for specific conduit or raceway system used.

B. For threaded rigid steel conduit do not use threadless or compression type fittings.

C. Bushing and connector shall be insulated type which maintain continuity of conduit grounding system. Insulating material shall be molded or locked into metallic body of the fitting. Bushing made entirely of nonmetallic material will not be allowed. Where concentric, eccentric or over- sized knockouts are encountered, a grounding-type insulated bushing shall be provided.

D. Provide flexible metal conduit fittings made of steel or malleable iron. They shall be insulated and be of the following types:

1. Liquid-tight flexible metal conduit shall incorporate a threaded grounding cone, a steel, nylon or equal plastic compression ring and a gland for tightening. Fitting shall be steel, or malleable iron with insulated throat, with male thread and locknut or male bushing with or without "O" ring seal.

E. Provide expansion fittings for all rigidly fastened conduits spanning a building expansion joint and if not otherwise provided, for all runs 1-1/2-inch or larger, exceeding 150 feet in length. Fittings shall be hot-dipped galvanized malleable iron with a packing ring to prevent entrance of water, a pressure ring, a grounding ring and a separate external copper bonding jumper.

F. Inferior material such as "pot metal" shall not be used for any type of fitting.

G. All locknuts shall be the bonding type with sharp edges for digging into the metal wall of an enclosure.

H. The use of "LB's" shall be limited where possible. Where necessary to use "LB's" sized above 2-inch, mogul units shall be installed.

3.07 GENERAL

A. Conduit runs shall be mechanically and electrically continuous from service entrance to all outlets. Each conduit shall enter and be securely connected to a cabinet, junction box, pull box or outlet by means of a locknut on the outside and a bushing on the inside or by means of liquid-tight, threaded, self-locking, cold-weld type wedge adapter.

B. All conduits, except those run in floor slab or underground, are to be run on surface of building. No conduits shall be run in walls or ceiling.

C. All conduits entering floor slab shall have a concrete curb at point of floor slab entrance.

D. Level and square raceway runs.

E. Install horizontal raceway runs above water piping.

F. Complete installation of electrical raceways before starting installation of cables/wires within raceways.

G. Provide supports for raceways as specified elsewhere in Division 16.

H. Prevent foreign matter from entering raceways; use temporary closure protection.

I. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab, nor below the slab where the slab is a finished ceiling.

J. Make bends and offsets so the inside diameter is not effectively reduced.

K. Unless otherwise indicated keep the legs of a bend in the same plane and the straight legs of offsets parallel.

L. Install exposed raceways parallel and perpendicular to nearby surfaces or exposed structural members, and follow the surface contours.

M. Run exposed, parallel or banked raceways together.

N. Make bends in parallel or banked runs from the same center line so that the bends are parallel. Factory elbows may be used in banked runs where they can be installed parallel.

O. Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts so that the dished part is against the box. Use two locknuts, one inside and the other outside the box.

P. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder.

Q. Where chase nipples are used, align the raceway and coupling square to the box and tighten the chase nipple so no threads are exposed. Running threads are not allowed.

R. Install pull wires in all empty raceways and label each side with the destination. Use No. 14 AWG plastic having not less than 200 pounds tensile strength. Leave not less than 12-inches of slack at

each end of the pull wire.

S. Exposed horizontal runs, where permitted, shall be installed close to ceiling or ceiling beams. Conduits connected to wall outlets shall be run in such a manner that they will not cross water or waste pipes.

T. Conduits shall not be run through beams, except where clearly indicated on drawings or where permitted.

U. Terminate conduits to main pump motors in coupling above floor and provide sealtight flexible conduit to motor connection box.

V. All conduit entering the top of panels, panel boards, controllers, MCC, etc. shall employ a Myers style weatherproof hub.

3.08 ADJUSTING AND CLEANING

A. Upon completion of installation of raceways, inspect interiors of raceways at all outlet, junction and pull boxes, remove burrs and obstructions.

B. Run a swab or mandrel to remove dirt and blockages. Raceways which are deformed and prevent the passage of a mandrel shall be replaced.

C. Remove dirt and construction debris from outlet, junction and pull boxes.

END OF SECTION

SECTION 16120 - WIRE AND CABLES

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope: Extent of electrical wire and cable work is indicated on the drawings and schedules, by the requirements of this Section, Section 16010 – Electrical Basic Requirements and Section 16035 – Electrical Testing and Placing in Service.

B. Types: Types of electrical wire, cable, and connectors specified in this section include the following:

1. Copper conductors.
2. Tap type connectors.
3. Split-bolt connectors.
4. Wire nut connectors.

1.02 QUALITY ASSURANCE

A. American Society for Testing and Materials (ASTM): Comply with requirements of the following:

1. B 1 Standard Specification for Hard-Drawn Copper Wire
2. B 8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft

B. Electrical Testing Laboratories (ETL): Provide wiring, cabling and connector products which are ETL listed and labeled.

C. Institute of Electrical and Electronics Engineers (IEEE): Comply with the following standards which apply to wiring systems:

1. 82 Test Procedure for Impulse Voltage Tests on Insulated Conductors
2. 241 Recommended Practice for Electrical Power Systems in Commercial Buildings

D. NFPA: Comply with NFPA 70 requirements for construction, installation and color coding of electrical wire, cable and connections.

E. UL: Provide material conforming to the following standards:

1. 44 Rubber-Insulated Wires and Cables
2. 83 Thermoplastic-Insulated Wires and Cables
3. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
4. 854 Service-Entrance Cables

F. UL Labels: Provide wiring, cabling and connector products which are UL listed and labeled.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical wire, cables, conductors, connectors and connector crimping tools.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver wire and cable packaged in factory-sealed containers, or wound on NEMA wire and cable reels.

B. Storage: Store wire and cable in a clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.

C. Handling: Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that resistance integrity of wires/cables is maintained.

PART 2 - PRODUCTS

2.01 COPPER WIRE

A. Conductors:

1. Provide wire rated 600 V minimum of the single conductor annealed copper type.
2. Conductors shall be Class B stranded.
3. Control wiring shall have stranded conductors.
4. The minimum conductor size for all power and lighting circuits shall be #12 AWG.
5. The maximum conductor size allowed shall be #500 kcmil.
6. Control wiring shall be #14 AWG minimum.

B. Insulation:

1. The insulation type for interior wiring shall be XHHW or THHN/THWN.

2.02 CABLE

A. Provide UL listed cables of sizes, ampacity, temperature ratings and insulating materials indicated on the drawings or in other sections of this specification.

2.03 CONNECTORS AND SPLICES

A. General: Provide UL listed metal connectors of sizes, ampacity, temperature ratings, materials, and classes required by NFPA 70 and NEMA standards for applications and services indicated.

B. Branch Circuits: For wires No. 10 AWG and smaller, provide solderless, insulated pressure cable type connectors, 600 V, of the compression or indent type or wire nut connectors. Temperature rating of connectors shall be at least equal to that of the wire on which they are used.

C. Copper Conductors: For No. 8 AWG and larger wire, provide socket head cap, hex screw, or bolt clamp type connectors, manufactured of high conductivity copper alloy or bronze castings. Select proper connector for each wire size. Cable sizes 250 kcmil and larger shall be retained in the connector by twin clamping elements.

2.04 INSULATING TAPE, PUTTY, RESIN AND SUPPORTS

A. Tape: Provide plastic electrical insulating tape which is flame retardant, cold and weather resistant. Tape for use in areas subject to temperatures 30 degrees C. to 105 degrees C., or where the tape will be subjected to an oil splash, shall have a minimum thickness of 8.5 mils, and shall consist of an oil-

resistant vinyl backing with an oil-resistant acrylic adhesive. Allowable tapes are: Scotch 33+ and Scotch 130C.

B. Materials:

1. Provide all insulating materials for splices and connections such as glass and synthetic tapes, putties, resins, splice cases, or compositions of the type approved for the particular use, location, voltage and temperature, and apply and install in an approved manner, all in accordance with the manufacturer's recommendations.

2. Supports: Provide cable supports of the wedge type which firmly clamp each individual cable and tighten due to the cable weight.

2.05 PROHIBITED PRODUCTS

A. The use of non-metallic sheathed cable Types NM to NMC, Metal Clad Cable (MC), armored bushed cable (BX) and armor-clad cable (AC) is prohibited.

PART 3 – EXECUTION

3.01 INSTALLATION OF WIRES AND CABLES

A. General: Install electrical wires, cables and wiring connectors in compliance with applicable requirements of NFPA 70, NEMA, UL and National Electrical Contractors Association (NECA) "Standard of Installation".

B. Conduit: Unless otherwise noted, install all wiring in rigid metal conduit, flexible metal conduit, and non-metallic conduit as indicated on the drawings or in the specifications, in conformance with NFPA 70.

C. Complete System: Provide wire, cables and connectors necessary for a complete installation from point of service connection to all receptacles, lighting fixtures, devices, utilization equipment and outlets for future extensions as indicated on the drawings, in schedules, and in the specification. Provide ample slack wire for connections.

D. Voltage Rating: Wire and cables for general wiring shall be rated for 600 volts minimum.

E. Minimum Size: Minimum branch circuit conductor size shall be No. 12 AWG. Where the length of a branch circuit homerun exceeds 50 feet for a 120 V circuit, or 125 feet for 277 V, the conductor size shall be No. 10 AWG.

F. Shelf Life: Wire and Cable manufactured more than 12 months prior to date of delivery to the site shall not be used.

G. Bundling: Neatly train all conductors located in branch circuit panelboards, signal cabinets, signal control boards, switchboards and motor control centers.

H. Feeder Identification: Securely fasten nonferrous identifying tags or pressure sensitive labels to all cables, feeders, and power circuits in vaults, pull boxes, manholes, switchboard rooms and at termination of cables.

I. Wires and cables shall be tagged at each end with machine stamped or printed black marking sleeves

to correspond with markings on drawings or marked so that feeder or cable may be readily identified. Markings shall be in accordance with the wire numbers and terminal strip numbers shown on the control panel wiring diagrams. Sleeves shall be white PVC tubing with machine stamped or printed black markings. Refer to Section 16425, paragraph 3.02.B.

J. If suspended type tags are provided, they shall be attached by approximately 55 pound test monofilament line or slip free plastic cable lacing units by approximately 55 pound test monofilament line or slip free plastic cable lacing units.

3.02 WIRE PULLING AND CABLE INSTALLATION

A. Raceways: Refer to Section 16110 – Raceways, for the preparation of raceways for wire and cables.

B. Equipment: Provide suitable installation equipment to prevent cutting and abrasion of conduits during the pulling of wires and cables.

C. Ropes used for pulling of conductors shall be made of polyethylene or other suitable nonmetallic material.

D. Metallic ropes shall not be used.

E. Pull conductors simultaneously where more than one is being installed in same raceway.

F. Use pulling compound or lubricant where necessary; compound shall not deteriorate conductor or insulation. Where polyethylene insulation is used and a pulling lubricant is required, the lubricant shall be certified by the manufacturer to be non-injurious to such insulation.

G. Lubricants shall conform to UL requirements applicable.

H. Pulling lines shall be attached to conductor cables by means of either woven basket grips or pulling eyes attached directly to the conductors. Rope hitches shall not be used.

I. Supports: Install cable supports for all vertical feeders in accordance with the applicable sections of the NFPA 70.

J. Splices: Keep conductor splices to a minimum. Splice wires and cables only in outlet boxes, junction boxes, pullboxes, manholes and handholes.

K. In the making of a splice, connectors shall be brought up securely upon the conductors such that all conductors are equally engaged, the insulation is not ruptured, no bare wires are exposed or have "backed off" due to the application of pressure and the connection will not loosen due to cycling or vibration, in order to insure an efficient splice.

L. The number, size and combinations of conductors permitted as listed on manufacturer's packaging of connector shall be strictly followed.

M. Connectors shall be fully insulated by a skirt, or taped to provide an insulation value at least equal to rating of wires being connected.

N. Connectors: Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values or comply with tightening torques specified in UL 486A and 486B.

O. All wiring shall conform to the following color code:
   a. 480 Volt, 3 Phase: Brown, Orange, Yellow - Phase Wires Gray - Neutral Wire
   b. 208 Volt, 3 Phase: Black, Red, Blue - Phase Wires, White - Neutral Wire
   c. 208 Volt, 1 Phase: Black, Red - Phase Wire
   d. 120 Volt, 1 Phase: Black - Phase Wire, White - Neutral Wire
   e. Control Wires: 120V AC- Red, 24V dc- Blue
   f. Ground Wires: Green

P. The colors shall be factory-applied entire length of the conductors by one of the following methods except as noted and limited below:

   1. Solid color compound.
   2. Solid color coating.
   3. Surface printing every 12 inches, maximum spacing of 18 inches.

Q. All branch circuit conductors Nos. 12 AWG and 10 AWG shall be solid color compound or solid color coating.

R. All sizes of conductors used for neutrals and equipment grounds shall be solid compound or solid color coating white, gray, or green, respectively.

S. All phase conductors No. 8 AWG and larger color coded with pressure sensitive tape shall have a background color other than white or green.

T. Color pressure-sensitive plastic tape shall be applied in half overlapping turns for a distance of six inches on all terminal points and in all boxes in which splices or taps are made. The last two laps of tape shall be applied with no tension to prevent possible unwinding.

U. Tape shall be 3/4-inch wide and colors shall be as specified.

V. Cable identification markings shall not be obliterated by taping and tape locations may be adjusted slightly to prevent obliteration of cable marking.

W. Pull spare pair of #14 AWG wire in all control conduits and label accordingly.

X. Shared common neutral conductors shall not be permitted.

3.03 FIELD QUALITY CONTROL

A. Tests: Feeders and branch circuit insulation shall be tested after installation, and before connection to fixtures and appliances.

   1. Tests shall be performed with a 500-volt megger, and conductors shall test free from short-circuits and grounds.

   2. Conductors shall be tested phase-to-phase and phase-to ground.

   3. Furnish the instruments, materials, and labor required. Perform the tests in the presence of the Owner.

   4. Test readings shall be recorded and delivered to the Owner.

B. Demonstration: Subsequent to wire and cable hookups, energize circuit and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION

SECTION 16130 - ELECTRICAL BOXES AND FITTINGS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope: This section covers electrical box and electrical fitting work for power, lighting, signal, communication, protection and auxiliary systems.

B. Types: Types of electrical boxes and fittings in this Section include the following:

1. Outlet boxes.
2. Junction boxes.
3. Pull boxes.
4. Splice Boxes.
5. Conduit bodies.
6. Bushings.
7. Locknuts.
8. Knockout closures.

1.02 QUALITY ASSURANCE

A. National Electrical Manufactures Association (NEMA): Conform to NEMA OS 1 "Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports", for sheet-steel outlet boxes, device boxes, covers and box supports. Conform to NEMA FB 1, "Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies"; for fittings, cast metal boxes and conduit bodies.

B. National Fire Protection Association (NFPA): Comply with NFPA 70, "National Electrical Code", for construction and installation of electrical wiring boxes and fittings.

C. Underwriters Laboratories, Inc. (UL): Provide electrical boxes and fittings which are UL-listed and labeled, and conform to UL 50, "Cabinets and Boxes", UL 514A, "Metallic Outlet Boxes", UL 514B, "Fittings for Conduit and Outlet Boxes", and UL 514C, "Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers".

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical boxes and fittings.

1.04 HAZARDOUS LOCATIONS

A. Raceway in designated hazardous or explosion proof locations shall conform to NFPA 70 requirements for installation.

PART 2 – PRODUCTS

2.01 GENERAL

A. Product Selection: Select boxes of types appropriate for each use and location.

1. Select covers for boxes of types appropriate for each use and location.

2. Provide gaskets for covers of boxes in damp locations or where immersion may occur.

B. Corrosion resistance: Provide galvanized or other approved corrosion resistant finish for all boxes, accessories and fittings.

2.02 FABRICATED MATERIALS

A. Interior Outlet Boxes: Provide deep drawn, galvanized steel, outlet boxes. Boxes shall be type FS with gasketed covers. All boxes shall be surface mounted.

1. Masonry Walls: 4-inch tall x 2 1/8 – inch wide x 2 ½ - inch deep
2. General use: 4 – inch square by 2 1/8 – inch deep
3. Hung devices: 4 – inch square by 2 1/8 – inch deep rated for the load supported.
4. Two or More Ganged devices: 4 – inch tall x 2 ½ - inch deep by width as required.
5. Concrete Floor: 4 – inch tall x 2 ½ - inch deep by width as required or floor box as indicated on drawings
6. Exposed: 4 inch square by 2 1/8 – inch deep octagonal

B. Provide boxes of increased depth where required by the project. Coordinate spacing of outlet boxes in fire rated walls.

C. Construction with stamped knockouts in the back and sides.

D. Provide threaded screw holes with corrosion-resistant screws for securing box covers and wiring devices. Interior Outlet Box Accessories: Provide outlet box accessories as required for each installation, including covers, mounting brackets, hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and fulfilling requirements of individual wiring situations.

E. Weatherproof Outlet Boxes: Provide corrosion-resistant cast-metal weatherproof outlet boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit ends.

F. Junction and Pull Boxes, Nema 3R: Provide galvanized sheet steel junction and pull boxes, with screw-on covers and of types, shapes and sizes, to suit each respective location and installation.

1. Provide welded seams and stainless steel nuts, bolts, screws and washers
2. Conform to the applicable requirements of NFPA 70 and to UL 50 for boxes over 100 cubic inches volume, except as modified below
3. Where necessary for boxes to provide a rigid assembly, provide integral structural steel bracing.

G. Conduit Bodies with Gasketed Covers: Provide galvanized cast-metal conduit bodies, of types, shapes and sizes, to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws.

H. Bushings, Knockout Closures and Locknuts: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts, malleable iron conduit bushings and offset connectors of types and sizes to suit respective uses and installation.

PART 3 – EXECUTION

3.01 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS, GENERAL

A. Coordination: Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work, and with the work of other trades.

B. Weatherproof: Provide weatherproof outlets for all interior and exterior locations.

C. Knockout Caps: Provide knockout closures to cap unused knockout holes where blanks have been removed.

D. Anchoring: Support and fasten boxes securely. Plastic anchors and powder driven shot anchors are not permitted.

E. Sizes: Provide boxes of sizes adequate to meet NFPA 70 volume requirements, but in no case smaller than sizes indicated.

F. All outlet boxes are to be “FS” series with cast hubs.

3.02 INSTALLATION OF OUTLET BOXES

A. Coordination: Verify location of outlet boxes with other equipment.

B. Grounding: Provide each box to which a device is to be attached with a grounding terminal, consisting of either a green-colored washer-in-head machine screw, not smaller than No. 10-32, screwed into a tapped hole or a grounding bushing attached to one of the conduits.

C. Mounting Height: The "mounting height" of a wall-mounted outlet box is defined as the height from the finished floor to the horizontal center line of the cover plate for receptacles and top of the outlet box for switches.

D. Where mounting heights are not indicated or where heights and locations interfere with mechanical, architectural or structural features, install outlet boxes in an approved location, without additional cost.

E. Where a ceiling outlet and a dropped beam or other change in ceiling level are shown at the same location, place the outlet at least 9-inches from the finished edge of the beam or change in level, except as otherwise indicated.

F. Where mounting heights for switches mounted in masonry walls shall be 46 inches or top of coursing not to exceed 48 inches. Do not mount outlet box in the mortar joint.

G. Locate outlet boxes for switches and receptacles on columns or pilasters approximately four inches off the centers of the columns to allow for future installation of partitions.

H. Vertical Axis: Except as otherwise indicated, mount outlet boxes for switches with the long axis vertical.

1. Mount boxes for receptacles vertically.

2. Three or more gang boxes shall be mounted with the long axis horizontal.

3. Locate boxes, covers or device plates not to span different types of building finishes whether vertically or horizontally.

I. Ceilings: For outlets in ceilings, all conduit shall be exposed. Use surface mounted outlet boxes.

J. Prohibited Work:

1. Do not use sectional (gangable) boxes.

2. Do not use device plates as covers for boxes in exposed locations.

3. Do not use round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections when fastened with locknut or bushing on rounded surface.

K. Protection: Protect outlet boxes to prevent entrance of debris. Thoroughly clean foreign material from boxes before conductors are installed.

L. Threaded Hubs: At the following locations use threaded hub type boxes with gasketed weatherproof covers:

1. All locations.

3.03 PULL AND JUNCTION BOXES

A. Installation: For installation of junction and pull boxes, conform to NFPA 70 and the following:

1. For boxes exposed to rain or installed in wet locations use weatherproof type.

2. For boxes in main feeder conduit runs use sizes not smaller than 8-inches square by 4-inches deep.

3. Do not exceed 6 conductors entering and 6 leaving raceways in a single box.

B. Conductors in any pull or junction box including equipment grounding conductors shall not exceed:

Size of Conductors	Maximum No. Largest Conductors
No. #4/0 AWG	30
#250 MCM	20
#500 MCM	15

C. Supports: Provide in each box, including boxes above switchboards with sufficient clamps, grids, or devices to which cables are secured in neat and orderly fashion permitting ready identification and so that no cable will have an unsupported length of more than 30-inches.

D. Adjacent Boxes: Locate adjacent boxes a minimum of 2 feet from any other pull or junction box.

E. No flush mount boxes.

END OF SECTION

SECTION 16135 – WIRING DEVICES

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope: Extent of wiring device work is indicated on the Drawings and schedules, by requirements of this Section, and Section 16010 – Electrical Basic Requirements.

B. Types: Types of electrical wiring devices specified in this Section include the following:

1. Receptacles.
2. Ground-fault circuit interrupters.
3. Switches.
4. Wallplates.
5. Plugs and connectors.

1.02 RELATED WORK

A. For work related to Boxes, Wire and Cables refer to other sections of Division 16.

1.03 QUALITY ASSURANCE

Codes: Provide wiring devices conforming to the following:

A. American National Standards Institute (ANSI): Provide plugs and receptacle devices constructed in accordance with ANSI C73, "Attachment Plugs and Receptacles, Dimensions of".

B. Institute of Electrical and Electronics Engineers (IEEE): Construct and install wiring devices in accordance with requirements of IEEE 241, "Recommended Practice for Electric Power Systems in Commercial Buildings".

C. National Electrical Manufacturers Association (NEMA): Provide wiring devices constructed and configured in accordance with the requirements of:

1. WD 1 General Requirements for Wiring Devices.
2. WD 2 Semiconductor Dimmers for Incandescent Lamps.
3. WD 6 Wiring Devices - Dimensional Requirements.

D. National Fire Protection Association (NFPA): Comply with NFPA 70, "National Electrical Code", as applicable to construction and installation of electrical wiring devices.

E. Underwriters Laboratories, Inc. (UL): Provide wiring devices which are UL listed and comply with the requirements of:

1. 20 General- Use Snap Switches.
2. 49 Attachment Plugs and Receptacles.
3. 514A Metallic Outlet Boxes.
4. 514B Fittings for Conduit and Outlet Boxes.
5. 514C Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
6. 943 Ground-Fault Circuit Interrupters.

1.04 SUBMITTALS

A. Submit manufacturer's data / Shop Drawings on all electrical wiring devices in accordance with the requirements of Section 16010 – Electrical Basic Requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Handle wiring devices carefully to prevent damage. Do not install damaged wiring devices, replace with new.

B. Storage: Store wiring devices in a clean and dry place. Protect from dirt, construction debris, and physical damage.

PART 2 – PRODUCTS

2.01 WIRING DEVICES

A. Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA WD 1.

2.02 RECEPTACLES

A. Duplex Receptacles: Provide specification grade duplex receptacles, 2-pole, 3-wire a grounding, with green hexagonal equipment ground screw, ground terminals and poles internally connected to mounting yoke, 20 A, 125 V, with metal plaster ears, design for side wiring with four captively held binding screws and provisions for back wiring from eight separate metal wiring clamps, with spring loaded, screw activated pressure plate, with NEMA configuration 5-20R unless otherwise indicated. Self-grounding or automatic type grounding receptacles are not acceptable in lieu of receptacles with separate grounding screw lugs and a direct, green insulated conductor connection to the equipment grounding system.

B. Single Receptacles: Provide specification grade single receptacles, 2-pole, 3-wire, grounding, with green hexagonal equipment ground screw, 20 A, 125 V, with metal plaster ears, design for side and back wiring with spring loaded, screw activated pressure plate, with NEMA configuration 5-20R unless otherwise indicated.

C. Ground Fault Interrupter: Provide termination type ground fault circuit interrupters, with duplex receptacles, capable of protecting connected receptacles on single circuit, and installed in an outlet box without adaptor. Provide grounding type UL rated Class A, Group 1, rated 20 A, 125 V, 60 Hz; solid-state ground fault sensing and signaling with 5 milliamperes ground fault trip level, equip with NEMA configuration 5-20R.

D. Weatherproof Receptacles: Provide in cast metal box with gasketed, weatherproof PVC cover plate and shall be listed as "raintight while in use".

2.03 SWITCHES

A. General: Provide specification grade switches with green hexagonal equipment ground screw, as indicated on the drawings conforming to NEMA WD 1 and to the following:

B. Snap Switches: Provide specification grade, general duty flush single pole toggle AC quiet switches, 20 A, 120-277 V, with mounting yoke insulated from mechanism, equip with plaster ears, switch

handle and back or side-wired screw terminals. Provide captive or terminal type terminal screws not smaller than No. 8. Provide back-wired devices with separate access holes for wiring.

2.04 WIRING DEVICE ACCESSORIES

A. Wallplates: Provide wall plate for each switch, receptacle, and special purpose outlet. Do not use sectional gang plates. Provide multi-gang outlet plates for multi-gang boxes. Wall plates shall be in accordance with UL 514A, UL 514B, UL 514C, and as follows unless otherwise noted.

B. Switch and receptacle cover plates on exposed work shall be galvanized cast ferrous metal or Feraloy, standard size, and shall be single or ganged as indicated on the Drawings.

C. Exterior mounted switch and receptacle plates, and those noted to be weatherproof, shall be gasketed weatherproof PVC cover plates, standard size, single or ganged as indicated on the Drawings, and shall be listed as "raintight while in use".

PART 3 – EXECUTION

3.01 INSTALLATION OF WIRING DEVICES

A. General: Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NFPA 70 and NEMA "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements. Where not indicated, mount switch adjacent to latch jamb of door.

B. Coordination: Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.

C. Boxes: Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.

D. Receptacles: Install receptacles with centerline located 18-inches above the finished floor, unless otherwise noted or specified.

E. Work Sequence: Install wiring devices after wiring work is completed.

F. Switches: Install switches with centerline located 48 inches above finished floor unless otherwise noted or specified.

3.02 PROTECTION OF WALL PLATES AND RECEPTACLES

A. Upon installation of wall plates and receptacles, advise Owner's representative regarding proper and cautious use of convenience outlets. At time of substantial completion, replace those items, which have been damaged, including those burned and scored by faulty plugs.

3.03 GROUNDING

A. Provide equipment grounding connections for wiring devices, unless otherwise indicated.

3.04 TESTING

A. Test wiring devices for electrical continuity, and for short-circuits prior to energizing circuitry.

Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

END OF SECTION

SECTION 16190 - SUPPORTING DEVICES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope: Provide support for all electrical items using supports, anchors, sleeves, seals, fastenings and other components. The extent of supporting devices is covered by this Section, the Drawings and Section 16010 – Electrical Basic Requirements and Section 16400 – Electrical Work.

B. Types: Types of supports, anchors, sleeves, seals and fastenings specified in this Section include the following:

1. Clevis hangers.
2. Riser clamps.
3. C-clamps.
4. I-beam clamps.
5. One-hole conduit straps.
6. Two-hole conduit straps.
7. Round steel rods.
8. Lead expansion anchors.
9. Toggle bolts.
10. Wall and floor seals.

C. Equipment: Supports, sleeves, seals and fasteners furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other sections.

1.02 QUALITY ASSURANCE

A. National Fire Protection Association (NFPA): Comply with NFPA 70 as applicable to construction and installation of electrical supporting devices.

B. Underwriters Laboratories, Inc. (UL): Conform to UL listings and labeling.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. General: Provide supporting devices with manufacturer's standard materials, designed and constructed in accordance with published product information, for a complete installation and as herein specified.

B. Corrosion Resistance: Provide all supports, support hardware and fasteners hot-dipped galvanized or cadmium plated. Provide stainless steel supports, hardware and fasteners in Chemical Rooms.

C. For Raceway Supports: Provide manufacturer's standard supports including clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze, wall brackets and spring steel clamps.

D. Fasteners: Provide fasteners of types, sizes and materials indicated with the following construction features:

1. 1/2-inch lead or steel expansion anchors approximately 38 pounds weight per 100 units.
2. 3/16-inch by 4-inch springhead toggle bolts approximately 5 pounds weight per 100 units.

E. Sleeves and Seals: Provide sleeves and seals, of types, sizes and materials indicated with the following features:

1. Smoke and fire stop seals shall have a UL fire rating of where installed in fire rated construction or as indicated.

2. Seal between sleeve and pipe where a fire rated seal is not required or specified. Weatherproof seals required for penetrations thru exterior walls. Seals capable of withstanding a corrosive environment and sulfide gases are required for penetrations into the wet well.

3. U-Channel Strut Systems: Provide U-channel strut system for mounting and supporting electrical equipment. Fabricate strut from 16-gauge hot-dip galvanized steel sheet, 9/16-inch diameter holes, 8-inches on center on top surface. Fittings shall mate with the U-channel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Compliance: Install hangers, sleeves, seals, U-channel supports and fasteners as indicated and in accordance with manufacturer's written instructions. Comply with requirements of NFPA 70 and American National Standards Institute (ANSI)/National Electrical Manufacturers Association (NEMA) for installation of supporting devices.

B. Coordination: Coordinate with other electrical work, including raceway and wiring work.

C. Conduit Supports:

1. Provide raceway support meeting the requirements of these specifications and NFPA 70. Conform to manufacturer's recommendations. For each support provide strength equal to the maximum weight of the present load plus all future raceways for which the support provides space, times a safety factor. Except as otherwise indicated, use a safety factor greater than four where necessary to provide a minimum safety allowance of 200 pounds. Provide additional support strength where required to prevent distortion of raceway during wire pulling.

2. Provide individual and multiple (trapeze) raceway hangers, and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly, and for securing hanger rods and conduits.

3. Arrange for grouping of parallel runs of horizontal raceways to be supported together on trapeze type hangers where possible.

4. PVC conduits shall be strapped at 2-ft. intervals.

D. Exposed conduits installed on the interior surface of exterior building walls shall be spaced off the wall surface a minimum of 1/4-inch using "clamp-backs" or strut.

E. Support individual horizontal conduits and EMT 1-1/2-inch size and smaller by either one-hole pipe straps or separate pipe hangers, use separate pipe hangers for larger sizes. Use steel

fasteners that are specifically designed for supporting single conduits or EMT. Unless otherwise indicated, do not use wire as a means of support.

F. Except as otherwise indicated, space supports for metallic and non-metallic raceways in accordance with the requirements of this Section and the requirements of the NFPA 70.

G. Provide support for exposed or concealed raceway as close as practical to and not exceeding one foot from an unsupported box or access fitting. In horizontal runs a support at a box or access fitting may be omitted when the box or access fitting is independently supported and the raceway termination is not made with a close nipple or threadless box connector.

H. In vertical runs provide such support that the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports, with no weight load on raceway terminations or conductor terminals.

I. Miscellaneous Supports:

1. Provide supports for all miscellaneous electrical components as required to produce the same safety allowances as specified for raceway supports above. Provide metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, etc.

2. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support and to the extent necessary to prevent movement during wire installation; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type fastener not more than 24-inches from the box. When penetrating reinforced-concrete members, avoid cutting any reinforcing steel.

J. Cable Supports:

1. Install in strict compliance with manufacturer's instructions.

2. Spacing not to exceed NFPA 70 tabulation for spacing of conductor supports.

3. Allow adequate slack in conductors to prevent any stress on terminations. Take into consideration conductor thermal contraction.

K. Fasteners:

1. Unless otherwise indicated securely fasten all electrical items and their supporting hardware including, but not limited to, conduits, raceways, cables, cable trays, busways, cabinets, panelboards, wall-mounted transformers, boxes, disconnect switches and control components to the building structure.

2. Provide supports for conduits: Conduit shall be secured and supported in accordance with NFPA-70. Conduits shall be supported within 3 feet of changes in direction.

3. Supports shall be approved pipe straps, wall brackets, hangers or ceiling trapeze.

4. Fasten by means of wood screws on wood; by toggle bolts on hollow masonry units; by concrete anchors on concrete or brick- and by machine screws, welded threaded studs, or spring-tension clamps on steel work.

5. Wooden plugs shall not be inserted in masonry, and nails shall not be used for fastening.

6. Conduits or pipe straps shall not be welded to steel structures.

7. Holes cut to a depth of more than 1- 1/2 inches in reinforced concrete beams or to a depth of more than 3 /4 inch in concrete joints shall not cut the main reinforcing bars. Holes not used shall be filled.

8. Rigid steel conduits shall be fastened with two locknuts to all sheet-metal boxes where nonmetallic bushings are used or where metallic bushings cannot be brought into firm contact with the box. Locknuts shall have sharp edges for digging into the wall of metal enclosures. Insulated bushings or insulated fittings shall be installed on the ends of conduits

9. Loads applied to any fastener shall not exceed one-fifth of the proof test load. Use vibration and shock-resistant fasteners.

L. Sleeve Seals:

1. Tighten sleeve seal nuts until sealing grommets have expanded to form watertight and smoketight seal.

2. Sleeves: Where installed in slabs or partitions completely fill the void between the sleeve and masonry with expanding cement grout.

END OF SECTION

SECTION 16195 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope: Extent of electrical identification work required by this Section is indicated in this section, on the Drawings or where specified in other sections of Division 16.

B. Types: Types of electrical identification work specified in this section include the following:

1. Identification of electrical power, control and communication raceways, cables, and conductors.

2. Equipment labels and signs.

1.02 QUALITY ASSURANCE

A. National Fire Protection Association (NFPA): Comply with NFPA 70, "National Electrical Code" requirements for identification and for provision of warning and caution signs for wiring and equipment.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical identification materials and products.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application.

B. Furnish and install engraved laminated phenolic nameplates for all safety switches, panelboards, starters, and other electrical equipment supplied for the project for identification of equipment, controlled, served, phase, voltage, etc. Nameplates shall be securely attached to equipment with self-tapping stainless steel screws, riveted or bolted and shall identify equipment controlled, attached, etc. Letters shall be approximately 1/2-inch high minimum for identification and 1/4-inch high minimum for other descriptions. Embossed, self-adhesive plastic tape is not acceptable for marking equipment. Nameplate material colors shall be:

1. Blue surface with white core for 120/208 volt equipment.

C. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate. Identification shall be by tags with wire attached to conduit or outlet.

D. All control wiring shall be tagged at each end with legible permanent coded wire marking sleeve. Sleeves shall be white PVC tubing with machine printed black marking. Marking shall be in accordance with the wire numbers and terminal strip numbers shown on the control panel wiring diagrams. All labeling and tagging of control wiring shall be done by the Control Panel Supplier.

E. Cable Ties: Provide fungus-inert, self-extinguishing, one piece, self locking nylon cable ties, 0.18-inch minimum width, 50 pounds minimum tensile strength and suitable for a temperature range from -50 degrees F. to +350 degrees F. Provide ties in specified colors when used for color coding.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements:

1. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations, specified or indicated on drawings. Provide numbers, lettering and wording as approved in submittals, as required by code, or as recommended by manufacturers.

2. Install products covered by this section where indicated on drawings or specified. Install products covered by this section where required by NFPA 70, whether or not otherwise indicated. Install products in accordance with manufacturer's written instructions and requirements of NFPA 70.

3. Where identification is to be applied to surfaces which require finish, install identification after completion of finish work.

B. Panel Identification

1. All electrical and instrumentation panels shall have legend plates that denote the following information:
   a. EQUIPMENT NAME (ex. WATER PUMP CONTROL #1)
   b. EQUIPMENT IDENTIFICATION NUMBER (ex. FP-50-10-1)
   c. SOURCE BREAKER IDENTIFICATION (ex. FED FROM MCC-4)

2. All devices that have more than one source of voltage will have a similar plastic laminate label, red w/white lettering that clearly states the presence of additional voltage sources. It also shall be secured to the panel in a similar fashion as the previously mentioned legend plates.

3. All terminal devices such as solenoids, limit switches, level probes, thermostats, etc. shall have labels made of material identical to that previously mentioned. They also shall be black w/white lettering and secured with 30# stainless steel beaded chain or attached with an appropriate adhesive.

4. All lettering shall be engraved block font, 3/8” high.

C. Panel Items

1. Lens colors shall be red for “run”, “open,” or “on”; “green” for “stopped”, or “off”; “amber” for alarm.

2. Terminal strips shall be provided for all panels and shall be of the flanged fork or ring lug type suitable for No.12 AWG stranded wire minimum. Provide 25 percent spare terminals in each panel

A. Tagging or Labeling Conductors: Tag or label conductors as follows:

1. Match identification markings with designations used in panelboards, shop drawings, Contract Documents and similar previously established identification schemes for the facility electrical work.

END OF SECTION

SECTION 16400 - ELECTRICAL WORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. The scope of this section covers the electrical work related to the following items:

Conductors: Wires, Cables and Grounding Equipment
Toggle Switches
Push-Button Switches, Selector Switches and Pilot Lights
Circuit Breakers
Relays
Transient Voltage Surge Suppressor
Thermostat

1.02 RELATED WORK

A. Electrical work specified elsewhere:

Section 16010 – Electrical Basic Requirements
Section 16100 – Motor Control Center
Section 16461 – Dry Type Transformers
Section 16612 – Emergency Generator System
Section 16690 – Variable Frequency Drives
Section 16920 – Programmable Logic Controller
Section 16950 – Description of Operations

1.03 QUALITY ASSURANCE

A. All Electrical work as described in this Section, including labor, parts and method of installation shall be in accordance with the specified standards and the appropriate standards listed in Section 16010 – Electrical Basic Requirements.

B. Labels and Listings: Materials, appliances and equipment provided shall meet the requirements of the Underwriters Laboratories, Inc. (UL), Electrical Testing Laboratories (ETL) and other standards organizations.

1.04 SUBMITTALS

A. Shop Drawings and Catalog Data: Shop drawings and catalog data shall be submitted for, but not limited to, all electrical items listed in Section 16010 – Electrical Basic Requirements.

B. Test Reports shall be submitted as specified herein and in Section 16010 – Electrical Basic Requirements.

1. All tests specified shall be completely documented indicating time of day, date, temperature and all pertinent test information.
2. All required documentation of readings indicated above shall be submitted to the Owner prior to, and as one of the pre-requisites for, Initial Field Testing and Final Acceptance Testing.

C. Certification of compliance with specified criteria for those items identified herein and in Section 16010 – Electrical Basic Requirements shall be provided as part of the project submittals.

1.05 RECORD DOCUMENTS

A. Electrical record interconnection diagrams "as-built" shall be submitted and approved prior to final acceptance by the Owner in accordance with Section 01030 – Record Documents.

1.06 PARTS AND OPERATION AND MAINTENANCE MANUAL

A. Spare Parts and O&M Manual shall be furnished in accordance with Section 01020 – Operation and Maintenance Data/Manual and Section 16010 – Electrical Basic Requirements.

PART 2 - PRODUCTS

2.01 ELECTRICAL IDENTIFICATION AND EQUIPMENT LABELING

A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application.

B. Furnish and install engraved laminated phenolic nameplates for all safety switches, panelboards, starters, and other electrical equipment supplied for the project for identification of equipment, controlled, served, phase, voltage, etc. Nameplates shall be securely attached to equipment with self-tapping stainless steel screws, riveted or bolted and shall identify equipment controlled, attached, etc. Letters shall be approximately 1/2-inch high minimum for identification and 1/4-inch high minimum for other descriptions. Embossed, self-adhesive plastic tape is not acceptable for marking equipment. Nameplate material colors shall be:

1. Blue surface with white core for 120/208 volt equipment.
2. Black surface with white core for 480/277 volt equipment.

C. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate. Identification shall be by tags with wire attached to conduit or outlet.

D. Wire/Cable Designation Tape Markers: Provide vinyl or vinyl cloth, self-adhesive wrap-around cable/conductor markers with pre-printed numbers and letters for designation purposes.

E. Cable Ties: Provide fungus-inert, self-extinguishing, one piece, self-locking nylon cable ties, 0.18-inch minimum width, 50 pounds minimum tensile strength and suitable for a temperature range from -50 degrees F. to +350 degrees F. Provide ties in specified colors when used for color coding.

2.02 CONDUITS AND FITTINGS

A. Provide specified Conduits and Fittings in conformance with the indicated standards for application, size, location and installation.

B. Types of Conduits in this Section include the following:

1. Flexible steel conduit
2. Rigid Galvanized Steel Conduit
3. Liquid-tight flexible metal conduit
4. Rigid metal conduit
5. Wireway
6. Plastic / PVC

C. Conduits – Product Requirements

1. Each length of conduit shall bear the manufacturer's stamp and UL label.

2. Rigid steel conduit zinc coated shall conform to American National Standards Institute (ANSI) C80.2, "Rigid and Steel Conduit".

3. Flexible metal electrical conduit shall conform to UL 1, "Flexible Metal Conduit" and shall have an extruded moisture and oil-proof PVC jacket.

4. Electrical plastic conduit, PVC Type, shall conform to NEMA TC 2, "Conduit (EPC-40 and EPC-80)".

5. Nonmetallic conduits shall conform to ANSI 870, "Wireways, Auxiliary Gutters, and Associated Fittings".

D. Conduit Fittings, Coupling and Connectors – Product Requirements

1. Fittings for rigid metal conduit shall be threaded. Fittings for all conduit shall be of the same material as the conduit, and when installed in wet locations and underground, they shall provide a watertight joint.

2. Fittings for conduit and outlet boxes shall conform to UL 514B, "Fittings for Conduit and Outlet Boxes".

3. PVC fittings for use with rigid PVC conduit and tubing shall conform to NEMA TC 3, "PVC Fittings for Use with Rigid PVC Conduit and Tubing".

2.03 ELECTRICAL BOXES

A. Provide specified Conduits and Fittings in conformance with the indicated standards for application, size, location and installation.

B. Types of Electrical Boxes in this Section include the following:

1. Outlet boxes.
2. Junction boxes.
3. Pull boxes.
4. Splice Boxes.
5. Conduit bodies.

C. Electrical Boxes – Product Requirements

1. Underwriters Laboratories, Inc. (UL): Provide electrical boxes and fittings which are UL-

listed and labeled, and conform to UL 50, "Cabinets and Boxes", UL 514A, "Metallic Outlet Boxes", and UL 514C, "Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers".

2. Product Selection:
   a. Select boxes of types appropriate for each use and location.
   b. Boxes shall be cast metal hub type.
   c. Boxes shall have threaded screw holes with corrosion-resistant screws for securing box covers and wiring devices.
   d. Select covers for boxes of types appropriate for each use and location. Covers and Device Plates shall be UL 514A. One-piece covers and device plates shall be provided for all outlets and fittings to suit the devices installed. Plates shall be zinc-coated steel or cast-metal with round of beveled edges. Screws shall be machine type with countersunk heads, painted or finished to match the plate. Steel and aluminum plates shall be a minimum of 0.03 inch thick.
   e. For metallic conduits, boxes shall be of the cast metal hub type.
   f. Gaskets shall be provided on all boxes and outlet boxes.

D. Interior Outlet Boxes:

1. Provide deep drawn, galvanized cast metal weatherproof boxes.
   a. General use: 4 – inch square by 2 1/8 – inch deep
   b. Hung devices: 4 – inch square by 2 1/8 – inch deep rated for the load supported.
   c. Two or More Ganged devices: 4 – inch tall x 2 ½ - inch deep by width as required.
   d. Concrete Floor: 4 – inch tall x 2 ½ - inch deep by width as required or floor box as indicated on drawings
   e. Exposed: 4 inch square by 2 1/8 – inch deep octagonal
   f. Provide boxes of increased depth where required by the project. Coordinate spacing of outlet boxes in fire rated walls.
2. Accessories: Provide outlet box accessories as required for each installation, including covers, mounting brackets, hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and fulfilling requirements of individual wiring situations.
3. Weatherproof Outlet Boxes: Provide corrosion-resistant cast-metal weatherproof outlet boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit ends.

E. Junction and Pull Boxes: Provide NEMA 4 galvanized cast metal junction and pull boxes, with screw-on covers and of types, shapes and sizes, to suit each respective location and installation.

1. Provide welded seams and stainless steel nuts, bolts, screws and washers
2. Conform to the applicable requirements of NFPA 70 and to UL 50 for boxes over 100 cubic inches volume, except as modified below
3. Where necessary for boxes to provide a rigid assembly, provide integral structural steel bracing.

F. Conduit Bodies: Provide galvanized cast-metal conduit bodies, of types, shapes and sizes, to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable

covers, and corrosion-resistant screws.

G. Bushings, Knockout Closures and Locknuts: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts, malleable iron conduit bushings and offset connectors of types and sizes to suit respective uses and installation.

H. Provide weatherproof hubs, as manufactured by Myers or approved equal, where conduits enter the top of enclosures, panels or non-threaded boxes.

I. Receptacle:

1. Receptacle: Ground-Fault Interrupter: Provide general-duty, weatherproof, duplex receptacles, ground-fault circuit interrupters; grounding type UL-rated Class A, Group 1, 20-amperes rating, 120-volts, 60 Hz-, with solid-state ground-fault sensing and signaling with 5 milliamperes ground-fault trip level; equip with 20-ampere plug configuration, NEMA 5-20R.
2. 20 Ampere, 120 Volt, Duplex Receptacles, NEMA 5-20R: Duplex receptacles shall be 3-wire, U-ground, to meet Federal Specification #WC 596f. Receptacles shall be Bryant #5362, A-H #5362, P & S #5362, Hubbell #5362, Leviton #5362 or Woodhead #5362 DW.

2.04 CONDUCTORS: WIRES, CABLES AND GROUNDING EQUIPMENT

A. Conductors – Products Requirement:

1. Delivery: Deliver wire and cable packaged in factory-sealed containers, or wound on NEMA wire and cable reels.
2. Storage: Store wire and cable in a clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
3. Handling: Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that resistance integrity of wires/cables is maintained.
4. UL Labels: Provide wiring, cabling and connector products which are UL listed and labeled.
5. No common neutrals.
6. All wiring shall be marked with vinyl tags at all termination points.

B. Conductor Types:

1. Conductors, 600 Volts and Below: Conductors sizes are expressed in American Wire Gage (AWG) or in circular mils. Minimum conductor sizes shall be No. 12 AWG, except control wires and cables shall be minimum No. 14 AWG. All conductors shall be stranded. Conductors shall be copper. The maximum conductor size allowed shall be #500 kcmil.
2. Power and Lighting Conductors: Conductors shall be stranded, UL 83, 600-volt, type THHN. Branch circuit wires run in or through fluorescent fixtures shall be rated for 90 degrees C and shall be Type THHN.
3. Panel control wiring to PLC shall be stranded #16AWG THHN. All signal wiring from external sensing devices to the PLC shall be twisted pair shielded cable, 600V insulation or as recommended by the equipment manufacturer.
4. Grounding and Bonding Conductors: ASTM B 1, stranded copper wire for sizes No. 8 AWG and smaller; ASTM B 8, Class B, stranded copper wire for sizes No. 6 AWG and larger. Grounding conductors shall be insulated (green).

5. Service-Entrance, Underground Secondary Conductors, and Conductors Below Slab On Grade: UL 854, Type USE, single conductors rated 600 volts. Cable shall be suitable for installation in conduit. No direct buried conductors shall be allowed.
6. The use of non-metallic sheathed cable Types NM to NMC, Metal Clad Cable (MC), armored bushed cable (BX) and armor-clad cable (AC) is prohibited.

C. Flexible Connections. Short-length flexible connections shall be provided for equipment subject to vibration or movement and for all motors.

D. All wiring shall conform to the following color code:

1.	480 Volt, three (3) phase:	brown, orange, yellow - phase wires gray – neutral wire
2.	208 Volt, three (3) phase:	black, red, blue – phase wires white – neutral wire
3.	208 Volt, one (1) phase:	black, red – phase wire
4.	120 Volt, one (1) phase:	black – phase wire white – neutral wire
5.	Control wires:	120 VAC – red 24 VDC – blue
6.	Ground wires:	green

7. AC control wires energized from a source external to the control panel power source shall be yellow.

E. Splice and Termination Components:

1. Provide Splice and Termination Components: UL 486A for wire connectors and soldering lugs, UL 5 1 0 for insulating tapes.
2. Branch Circuits: For wires No. 10 AWG and smaller, provide solderless, 600 V, wire nut connectors. Temperature rating of connectors shall be at least equal to that of the wire on which they are used.
3. Copper Conductors: For No. 8 AWG and larger wire, provide socket head cap, hex screw, or bolt clamp type connectors, manufactured of high conductivity copper alloy or bronze castings. Select proper connector for each wire size. Cable sizes 250 kcmil and larger shall be retained in the connector by twin clamping elements.
4. Insulating Tape: Provide plastic electrical insulating tape, which is flame retardant, cold and weather resistant. Tape for use in areas subject to temperatures 30 degrees C. to 105 degrees C., or where the tape will be subjected to an oil splash, shall have a minimum thickness of 8.5 mils, and shall consist of an oil-resistant vinyl backing with an oil-resistant acrylic adhesive. Allowable tapes are: Scotch 33+ and Scotch 130C.
5. Provide all insulating materials for splices and connections such as glass and synthetic tapes, putties, resins, splice cases, or compositions of the type approved for the particular use, location, voltage and temperature, and apply and install in an approved manner, all in accordance with the manufacturer's recommendations.
6. Supports: Provide cable supports of the wedge type which firmly clamp each individual cable and tighten due to the cable weight.

F. Grounding and Bonding Equipment- UL 467. Ground rods shall be copper or copper covered steel not less than 3/4 inch in diameter and 10 feet long.

2.05 LIGHTING FIXTURES AND ACCESSORIES

A. General: Lighting fixtures and accessories shall conform to UL 57. All fixtures shall be LED and shall have been submitted to UL or other nationally recognized independent testing laboratory for a lighting performance test. Reports of such tests shall accompany the shop drawings.

B. The lighting fixtures, including information for LED lamp and other accessories have been scheduled on the drawings by manufacturer and catalog number.

C. Exterior Lighting:

1. Exterior lighting and fixtures shall be LED and of the type scheduled on the drawings.

2.06 PANELBOARDS

D. Manufacturer: Panelboard, back-box and front plate shall be as manufactured by Square D. Factory fit components before shipment.

E. Enclosure Type: Construct in accordance with UL 50 and NEMA PB1 except modify as hereinafter specified:

1. Construct of minimum 16-gauge galvanized steel.
2. Conform to UL 67 for additional enclosure requirements.

F. Front Plates: Provide removable front plates of the dead-front type with removable, adjustable cadmium plated trim clamps, and flush hinged enclosure door.

G. Knockouts: Provide multiple knockouts not fewer than 1.5 times the number of bus circuits.

H. Painting: In addition to galvanizing or priming coat, all inside and outside surfaces of trim and doors shall be given a factory finish coat of gray paint. Recessed boxes and surface boxes in transformer vaults, switchgear rooms and electrical closets may be galvanized or painted as described above.

I. Directories: Provide waterproof, white cardboard stock, factory printed directories with a clear plastic directory cover and metal frame attached to the panel door. Directory information shall be typed.

J. Service Equipment: Panelboards identified for use as service equipment shall be labeled.

K. Buses: Provide panelboards with buses constructed of solid copper, minimum conductivity 98 percent and rectangular shape.

1. Mechanically mount and brace buses in conformance with UL 67.
2. Provide solderless lugs for copper or aluminum cable.
3. Provide ampacity as scheduled on the drawings.

L. Grounding Bus: Provide bare, uninsulated copper, factory installed grounding bus with ampacity equal to the main bus. Provide copper pressure connected terminations.

M. Bus sequencing: Provide bus bar connections to branch circuits of the sequenced phased type.

1. Mount in accordance with UL 67.
2. Provide numbered terminals.
3. Provide pressure connectors, copper.

N. Spaces: Where words similar to "space", "space only", "future space" or similar wording are used on the drawings and panel schedules, provide bus space for future overcurrent devices.

1. Extend buses full size.
2. Brace and insulate bus in accordance with UL 67.
3. Provide bolted connections for future overcurrent devices.

O. Wiring Space:

1. Conform to the requirements of UL 67. Feed-through gutters not permitted.
2. Conform to NFPA 70 for maximum gutter fill.
3. Conform to UL 67 for minimum width of gutter and wire bending space.

P. Load Centers are not acceptable.

Q. Automatic Circuit Breakers:

1. Circuit Protective Devices: Provide molded case circuit breakers conforming to UL 489 and NEMA AB 1; voltage and poles as scheduled:

a. Provide interrupting ratings as scheduled.
b. Provide common trip mechanisms for multi-pole breakers.
c. Provide instantaneous automatic trips conforming to NEMA AB 1.
d. Provide breakers with adjustable trip settings as scheduled.
e. Breakers shall be bolt-on type, factory assembled.
f. Stab-in circuit breaker types are not acceptable.
g. Circuit breaker door mounted operating mechanism is not acceptable.
h. Provide branch circuit arrangement as scheduled.
i. Provide quick-make and quick-break mechanism.

2. Molded Case Circuit Breakers shall be as manufactured by Square D, type QO.

R. Integrated Equipment Short Circuit Rating: Panelboard and circuit breakers shall have an integrated short circuit rating in RMS symmetrical amperes of not less than the interrupting rating of the lowest rated circuit breaker in the panel.

S. Control Panel Door Arrangement. Submit to Owner for approval.

2.07 TERMINAL STRIPS

A. Terminal strips shall be provided in the control panel for all field wiring. Terminal strips shall be NEMA type rated for 600 volts AC, and shall be identified with a permanent machine printed marking in accordance with the terminal numbers shown on the panel wiring diagrams. Provide 20 percent spare terminal strips in the control panel.

B. Provide separate terminal strips for 24 vdc, 120 VAC and analog wiring. Provide two terminal strips for each digital I/O point and three terminal strips for each analog I/O point. A separate terminal strip shall be provided for each analog signal cable shield.

C. Terminal strips for 120 VAC PLC output shall be individually fused. Provide ten percent spare fuses or three (whichever is greater) of each size and type installed. The spare fuses shall be delivered in the original boxes.

2.08 DISCONNECT SWITCHES

A. Disconnect Switches: NEMA 4. Switches servicing as motor-disconnect means shall be horsepower rated. Switches shall be heavy duty type. Main switch shall be service entrance rated. Disconnect switches shall be as manufactured by Square D or Allen Bradley. No fused disconnects shall be used.

B. Switching Action: Provide quick-make, quick-break type switch action.

C. Construction: All current carrying parts shall be high conductivity copper, with heating ratings conforming to UL 98.

1. Provide silver tungsten or silver-plated copper contacts.
2. Switches shall have defeatable door interlocks that prevent the door from opening when the operating handle is in the "on" position.
3. Switches shall have handles whose positions are easily recognizable and are padlockable in the "on" or "off" position.

2.09 TOGGLE SWITCHES

A. Toggle Switches - UL 20, specification grade, totally enclosed, with bodies and handles of brown thermosetting plastic and a mounting strap. Switches shall be rated quiet type, AC only, 20 ampere, 120-277 volts, single-pole.

2.10 PUSHBUTTON SWITCHES, SELECTOR SWITCHES AND PILOT LIGHTS

A. Pushbutton switches, selector switches and pilot lights shall be oiltight/watertight in Nema 4 enclosure as manufactured by Square “D”.

2.11 RELAYS

A. General: Provide relays in sizes, ratings, and with number of contacts as indicated on the drawings. All relays to be mounted on din rail bases with LED pilot light. Relays shall be as manufactured by IDEC or approved equal.

B. Furnish timing relays with adjustable timed closed and timed open relays from 0 to 60 seconds minimum or as indicated on the drawings with LED pilot light. Timing Relays shall be as manufactured by IDEC or approved equal.

2.12 CIRCUIT BREAKERS

A. Provide circuit breakers for lights, vent fans, PLC panel, and convenience receptacles as may be required. A step down transformer may be required to control circuits and station auxiliaries.

2.13 MAIN CIRCUIT BREAKER

A. Provide a properly-sized thermal-magnetic molded case main circuit breaker in the Control Panel. The circuit breaker shall have a quick-make, quick-break mechanism. The main circuit breaker shall be Square D Type QOU.

2.14 TRANSIENT VOLTAGE SURGE SUPPRESSOR

A. Provide transient voltage surge suppressors in the panels as specified herein to protect the panel components from damage which may occur from transient voltages caused by lightning or surges on the incoming power line. The surge suppressors shall have an indication light to indicate the unit is functioning. Surge suppressor shall be as manufactured by Innovative Technology. The following TVSS shall be used:

1. HS-P-SP-120-30A-RJ
2. PTX300 for the MCC and Service Entrance.
3. PTX160 for the Power Distribution.

2.15 THERMOSTATS

A. Thermostat shall be provided with NEMA 4 enclosure from same manufacturer. Thermostats shall be provided with 2 SPDT Relays, 2A @ 250VAC, and PLC on/off connection.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation: Electrical installation shall conform to the National Electrical Safety Code, the National Electrical Code (NFPA-70), and the requirements specified herein. Mounting heights specified or indicated shall be measured to the bottom of lighting fixtures and to the center of other devices and outlets.

3.02 ELECTRICAL EQUIPMENT INDENTIFCATION AND EQUIPMENT LABELING

A. General Installation Requirements:

1. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations, specified or indicated on drawings. Provide numbers, lettering and wording as approved in submittals, as required by code, or as recommended by manufacturers.
2. Install products covered by this section where indicated on drawings or specified. Install products covered by this section where required by NFPA 70, whether or not otherwise indicated. Install products in accordance with manufacturer's written instructions and requirements of NFPA 70.
3. Where identification is to be applied to surfaces which require finish, install identification after completion of finish work.

B. Panel Identification

1. All electrical and instrumentation panels shall have legend plates that denote the following information:

   EQUIPMENT NAME (ex. WATER PUMP CONTROL #1)

EQUIPMENT IDENTIFICATION NUMBER (ex. FP-50-10-1)

SOURCE BREAKER IDENTIFICATION (ex. FED FROM MCC-4)

2. All devices that have more than one source of voltage will have a similar plastic laminate label, red w/white lettering that clearly states the presence of additional voltage sources. It also shall be secured to the panel in a similar fashion as the previously mentioned legend plates.
3. All terminal devices such as solenoids, limit switches, level probes, thermostats, etc. shall have labels made of material identical to that previously mentioned. They also shall be black w/white lettering and secured with 30# stainless steel beaded chain or attached with an appropriate adhesive.
4. All lettering shall be engraved block font, 3/8" high.

C. Panel Items:

1. Lens colors shall be red for "run", "open," or "on"; "green" for "stopped", or "off"; "amber" for alarm.
2. Pilot lights shall be full voltage LED cluster style.
3. The local stop pushbutton will be a red head maintained type device and local start button will be black head momentary type devices.
4. Terminal strips shall be provided for all panels and shall be of the flanged fork or ring lug type suitable for No.12 AWG stranded wire minimum. Provide 25 percent spare terminals in each panel.

3.03 CONDUITS, FITTING AND SUPPORTS

A. Conduits – Installation

1. Conduit in Floors: Conduit installed in concrete floor slabs shall not affect the structural strength of the slabs. Conduit shall be installed within the middle one-third of the concrete slab unless otherwise indicated. Outside diameter of conduit shall not exceed one-third of the slab thickness, and conduits shall be spaced not closer than three diameters except at cabinet locations. Where conduits rise above the slab, they shall have a 4" concrete curbing with beveled edges poured around them to prevent corrosion. Curved portions of bends shall not be visible above the finished slab. Where embedded conduits cross expansion joints, suitable watertight expansion fittings and bonding jumpers shall be provided. Conduit larger than one inch trade size shall be parallel with or at right angles to the main reinforcement; when at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab. Conduits shall not be stacked more than 2 diameters high in floor slabs.

2. Conduit Installed Underground without Concrete Encasement (outside of building foot print): Conduit shall be not less than 24 inches below grade. Conduit shall have a minimum slope of 3 inches in 1 00 feet away from buildings and shall run in straight lines except where a change of direction is necessary. Clearance from the conduit to each side of the trench shall be not less than 3 inches. Where underground conduits rise above grade, an "LB" type fitting will be used to enter buildings or structures. The bottom of trenches shall be graded carefully and shall be smooth- where rock, soft spots, and/or sharp-edged materials are encountered, the bottom shall be excavated for an additional 3 inches, filled with sand or earth free from particles that would be retained on a 1/2-inch sieve, and tamped level with the original bottom.

3.04 CONDUCTORS: WIRING, CABLES AND GROUNDING

A. Wiring and Cable Installation - General

1. Balance circuits across the phase wires of the branch and distribution panels.
2. Switches shall not be connected to the neutral conductor.

B. Test: Check cable continuity and phase identification.

C. Tests: Feeders and branch circuit insulation shall be tested after installation, and before connection to fixtures and appliances.

1. Tests shall be performed with a 500-volt megger, and conductors shall test free from short-circuits and grounds.
2. Conductors shall be tested phase-to-phase and phase-to-ground.
3. Furnish the instruments, materials, and labor required. Perform the tests in the presence of the Owner.
4. Test readings shall be recorded and delivered to the Owner.

D. Demonstration: Subsequent to wire and cable hookups, energize circuit and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

E. Grounding and Bonding

1. UL Labels: Provide grounding electrodes and connectors which are UL listed and labeled.

2. Except where specifically indicated or specified otherwise, exposed noncurrent-carrying metallic parts of electrical equipment, metallic conduit systems and neutral conductors of wiring systems shall be grounded.

3. Grounding system shall comply with the current edition of the National Electric Code (NEC), the current edition of the National Electrical Safety Code, and as specified herein.

4. Flexible conduit to motors shall not be used as a ground conductor.

5. All ground conductors shall be copper and sized according to the requirements of the NEC, Tables 250-94 and 250-95 as applicable.

6. All conduits used for electrical power feed, branch circuit, and control wiring shall be furnished with a separate ground conductor. Conduits shall not be used as a ground conductor.

7. All metallic electrical conduits shall be bonded to the equipment ground terminal, ground wire, or ground bus using an insulated ground bushing and jumpers sized as required by the NEC. Bond shall be provided at all conduit terminations.

8. Ground rods shall be ¾-inch diameter by 10 feet long copper clad steel. The exterior shall be electrolytic copper metallically bonded to a round one-piece carbon steel rod. The rod heads shall be fabricated so as to prevent mushrooming of rodhead during driving or a steel driving stud, manufactured for such a purpose, shall be used.

9. Ground conductors shall be green, insulated stranded type where installed in conduit. All other ground conductors shall be bare type unless otherwise noted on the drawings or in the specifications.

10. Grounding ring and all associated conductors shall be soft drawn stranded copper, size 2/0.

11. Unless otherwise indicated on the drawings or in the specifications, all copper-to-copper or copper-to-steel splices and terminations for ground ring and connections to the ground ring shall be made by controlled exothermic reaction welding process using the appropriate fittings for the process employed. Ground connections shall be exothermic type cadweld or thermoweld, when direct buried. Steel shall be ground or filed, and copper conductors shall be cleaned to ensure all surfaces are clean, dry, and free from oxide before welding process is performed.

12. Flexible jumpers (bonding straps) shall be installed where conduit expansion fittings occur.

13. System ground ring and top of ground electrodes shall be direct buried to a minimum depth of 24 inches and a maximum depth of 30 inches. Electrodes shall be driven straight down, perpendicular to the finished grade, or, if this is not possible, as allowed by NEC Article 250-83,c,3.

14. Concrete rebar systems, structural steel system, piping systems, gratings, handrails, or any process equipment shall be grounded but shall not be used as a ground conductor for any of the other equipment or systems required to be connected to ground by these specifications.

15. Ground generator fuel tank, generator frame and MCC to the ground ring system.

16. Ground electrodes in the ground ring shall be installed at no less than 10 feet intervals nor greater than 20 feet intervals.

17. All metallic water piping systems shall be connected to the building's associated ground ring at two locations. Where flow meters, valves, flexible piping, or any type of nonmetallic connection occur in a piping system, a bonding jumper shall be installed around the device to ensure ground continuity. Jumpers installed under other portions of these specifications, such as reference grounds for process flow meters, etc., shall not be used to replace or be considered as grounding system jumpers.

18. The ground ring shall be furnished with inspection points as indicated on the drawings. The inspection point shall consist of a six (6) inch diameter, schedule 40 PVC conduit brought flush with finished grade and extending down to four (4) inches below point on ground rod where ring conductor is attached. The PVC shall be notched as required to prevent stress on the ground ring conductor if the PVC is pushed downward from grade for any reason. Provide threaded end cap on top of PVC conduit. End cap shall be labeled "Ground Inspection Point."

19. Testing of actual ground resistance shall be made by the Contractor before any finish landscaping is accomplished. Testing shall not be performed until all underground connections are made and buried and all structural steel has been connected to the ground ring. Test shall be made at the ground ring using a megger type ground tester and the "fall of potential" test method. Maximum resistance at the test point shall be five OHMS unless otherwise noted. Where measured values exceed the above figures, the Contractor shall install additional electrodes at no additional cost to the owner until further tests indicate the ground resistance has been reduced to the specified limit.

3.05 TOGGLES SWITCHES

A. Toggle Switches: Install single or in gangs, as indicated, and connect to provide control over the indicated outlets.

3.06 EQUIPMENT CONNECTIONS:

A. Equipment Connections: Power wiring for the connection of motors and control equipment shall be provided under this section of the specifications, except as otherwise specifically noted or specified.

3.07 FIELD TEST

A. The Contractor shall perform all field tests and shall provide all labor, equipment, and incidentals required for testing, except the electric power, which will be provided by the Owner. Defective material and workmanship disclosed by the tests shall be corrected by the Contractor at no cost to the Owner. The Contractor shall show by demonstration in service that all circuits and devices are in good operating condition. Tests shall be such that each item of control equipment will function not less than five times.

B. Insulation Resistance Test For Systems 600 Volts And Less: After wiring is complete and connected for operation, but before systems are placed in service and branch circuit breakers are closed, insulation resistance shall be tested in each feeder and subfeeder circuit. The insulation resistance between conductors and between each conductor and ground shall be measured. Measurements shall be made with an instrument capable of operating at an applied potential of 500 volts. Readings shall be taken after the voltage has been applied for a minimum of one minute. The minimum insulation resistance of conductors shall be 1,000,000 ohms. Test results shall be submitted to the Engineer.

3.08 PANELBOARDS

A. Install panelboards in conformance with NEMA PB 1, and NFPA 70.

B. Lug Torqueing: Torque lug screws in accordance with UL 486A for copper conductors. Install connectors, lugs, neutral bus and other field installed components in accordance with manufacturer's published literature.

C. Wiring: Refer to drawings for feeder and branch circuit wiring.

1. Verify gutter size conforms to wire bending space requirements of NFPA 70 and UL 67.
2. Wire wrap branch circuit in gutters after installation. Use approved wire ties.
3. Verify maximum gutter fill to conform to NFPA 70 and UL 67.
4. Verify bolted circuit breaker connection lugs conforming to shop drawings.
5. Verify breaker size, trip setting, and breaker type in conformance with schedules.

D. The top operating handle shall be not more than 6 feet 6 inches from the floor. Panelboards mounted in the same room or area shall have a uniform mounting height.

E. Complete typewritten panelboard circuit directory prior to project acceptance.

F. Only wires made of the conductor material for which the panelboard terminals have been marked shall be used.

G. Grounding: Provide equipment grounding connections for panelboards as indicated on Drawings or schedules.

1. Conform to the requirements of NFPA 70.
2. Install lugs and ground connectors in conformance with UL 486A and UL 486B.

H. Adjustable Trip Settings:

1. Verify factory settings for adjustable trip breakers.
2. Field adjust in conformance with manufacturer's recommendations, if necessary.

I. Identification: Provide nameplates as specified elsewhere in this Section.

J. Inspection and Testing:

1. Check circuit breakers and switches for proper mounting, conductor size, and feeder designation.
2. Operate circuit breakers and switches to ensure smooth operation.
3. Inspect the cases of molded case circuit breakers for cracks or other defects.
4. Measure the insulation resistance of the panelboard bus system using a 500VDC megohm-meter.
5. Measure both phase-to-phase and phase-to-ground resistance. The minimum acceptable resistance shall be two megohms.

END OF SECTION

SECTION 16425 - PUMP CONTROL SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish all labor and materials required for the complete booster pump facility pump control system including required Motor Control Center, number of vertical sections, motor starters, circuit breakers, magnetic relays, switches, push buttons, pilot lights, control transformers, Programmable Logic Controller and special controls. Extent of work is indicated on Drawings and schedules, by requirements of this Section, applicable parts of the Specifications, and the following Sections:

1. Section 16010 – Electrical Basic Requirements
2. Section 16400 – Electrical Work
3. Section 16100 – Motor Control Center
4. Section 16920 – Programmable Logic Controller
5. Section 16950 – Description of Operation
6. Section 16690 – Variable Frequency Drives

B. The booster pump facility pump control system shall be designed and manufactured by one of the following companies:

1. Systems East Inc. – Newport News, Virginia
2. Essco- Chesapeake, Virginia
3. Control Corporation of America – Richmond, Virginia

C. The contractor shall coordinate and schedule installation of the County provided Dorsett Controls, Inc. SCADA system and integration with the pump control system PLC. Communications between the pump control system PLC and the SCADA system shall be through Modbus TCP-IP.

1.02 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. American National Standards Institute (ANSI)

1. ANSI C12.1 - (1995) Code for Electricity Metering
2. ANSI C12.4 - (1984; R 1996) Mechanical Demand Registers
3. ANSI C12.10 - (1987) Electromechanical Watthour Meters
4. ANSI C12.11 - (1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL Through 350 kV BIL (0.6 kV NSV Through 69 kV NSV)
5. ANSI C39.1 - (1981; R 1992) Requirements for Electrical Analog Indicating Instruments

C. American Society for Testing and Materials (ASTM)

1. ASTM B 8 - (1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

2. ASTM D 709 - (1992) Laminated Thermosetting Materials

D. American Society of Mechanical Engineers (ASME)

1. (1996) Boiler and Pressure Vessel Code Industrial, Scientific, and Medical Equipment

E. Institute of Electrical and Electronic Engineers (IEEE)

1. IEEE ANSI/IEEE C57.13 – (1993) Instrument Transformers

F. National Electrical Manufacturer Association (NEMA)

1. NEMA 250 - (1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
2. NEMA AB 1 - (1993) Molded Case Circuit Breakers and Molded Case Switches
3. NEMA FU 1 - (1986) Low Voltage Cartridge Fuses
4. NEMA ICS 1 - (1993) Industrial Control and Systems
5. NEMA ICS 2 - (1993) Industrial Control and Systems Controllers, Contactors, Overload Relays Rated Not More Than 2,000 Volts AC or 750 DC
6. NEMA ICS 3 - (1993) Industrial Control and Systems Factory Built Assemblies
7. NEMA ICS 6 - (1993) Industrial Control and Systems Enclosures
8. NEMA MG 1 - (1993; Rev 1; Rev 2; Rev 3) Motors and Generators

G. National Fire Protection Association (NFPA)

1. NFPA 70 and NFPA 70E - (1999) National Electrical Code

H. Underwriters Laboratories (UL)

1. UL 50 - (1995; Rev Oct 1996) Enclosures for Electrical Equipment
2. UL 83 - 1996) Thermoplastic-Insulated Wires and Cables
3. UL 198B - (1995) Class H Fuses
4. UL 467 - (1993; Rev thru Aug 1996) Grounding and Bonding Equipment
5. UL 486A - (1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors
6. UL 486E - (1994; Rev thru Feb 1997) Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
7. UL 489 (1996; Rev May 1997) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
8. UL 508 - (1993) Industrial Control Equipment
9. UL 510 - (1994) Insulating Tape
10. UL 512 - (1993; R Dec 1995) Fuseholders
11. UL 845 - (1995; Rev Feb 1996) Motor Control Centers
12. UL 854 - (1996; Rev May 1996) Service-Entrance Cables
13. UL 1004 - (1994; Rev thru Feb 1997) Electric Motors

1.03 GENERAL CONDITIONS

A. Rules: The installation shall conform to the requirements of NFPA 70 and NFPA 70E, unless more stringent requirements are indicated herein or shown.

B. Coordination: The Drawings indicate the extent and the general location and arrangement of

equipment. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the equipment shall be properly located and readily accessible. Equipment and materials shall be located to avoid interference with mechanical or structural features. If any conflicts occur necessitating departures from the Drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change.

C. Standard Products: Material and equipment shall be new and of the minimum quality specified and shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 5 years prior to bid opening. Used, recycled, or rehabilitated material or equipment will not be acceptable.

1.04 SUBMITTALS

The following shall be submitted in accordance with the Specifications. All shop drawing submissions and resubmissions required under Division 11, 15, and 16 shall be submitted in one complete package.

A. Product Data: Submit manufacturer's catalog data, shop drawings, certifications and installation instructions for the following:

1. Motor Control Center and its Associated Components
2. Circuit Breakers, Switches, Relays, Fuses, Instruments, Enclosures, Starters, Automatic Control Devices, Programmable Logic Controller, Meters, Transformers
3. Flow Metering Equipment
4. Variable Frequency Drives
5. Pressure Sensing Equipment
6. Metering Pumps
7. Gauges
8. 24V Backup Power Supplies

B. Drawings: Contractor to submit drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

Submit detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams, and other information necessary to define the installation. Detail drawings shall show the rating of items and systems and how the components of an item and system are assembled, function together, and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Owner. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall show physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. Optional items shall be clearly identified as included or excluded. Detail drawings shall as a minimum include:

1. Motor control center.

2. Single line electrical diagrams including primary, metering, sensing and relaying, control wiring, indicator lights, pushbutton switches and control logic.

Electrical drawings including single-line diagrams, and schematics or elementary diagrams of each electrical system; internal wiring and field connection diagrams of each electrical device when published by the manufacturer; wiring diagrams of cabinets, panels, units, or separate mountings; interconnection diagrams that show the wiring between separate components of assemblies; field connection diagrams that show the termination of wiring routed between separate items of equipment; internal wiring diagrams of equipment showing wiring as actually provided for this project. Field wiring connections shall be clearly identified.

If departures from the Contract Drawings are deemed necessary by the Contractor, complete details of such departures, including changes in related portions of the project and the reasons why, shall be submitted with the detail drawings. Approved departures shall be made at no additional cost to the Owner.

C. As-Built Drawings: The as-built drawings shall be a record of the construction as installed including interconnection drawings and shall be prepared in accordance with Section 01030 – Record Documents. The drawings shall include all the information shown on the Drawings, deviations, modifications, and changes from the Drawings and corrected wiring diagrams of the control panel submitted under the shop drawing phase; however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full-sized set of prints marked to reflect all deviations, changes, and modifications. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Owner prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Owner for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Owner for approval within ten calendar days from the time the drawings are returned to the Contractor. Submit the following items with the “As-Built”:

1. Electronic copy of PLC program and programming software on thumb drive.

D. Factory Test Reports: Contractor to provide six copies of the information described below in 81/2 x 11-inch binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

1. A list of equipment used, with calibration certifications.

2. A copy of measurements taken.

3. The dates of testing.

4. The equipment and values to be verified.

5. The conditions specified for the test.

6. The test results, signed and dated.

7. A description of adjustments made.

E. Initial Field Test Plan: Detailed testing protocol at least 30 days prior to scheduled initial field testing to demonstrate pumping system operational testing. The protocol shall describe all tests to be conducted and the inter-relationships thereof. The initial field testing will not be scheduled or performed until the contractor's test plan is approved.

F. Initial Field Test Report: A detailed field testing and equipment adjustment report within 30 days of completion of successful initial field tests and prior to final acceptance testing. Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed systems. Each test report shall indicate the final position of all control functions.

Submit the information described below in 8 1/2 x 11-inch binders, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

1. Contractor's certification that the initial field test was satisfactorily completed, all deficiencies were corrected and successfully retested, and that the booster pump facility is ready for Final Acceptance Testing.

2. A list of equipment used, with calibration certifications.

3. A copy of measurements taken.

4. The dates of testing.

5. The equipment and values to be verified including acceptable reference values.

6. The conditions specified for the test.

7. The test results, signed and dated.

8. A description of adjustments made.

9. Final position of controls and device settings.

10. Submit in accordance with part I. below.

G. Final Acceptance Test Plan: Detailed testing protocol at least 14 days prior to scheduled final acceptance testing to demonstrate pumping system operations and compliance with the project requirements. The protocol shall describe all tests to be conducted and the inter-relationships thereof. The final acceptance testing will not be scheduled or performed until the contractor's test plan is approved.

H. Final Acceptance Testing Report: A detailed final acceptance testing and equipment adjustment report within 30 days of completion of successful final acceptance tests and prior to final acceptance. Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed systems. Each test report shall indicate the

final position of all control functions.

Submit the information described below in 8 1/2 x 11-inch binders, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

1. Contractor's certification that the Final Acceptance Testing was satisfactorily completed, all deficiencies were corrected and successfully retested, and that the booster pump facility is ready for conveyance to the Owner and operation.

2. A list of equipment used, with calibration certifications.

3. A copy of measurements taken.

4. The dates of testing.

5. The equipment and values to be verified including acceptable reference values.

6. The conditions specified for the test.

7. The test results, signed and dated.

8. A description of adjustments made.

9. Final position of controls and device settings.

10. Submit in accordance with part I. below.

I. Operation and Maintenance Manuals: Submit Operation and Maintenance Manuals for the motor control system in accordance with Section 01020 – Operation and Maintenance Data/Manuals.

J. Warranty: The controls manufacturer shall warrant the control system being provided to the Owner against defects in workmanship and materials for one-year after acceptance of the system. The warranty shall be in printed form and submitted with the O&M manuals.

All standard manufacturer warranties of control panel components shall be provided in writing with a summary of each component warranty information.

1.05 WORKMANSHIP

A. Materials and equipment shall be installed in accordance with NFPA 70 and NFPA 70E, recommendations of the manufacturer, and as shown.

PART 2 - PRODUCTS

Products shall conform to the respective publications and other requirements specified herein. Materials and equipment not listed below shall be as specified elsewhere in these Specifications. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.01 CABLES AND WIRES

A. Conductors for control, alarm, and signal circuits, shall be stranded. All conductors shall be copper.

B. Insulation: Unless indicated otherwise, or required by NFPA 70, power wires shall be 600-volt, Type XHHW conforming to UL 83. Control and signal circuits shall be Type XHHW conforming to UL 83.

C. Bonding Conductors: ASTM B 8, Class B, stranded bare copper wire.

D. Power and control wiring and AC & DC wiring shall be run in separate conduit.

2.02 MOLDED-CASE CIRCUIT BREAKERS

A. Molded-case circuit breakers shall conform to NEMA AB 1 and UL 489. Circuit breakers shall be as manufactured by Square D, type QO and installed in the motor control centers.

B. Construction: Circuit breakers shall be suitable for mounting and operating in any position. Lug shall be listed for copper conductors only in accordance with UL 486E. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle such that an overload or short circuit on any one pole will result in all poles opening simultaneously. All circuit breakers shall have a quick-make, quick-break overcenter toggle-type mechanism, and the handle mechanism shall be trip-free to prevent holding the contacts closed against a short-circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. All ratings shall be clearly visible. Circuit breakers shall be bolted type. Circuit breakers shall be furnished with lock-out devices as indicated on plans.

C. Ratings: Voltage ratings shall be not less than the applicable circuit voltage. The interrupting rating of the circuit breakers shall be at least equal to the available short-circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short-circuit current rating specified for the control center. Molded-case circuit breakers shall have nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings in accordance with NEMA AB 1.

D. Thermal-Magnetic Trip Elements: Thermal magnetic circuit breakers shall be provided as shown. Automatic operation shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. The instantaneous magnetic trip shall be adjustable and accessible from the front of all circuit breakers.

2.03 CONNECTORS, WIRE PRESSURE

A. UL 486A, for use with copper conductors.

2.04 ELECTRICAL GROUNDING AND BONDING EQUIPMENT

A. UL 467.

2.05 ENCLOSURES

A. NEMA ICS 6 or NEMA 250 unless otherwise specified. Cabinets and boxes with volume greater than 100 cubic inches shall be in accordance with UL 50, hot-dip, zinc-coated, if sheet steel.

2.06 LOW-VOLTAGE FUSES AND FUSEHOLDERS

A. Fuses, Low Voltage Cartridge Type: NEMA FU 1.

B. Fuses, Class H: UL 198B.

C. Fuseholders: UL 512.

2.07 TRANSIENT VOLTAGE SURGE SUPPRESSOR AND UPS SYSTEM

A. Transient voltage suppressor shall be Innovative Technologies model #HP-P-SP-120-30A-RJ.

B. UPS system shall be Minuteman model #CPE 1000 with SO cord. The UPS system shall back-up all control communications on the PLC control panel. Provide 120V outlet in the motor control center PLC control panel section for the UPS system.

2.08 INSTRUMENTS, ELECTRICAL INDICATING

A. ANSI C39.1.

2.09 INSTRUMENTATION

A. Flow Meter: The flow meter shall have a 4-20 mA dc process signal to communicate with the PLC. Flow meter shall be 0-500 gpm (min.) for the booster pumps. The flow meter shall be suitable for use in water distribution systems. The flow meter shall be Rosemount 8750W magnetic flow meter. Provide drinking water certification.

B. Electronic Pressure Transmitter: The electronic pressure transmitter shall produce a current output signal proportional to applied pressure. The meter body shall be of all sealed construction. The body shall be of ANSI 304 stainless steel and all wetted parts shall be ANSI 316 stainless steel. The transmitter section shall be a true two-wire device with dc power being derived from the receiver. No separate power supply shall be required at the transmitter. The transmitter output shall be 4 to 20 mA into 1050 ohms, maximum. Process connection shall be 1/2" NPT. The assembly shall include an isolation gate valve such that the transmitter section can be removed from the system. For connections to pressure piping, the operating range of the transmitter shall be 0-120 psig with 500 psi maximum. For tank level measurements, the operating range of the transmitter shall be 0-15 psig with 500 psi maximum. The electronic pressure transmitter shall be as manufactured by KPSI series 27 with option 009 surge protection kit.

C. Electronic Metering Pumps: The two (2) metering pumps shall be solenoid driven diaphragm pumps. All wetted parts shall be compatible with a 15 percent solution of sodium hypochlorite and 30 percent solution of aqua ammonia. The pump shall be capable of flow pacing by adjusting the speed of stroke upon receiving a signal from the Smartrol. All components necessary to provide complete chemical injection pacing facilities relative to station flow shall be furnished and installed by the Contractor. Chlorine dosage shall be manually adjustable by use of a percent stroke adjustment. Provide an air release valve on each pump. Pumps shall be as follows: Prominent GALA 1005NPE960UDC12000.

D. Magnetic Door Switch: Furnish and install magnetic door switch, Sentrol or approved equal.

2.10 MOTOR CONTROLS AND CONTROL PANELS

A. General: NEMA ICS 1, NEMA ICS 2, NEMA ICS 3 and NEMA ICS 6, and UL 508 and UL 845.

B. Motor Starters: Combination starters shall be provided with circuit breakers, as indicated. Motor starters shall be Allen-Bradley or Square D.

C. Thermal-Overload Protection: Each motor of 1/8 hp or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating.

D. Low-Voltage Motor Overload Relays

1. General: Thermal and magnetic current overload relays shall conform to NEMA ICS 2 and UL 508. Overload protection shall be provided integral with the motor controller, and shall be rated in accordance with the requirements of NFPA 70. Quick trip units shall be used on hermetically sealed, submersible pumps.

2. Construction: Manual reset type thermal relay shall be melting alloy or bimetallic construction. Automatic reset type thermal relays shall be bimetallic construction. Magnetic current relays shall consist of a contact mechanism and a dash pot mounted on a common frame.

3. Ratings: Voltage ratings shall be not less than the applicable circuit voltage. Trip current ratings shall be established by selection of the replaceable overload device and shall not be adjustable. Manual reset overload relays shall be provided otherwise, and at all locations where automatic starting is provided. Where the motor is located in a constant ambient temperature and the thermal device is located in an ambient temperature that regularly varies by more than minus 18 degrees F, an ambient temperature-compensated overload relay shall be provided.

E. Automatic Control Devices

1. Direct Control - Automatic control devices (such as pressure switches) which control the starting and stopping of motors directly shall be designed for that purpose.

2. Pilot-Relay Control- Where the automatic-control device (such as pressure switches) does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit.

3. Manual/Automatic Selection

a. Where combination manual and automatic control is specified and the automatic-control device actuates the pilot control circuit of a magnetic starter, the magnetic starter shall be provided with a three-position selector switch marked HAND-OFF-AUTO.

b. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low-or high-pressure cutouts, loss of prime, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Owner as shown on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

4. Thermal Overload and Leak Sensor: Each motor's winding thermal switches and leakage sensor shall be routed through the PLC and shall report alarms as specified herein.

F. Control Panels: Control panels shall conform to the requirements of NEMA ICS 1, NEMA ICS 2, NEMA ICS 3 and NEMA ICS 6, and UL 508 and UL 845. Control panels shall be indoor type and shall contain combination starters and other equipment as indicated. Control panels shall be NEMA ICS 2, Class II, Type B. Each control panel shall be mounted on floor sills or mounting channels. Each circuit shall have a suitable metal or laminated plastic nameplate with white cut letters. Control panels shall be provided with a full-length ground bus bar.

G. Variable Frequency Drive System for Motors: Provide all labor, materials, equipment and incidentals required to furnish, install, test, and place in operation the Variable Frequency Drives (VFDs) required for pump speed regulation and related equipment and accessories as shown and specified in Section 16690 – Variable Frequency Drives

2.11 TAPES

A. Plastic Tape: UL 510, Scotch 33+.

B. Rubber Tape: UL 510, Scotch 130C.

2.12 ELAPSED TIME METERS

A. Elapsed time meters shall be non-resettable, time totalizer. They shall have a synchronous motor which shall drive a set of digit readout wheels to indicate the total time the pump motor starter is energized. Readout shall be six-digit including 1/10 digit. Range shall be 0 to 99999.9 hours. Voltage rating shall be 120 volts. Elapsed time meters shall be Reddington.

B. Provide an elapsed time meter for each pump. Each elapsed time meter shall be energized through a contact on the pump motor starter.

2.13 MOTOR CONTROL CENTER ARRANGEMENT

A. Enclosure: The enclosure shall be constructed or in sections, shall be gasketed NEMA 12 in design, free standing style suitable for pad mounting with a housekeeping pad (6" clearance on front and sides of panel). It shall be provided with an epoxy powder coat finish, grey on the outside, and white on the inside. Each enclosure door shall be provided with a 3-point latching mechanism operated by a single handle on the door.

B. Panel Components: Wires shall be identified at both ends by adhesive wire labels and all wire numbers shall appear on drawings. No two wires shall have the same number. All motor wiring and line wiring in the control center shall be copper type XHHW. All controls and control voltage shall be 120 volts. All wiring shall be completely connected, requiring only connection for service.

C. All equipment in the control panel shall be identified by black laminated phenolic nameplates with engraved white lettering. The size of the plates shall be such that the lettering for major designations such as pump numbers, shall be a minimum height of 1/2 inch. Secondary descriptions shall have lettering, selector switches, etc., may be provided with standard nameplates.

D. Control relays shall be 10 ampere multi-pole "machine tool" type. Each contact shall be housed in a clear plastic enclosure to permit visual contact inspection. Contact shall be easily convertible from normally open to normally closed and vice versa. The relays shall hold up to eight convertible contacts and four fixed contacts for a total of 12 pole capability. Relay magnet shall have a double-wound molded epoxy magnet coil. Relays shall have a concealed but accessible operator for manual operation with provisions for holding the relay in the energized position for circuitry testing. Provide relays as required for system operation.

E. Panel Arrangement: The motor control center shall be provided in a number of individual sectioned enclosures. All components shall be wired and tubed to terminal strips for wiring and quick-disconnect bulkhead fittings for tubing.

One or more sections shall house the following:

1. Current transformers, voltmeter with selector switch, ammeter with selector switch, wattmeter, varmeter, power factor meter, and a branch circuit breaker to supply power to a 208Y/120 volt panel through a dry-type transformer.

2. A programmable logic controller (PLC) for receiving level and pressure signals from system level and pressure sensors and transmitting those signals in the proper sequence to the variable frequency drives for start, stop and speed control of the pumps; sequencing of the VFDs and pumps; generation of alarm signals; and, other system operation and data management functions.

3. A solid-state (4-20 mA) tank level and discharge line pressure sensing system transmitted to the PLC.

4. A voltage monitor shall continuously monitor incoming voltage to the motor control center. The voltage monitor shall provide protection for 3 phase under voltage, voltage spike, power loss, voltage unbalance, and phase reversal. The monitor shall have separately adjustable pickup and dropout ranges and maximum 6 second time delay on drop out. Activation of the voltage monitor shall disconnect power to the pumps. The voltage monitor shall automatically reset upon restoration of voltage. The monitor shall have one set of normally open contacts with a minimum 3 ampere continuous current rating for remote alarm function. Plug-in style monitor will not be acceptable.

5. Provide a motor-winding-overheat system for each pump motors which shall consist of sensors imbedded in the motor windings. If sensors indicate a high winding temperature condition, relays in the motor control center shall a pilot light on the face of the motor control center to be illuminated. The sensors in the winding shall reset automatically when

temperatures return to normal, the pilot light illuminated should the system not automatically reset. The function of the systems shall be performed by the PLC.

6. Provide interposing relays, as required, between PLC outputs and other system components.

7. Provide alarm contacts and circuitry wired to a terminal strip for the alarms listed in Section 16950 - Description of Operation.

8. The pump control panel / VFD section shall contain but not limited to the following (pilot lights, control switches, pushbuttons and meters shall be mounted in the door of the section). Pilot light lens color shall be in accordance with Section 16195 – Electrical Identification. Control devices required should also match all required by PLC I/O.

    a. Running time meter reading in hours and tenths, total of 6 digits, nonsetting type, one for each motor. Each motor's running time meter shall have a capability to generate an analog signal to the RTU for transmission.

    b. Analog type percent speed meter to register pump motor speed in percent of nameplate speed. Display shall be 0 to 100 % base speed. The meter shall be driven by scaled 0-1 mADC output signal from the VFD and will be active only while the VFD is operating. The speed meters shall match the running time meters in size and appearance, and shall be Precision Digital PD 690-3-N.

    c. Hand-Off-Auto switch. Handle shall be illuminated when switch is in the auto position by long life LED white lamp, or separate pilot light may be provided to indicate this condition.

    d. Pilot to indicate VFD fault condition with long life LED lamp. Note that all pilot lights shall have this type lamp.

    e. Pilot light to indicate pump running condition.

    f. Pilot light to indicate a failure-to-pump condition.

    g. Reset push button for failure-to-pump condition.

    h. Pilot light to indicate a motor overload trip condition.

    i. Reset push button for electromagnetic reset of the thermal overload relay.

    j. Pilot light to indicate motor winding overheat condition (automatic reset via Flight Mini CAS II).

    k. Variable frequency drive system touch pad.

    l. Isolating by-pass contactors, all rated for the horsepower of the motor load served. VFD output and bypass contactors shall be both mechanically and electrically interlocked to prevent both from being closed at the same time.

    m. The following components shall be mounted in the door or doors of the motor control center with components directly associated with a pump in the door of the section containing control components for that pump and components common to the system and

to more than one pump in the door of the system control section or sections:

1. On-off circuit breaker operator for the circuit breaker serving the remote panelboard, sized to fit properly with the circuit breaker.

2. 1-White "control on" pilot light.

3. Three position booster pump sequence selector (1, Alternate, 2).

4. One of the two VFD's for each set of pumps shall have a 2-position switch labeled "Emergency Override". This switch will override a preset speed on the VFD, driving them to 60 Hz.

PART 3 - EXECUTION

3.01 GROUNDING

A. Grounding shall be in conformance with NFPA 70 and the contract drawings.

3.02 CONDUCTOR IDENTIFICATION AND TAGGING

A. Control and signal circuit conductor identification shall be provided within each enclosure.

B. Control and signal circuit conductor shall be tagged at each end with legible permanent coded wire marking sleeve. Sleeves shall be white PVC tubing with machine printed black marking. Marking shall be in accordance with the wire numbers and terminal strip numbers shown on the control panel wiring diagrams. All labeling and tagging of control wiring shall be done by the Control Panel Supplier. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.

3.03 CIRCUIT PROTECTIVE DEVICES

A. The Contractor shall calibrate, adjust, set and test each new adjustable circuit protective device to ensure that they will function properly prior to the initial energization of the new power system under actual operating conditions.

3.04 PAINTING AND FINISHING

A. Field-applied paint on exposed surfaces shall be provided as specified in Section 09900 – Painting and Coatings.

3.05 FIELD TESTING

A. Field testing shall be performed in the presence of the Owner in accordance with these specifications. The Contractor shall notify the Owner 5 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspection recommended by the manufacturer unless specifically waived by the Owner. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test reports will be signed and dated by the

Contractor.

B. Safety: The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged during testing or handling.

3.06 OPERATING TESTS

A. After the installation is completed, electrical testing is successfully completed in accordance with Section 16035 – Electrical Testing and Placing in Service, and at such time as the Owner may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. Operating test report shall be submitted in accordance with paragraph 1.04 SUBMITTALS.

3.07 FIELD SERVICE

A. Onsite Training: The Contractor shall conduct a training course for the operating staff as designated by the Owner. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to acceptance. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations.

B. Installation Engineer: After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of equipment, assist in the performance of the onsite tests, oversee initial operations, and instruct personnel as to the operational and maintenance features of the equipment.

3.08 ACCEPTANCE

A. Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected and demonstrated to the Owner.

END OF SECTION

SECTION 16440 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope: Extent of disconnect switch work is indicated on the drawings and schedules, by the requirements of this Section, and Section 16010 – Electrical Basic Requirements.

B. Types: Types of disconnect switches covered by this Section include the following:

1. Enclosed, heavy duty non-fused switches.

1.02 QUALITY ASSURANCE

A. National Electrical Manufacturers Association (NEMA): Provide switches conforming to NEMA KS 1, "Enclosed Switches".

B. NEMA: Construct enclosures conforming to NEMA 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)".

C. National Fire Protection Association (NFPA): Conform to NFPA 70, "National Electrical Code", for installation and minimum fusing requirements.

D. Underwriters Laboratories, Inc. (UL): Manufacture switches conforming to the requirements of UL 98, "Enclosed and Dead-Front Switches".

1. Provide switches listed and labeled by UL.

2. Provide cabinets conforming to UL 50, "Cabinets and Boxes".

1.03 SUBMITTALS

A. Product Data: For each switch provided on this project, furnish the manufacturer's published technical data, drawings, dimensions, and capacities.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Square D only.

2.02 SWITCHES

A. General: Provide individually enclosed air-break switches as indicated and scheduled on the drawings, with all current-carrying parts enclosed and manually operable by means of external handles. Switches shall be heavy duty (HD) type, ampere and horsepower rated.

B. Provide NEMA 1 enclosure for indoors, NEMA 3R enclosure for outdoors, or as indicated on the drawings.

C. Ratings: Conform to NEMA KS 1 for voltage and horsepower ratings.

1. Voltages shall be 240 or 600 determined by the circuit voltage.

D. Switching Action: Provide quick-make, quick-break type switch action.

E. Construction: All current carrying parts shall be high conductivity copper, with heating ratings conforming to UL 98.

1. Provide silver tungsten or silver-plated copper contacts.

2. Switches shall have defeatable door interlocks that prevent the door from opening when the operating handle is in the "on" position.

3. Switches shall have handles whose positions are easily recognizable and are padlockable in the "on" or "off" position.

PART 3 - EXECUTION

3.01 INSTALLATION OF SWITCHES

A. General: Provide NEMA 1 disconnect switches for interior use and NEMA 3R for exterior use.

B. Installation: Install switches in conformance with the manufacturer's requirements and NFPA 70, paragraph, "Switches". Provide grounding in accordance with NFPA 70.

END OF SECTION

SECTION 16450 - SECONDARY GROUNDING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope: Extent of the secondary grounding work required is indicated on drawings, by the requirements of this Section, and Section 16010 - Electrical Basic Requirements.

B. Provide grounding in accordance with NEC as a minimum. Additional grounding requirements shall be as specified or indicated on drawings.

C. Related Sections: Refer to other Division 16 Sections for grounding and testing.

1.02 QUALITY ASSURANCE

A. American National Standards Institute (ANSI): Comply with the requirements of:

1. C2 National Electric Safety Code.

B. American Society for Testing and Materials (ASTM): Comply with the requirements of:

1. B 1 Standard Specification for Hard-Drawn Copper Wire
2. B 2 Standard Specification for Medium-Hard-Drawn Copper Wire
3. B 3 Standard Specification for Soft or Annealed Copper Wire
4. B 8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
5. B 228 Standard Specification for Concentric-Lay-Stranded Copper-Clad Steel Conductors

C. Institute of Electrical and Electronics Engineers (IEEE): Comply with the following standards which apply to the grounding of electrical systems:

1. Recommended Practice for Grounding of Industrial and Commercial Power Systems
2. Recommended Practice for Electric Power Systems in Commercial Buildings

D. National Fire Protection Association (NFPA): Comply with the requirements of NFPA 70, "National Electrical Code" for the grounding of electrical systems.

E. Underwriters Laboratories, Inc. (UL): Provide material and installation conforming to the following standards:

1. Grounding and Bonding Equipment
2. Service Equipment

F. UL Labels: Provide grounding electrodes and connectors which are UL listed and labeled.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's data on conductors, grounding electrodes, ground clamps, and exothermic welding devices.

PART 2 - PRODUCTS

2.01 GROUND RODS

A. Ground rods shall be copper clad steel, 10 feet in length and ¾-inch in diameter.

2.02 GROUNDING ELECTRODE CONDUCTORS

A. Grounding electrode conductors shall be bare copper sized in accordance with NEC Table 250-94.

2.03 EQUIPMENT GROUNDING CONDUCTORS

A. Equipment grounding conductors in raceways shall be copper with green insulation, sized in accordance with NEC 250-95. Bare copper grounding conductors will be acceptable in underground outside raceways.

2.04 GROUND CONNECTIONS

A. Ground connections shall be exothermic type cadweld or thermoweld, when direct buried.

PART 3 - EXECUTION

3.01 INSPECTION

A. General: Examine all areas and conditions under which electrical grounding connections are to be made. Do not proceed with the grounding work until such unsatisfactory conditions have been corrected.

3.02 GROUNDING BUILDING SERVICE

A. General: Supplement the grounded neutral of the secondary distribution system with an equipment grounding system to properly safeguard equipment and personnel. The system shall, as a minimum, comply with NFPA 70. Where the drawings or specifications exceed the requirements of NFPA 70 the drawings or specifications take preference.

B. Building Steel: Ground the electrical service to the steel frame of the building.

C. Common Ground Bus: Connect the system neutral ground and the equipment ground system to the common ground bus as indicated on the drawings. Where the connection is not shown, provide connection as required by NFPA 70.

3.03 GROUNDING OF SEPARATELY DERIVED A/C SYSTEMS - DRY TYPE TRANSFORMERS.

A. Grounding for dry type transformers shall be in accordance with NEC ART 250-26.

B. Provide a bonding jumper sized in accordance with NEC ART 250-79D. Connect the bonding jumper to the line side grounding conductor and the grounded conductor at the equipment enclosure.

C. Provide a grounding electrode conductor sized in accordance with NEC ART 250-94 for the derived phase conductors. Connect the grounding electrode conductor to the grounded conductor at the equipment enclosure and the nearest effectively grounded structural steel member or metal water pipe.

D. Provide grounding conductor and neutral conductor as shown on the contract drawings and extend to the panel/equipment as shown.

3.04 GENERAL

A. Install equipment grounding conductors in all raceways.

B. Ground all metallic enclosures.

C. A ground wire shall be run to all motors, receptacles, fixtures, and other electrical devices. All electrical equipment is to be grounded in accordance with the NEC.

D. The ground ring shall be furnished with one inspection point unless otherwise indicated on the Drawings. The inspection point shall consist of a six inch diameter Sch 40 PVC conduit brought flush with finished grade and extending down to four inches below point on ground rod where ring conductor is attached. The PVC shall be notched as required to prevent stress on the ground ring conductor if the PVC is pushed downward from grade for any reason. Provide threaded end cap on top of PVC conduit. End cap shall be labeled “Ground Inspection Point”.

E. The ground resistance of any "made" electrode shall be measured by an earth megger device and it shall be 25 ohms or less as per NEC 250-84.

F. A copy of the service ground resistance test shall be sent to the Owner and Owner representative.

END OF SECTION

SECTION 16461 - DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope: Extent of transformer work is indicated on the drawings, in schedules, by the requirements of this Section, and Section 16010 – Electrical Basic Requirements.

B. Types: Type of dry type transformers specified in this section are for general purpose.

1.02 QUALITY ASSURANCE

A. American National Standards Institute (ANSI): Construct and test transformers in accordance with the following ANSI standards:

1. C2 National Electrical Safety Code
2. C57.12.01 General Requirements for Dry Type Distribution and Power Transformers
3. C57.12.91 Test Code for Dry Type Distribution and Power Transformers

B. Installation: Install transformers in accordance with ANSI C57.94, "Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type General Purpose Distribution and Power Transformers".

C. National Electrical Manufacturers Association (NEMA): Manufacture transformers in accordance with the following requirements:

ST20 Dry-Type Transformers for General Applications

D. National Fire Protection Association (NFPA): Comply with applicable sections of NFPA 70, "National Electrical Code" for electrical work and Article 450 which pertain directly to transformers of the size, type, rating and style required by this project.

E. Underwriters Laboratories, Inc. (UL): Provide general purpose dry type transformers which have been UL listed and which have the UL label affixed. As a minimum these transformers shall comply with the requirements of UL 506, "Specialty Transformers".

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for each transformer shown on the drawings or shown in the transformer schedule. This data as a minimum shall include:

1. Rated transformer KVA
2. Primary voltage
3. Secondary voltage
4. Tap voltages polarity

B. Certified Test Reports: Provide certified test reports showing satisfactory compliance with all factory tests required including the following:

1. Percentage regulation at 100 percent power factor.
2. Percentage regulation at 80 percent power factor.
3. No load loss in watts.
4. Full load loss in watts.
5. Sound level in decibels.
6. Impedance at 75 degrees C. hot spot temperature.
7. Average temperature rise above 40 degrees C. ambient.

C. Shop Drawings: Submit manufacture's drawings indicating dimension, weights, layout, mounting, and supports.

D. Wiring Diagrams: Submit wiring, protection and control diagrams for transformers. Clearly differentiate between portions of wiring that are manufacturer installed at factory and those portions which are field installed.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Square D, Cutler-Hammer, GE, Siemens or approved equal.

2.02 GENERAL PURPOSE TRANSFORMERS - DRY TYPE

A. General: Provide air-cooled, dry type, general purpose transformers having sizes and ratings as shown on the drawings.

B. Taps: Provide transformer taps which permit transformers to deliver rated KVA at any tap setting in accordance with NEMA standards. Provide, as a minimum, the following:

1. Four 2-1/2 percent full capacity taps below rated primary voltage.
2. Two 2-1/2 percent full capacity taps above rated primary voltage.

C. Sound Level: Sound levels on transformers shall conform to the NEMA standard sound levels for the transformer sizes indicated. Provide transformer sizes indicated. Provide transformers having integral vibration, noise isolating and dampening supports.

D. Voltage Rating: Provide transformers with voltage ratings conforming to Contract requirements.

E. Provide three-phase transformers with 480 volt Delta primary: 208/120 volt wye secondary.

F. Temperature Rise: Temperature rise at rated voltage and full-load current shall not exceed 115° C. rise. All insulating materials shall be in accordance with NEMA ST 20 for 220° C.

G. Construction: Provide transformers with the following construction:

1. Provide coils with continuous wound construction impregnated with non-hygroscopic thermosetting varnish.

2. Construct cores of high-grade non-aging silicone steel with a low flux density sufficiently below saturation point.

3. Sound isolating systems requiring complete removal of all fastening devices will not be acceptable.

H. Enclosures: Provide sheet steel enclosures as follows:

1. For transformers 15 KVA and larger provide 16 MSS gauge sheet steel ventilated enclosure. Provide ventilating openings designed to prevent accidental access to live parts in accordance with UL, NEMA, and NFPA 70.

2. For transformers 75 KVA and smaller, design enclosures for either wall or floor mounting.

3. For transformers larger than 75 KVA, design enclosures for floor mounting.

4. Degrease, clean, phosphatize, prime, and finish enclosures with gray baked enamel.

I. Grounding: Ground transformer cores to enclosures by means of flexible grounding conductors sized in accordance with applicable NEMA, Institute of Electrical and Electronics Engineers (IEEE), and ANSI standards. Ground strap shall be visible when wiring compartment is open.

2.03 TESTING

A. Factory Tests: Tests classified "routine" in NEMA ST 20 shall be performed on each transformer. Submit certified reports of the test results.

B. Tests: As a minimum, the following tests shall be performed:

1. Ratio test.
2. Polarity test.
3. Phase relation test.
4. Exciting current.
5. No load loss test.
6. Load loss impedance.
7. Regulation.
8. Applied potential.
9. Induced potential.

PART 3 - EXECUTION

3.01 INSTALLATION OF TRANSFORMERS

A. Manufacturer's Instructions: Install transformer as indicated, complying with manufacturer's written instructions, applicable requirements of NFPA 70, NEMA, ANSI, and IEEE standards, and in accordance with recognized practices to ensure that products fulfill requirements.

3.02 GROUNDING

A. General: Provide equipment grounding connections as indicated on the drawings and in Section 16450 – Secondary Grounding, and as required by NFPA 70. Make all grounding connections by means of exothermic welds.

END OF SECTION

SECTION 16470 - PANELBOARDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope: Extent of panelboard work is indicated on the Drawings and schedules, by the requirements of this Section, and Section 16010 – Electrical Basic Requirements.

B. Types: Types of panelboards and enclosures covered under this Section include the following:

1. Panelboards with automatic circuit breakers.

1.02 QUALITY ASSURANCE

A. National Electrical Manufacturers Association (NEMA):

1. AB 1 Molded Case Circuit Breakers and Molded Case Switches
2. KS 1 Enclosed Switches
3. PB 1 Panelboards

B. National Fire Protection Association (NFPA): Conform to the requirements of NFPA 70, "National Electrical Code".

C. Underwriters Laboratories, Inc. (UL): Construct panelboards in conformance with the following UL publications:

1. UL 50 Cabinets and Boxes
2. UL 67 Panelboards
3. UL 310 Electrical Quick-Connect Terminals
4. UL 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
5. UL 486B Wire Connectors for Use with Aluminum Conductors
6. UL 489 Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
7. UL 512 Fuseholders
8. UL 943 Ground-Fault Circuit Interrupters
9. UL 1053 Ground-Fault Sensing and Relaying Equipment

1.03 SUBMITTALS

Submit the following:

A. Product Data: Submit manufacturer's data on panelboards including:

1. Manufacturer's materials specifications.
2. Certification for compliance with referenced standards
3. Enclosed type.
4. Breaker types.
5. Bus ampacity.
6. Voltage rating.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Square D, Cutler-Hammer, GE, Siemens or approved equal.

2.02 PANELBOARDS

A. Buses: Provide panelboards with buses constructed of solid copper, minimum conductivity 98 percent and rectangular shape.

1. Mechanically mount and brace buses in conformance with UL 67.
2. Provide solderless lugs for copper or aluminum cable.
3. Provide ampacity as scheduled on the drawings.

B. Grounding Bus: Provide bare, uninsulated copper, factory installed grounding bus with ampacity equal to the main bus.

1. Provide copper pressure connected terminations.

C. Bus sequencing: Provide bus bar connections to branch circuits of the sequenced phased type.

1. Mount in accordance with UL 67.
2. Provide numbered terminals.
3. Provide pressure connectors, copper.

D. Service Equipment: Panelboards identified for use as service equipment shall be labeled.

E. Spaces: Where words similar to "space", "space only", "future space" or similar wording are used on the drawings and panel schedules, provide bus space for future overcurrent devices.

1. Extend buses full size.
2. Brace and insulate bus in accordance with UL 67.
3. Provide bolted connections for future overcurrent devices.

F. Enclosures: Construct in accordance with UL 50 except modify as hereinafter specified.

1. Construct of minimum 16-gauge galvanized steel.
2. Conform to UL 67 for additional enclosure requirements.

G. Knockouts: Provide multiple knockouts not fewer than 1.5 times the number of bus circuits.

H. Painting: In addition to galvanizing or priming coat, all inside and outside surfaces of trim and doors shall be given a factory finish coat of gray paint. Recessed boxes, and surface boxes in transformer vaults, switchgear rooms and electrical closets may be galvanized or painted as described above.

I. Directories: Provide waterproof, white cardboard stock, factory printed directories with a clear plastic directory cover and metal frame attached to the panel door. Directory information shall be typed.

J. Wiring Space:

1. Conform to the requirements of UL 67. Feed-through gutters not permitted.
2. Conform to NFPA 70 for maximum gutter fill.
3. Conform to UL 67 for minimum width of gutter and wire bending space.

K. Manufacturer: Panelboard, back-box and front plate shall be the product of one manufacturer. Factory fit components before shipment.

L. Enclosure Type: Provide enclosure type in conformance with UL 50 and NEMA PB1.

M. Front Plates: Provide removable front plates of the dead-front type with removable, adjustable cadmium plated trim clamps, and flush hinged enclosure door.

N. Integrated Equipment Short Circuit Rating: Panelboard and circuit breakers shall have an integrated short circuit rating in RMS symmetrical amperes of not less than the interrupting rating of the lowest rated circuit breaker in the panel.

2.03 LOAD CENTERS ARE NOT ACCEPTABLE.

2.04 Circuit Protective Devices: Provide molded case circuit breakers conforming to UL 489 and NEMA AB 1; voltage and poles as scheduled:

1. Provide interrupting ratings as schedules.
2. Provide common trip mechanisms for multi-pole breakers.
3. Provide instantaneous automatic trips conforming to NEMA AB 1.
4. Provide breakers with adjustable trip settings as scheduled.
5. Breakers shall be bolt-on type, factory assembled.
6. Stab-in circuit breaker types are not acceptable.
7. Provide branch circuit arrangement as scheduled.
8. Provide quick-make and quick-break mechanism.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install panelboards in conformance with NEMA PB 1, and NFPA 70.

B. Lug Torquing: Torque lug screws in accordance with UL 486A for copper conductors. Install connectors, lugs, neutral bus and other field installed components in accordance with manufacturer's published literature.

C. Wiring: Refer to drawings for feeder and branch circuit wiring.

1. Verify gutter size conforms to wire bending space requirements of NFPA 70 and UL 67.
2. Wire wrap branch circuit in gutters after installation. Use approved wire ties.
3. Verify maximum gutter fill to conform to NFPA 70 and UL 67.

4. Verify bolted circuit breaker connection lugs conforming to shop drawings.
5. Verify breaker size, trip setting, and breaker type in conformance with schedules.

D. Complete typewritten panelboard circuit directory prior to project acceptance.

E. Only wires made of the conductor material for which the panelboard terminals have been marked shall be used.

3.02 GROUNDING

A. Provide equipment grounding connections for panelboards as indicated on Drawings or schedules.

1. Conform to the requirements of NFPA 70.
2. Install lugs and ground connectors in conformance with UL 486A and UL 486B.

3.03 ADJUSTABLE TRIP SETTINGS

A. Verify factory settings for adjustable trip breakers.

B. Field adjust in conformance with manufacturer's recommendations, if necessary.

3.04 NAMEPLATES

A. Identification: Provide rigid engraved plastic nameplates conforming to the requirements of Section 16195 - Electrical Identification, for each panelboard.

3.05 INSPECTION AND TESTS

A. Check circuit breakers and switches for proper mounting, conductor size, and feeder designation.

B. Operate circuit breakers and switches to ensure smooth operation.

C. Inspect the cases of molded case circuit breakers for cracks or other defects.

D. Measure the insulation resistance of the panelboard bus system using a 500VDC megohm-meter.

E. Measure both phase-to-phase and phase-to-ground resistance. The minimum acceptable resistance shall be two megohms.

END OF SECTION

SECTION 16482 - MOTOR STARTERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope: Extent of motor starter work is indicated on the drawings and schedules, by the requirements of this Section, and Section 16010 – Electrical Basic Requirements.

B. Types: Types of motor starters specified in this Section include the following

1. Manual.
2. Magnetic full voltage.

1.02 RELATED WORK

A. Refer to Division 15 sections for the work related to Starters furnished as an integral part of mechanical equipment.

B. Refer to the sections of Division 16 for the work related to Switches and Disconnects.

1.02 QUALITY ASSURANCE

A. National Electrical Manufacturers Association (NEMA): Provide starters and controllers conforming to the following NEMA standards:

1. ICS 2 Standards for Industrial Control Devices, Controllers and Assemblies.
2. Enclosures for Electrical Equipment (1,000 Volts Maximum).
3. Underwriters Laboratories, Inc. (UL): Provide fuses conforming to the following:
4. 198D Class K Fuses.
5. 198E Class R Fuses.
6. 198G Fuses for Supplementary Overcurrent Protection.
7. Provide starters conforming to UL 508 "Industrial Control Equipment".
8. Provide motor starters and components UL listed and labeled.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's data on all motor starters indicated or scheduled. For each starter show the following:

1. Type.
2. NEMA size.
3. Enclosure.
4. Pilot lights.
5. Selector switches.
6. Disconnect switches.
7. Circuit breakers.
8. Instruments.
9. Control transformer.

PART 2 - PRODUCTS

2.01 STARTERS: GENERAL

A. Starters: For each motor scheduled or indicated and not provided with integral starter, install a motor starter, unless otherwise indicated on Drawings.

B. Types: Provide types indicated and coordinate each starter in motor characteristics and control requirements.

C. Contacts: Equip each starter with contacts to break each ungrounded line to the motor.

D. Overload Trips: Provide thermal overload devices, in each phase, to open all contacts simultaneously. Equip starters with a manual thermal overload trip reset button. Size overload trips to match motor nameplate amperes, in accordance with the requirements of National Fire Protection Association (NFPA) 70, "National Electrical Code".

E. Enclosures: Unless otherwise specified or indicated, provide each starter in a NEMA Type 1 general purpose enclosure.

F. Construction: Design and construct starters as follows:

1. For each starter provide doors arranged for padlocking and with a cardholder for starter identification. Provide an external reset mechanism, "start-stop" pushbuttons for manually controlled motors, and hand-off-automatic ("H-O-A") switch for automatically started motors. Provide green "stop", red "run" pilot lights of the heavy duty oil-tight diode or resistor type.
2. Make connections to the selector switch such that only the manual automatic regulatory control devices will be bypassed when the switch is in the "hand" position. Control safeties cannot be bypassed.
3. All safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protectors, shall be connected in the motor control circuit in both the "hand" and the "automatic" positions.
4. Control circuit connections to any "hand-off-automatic" selector switch or to more than one automatic regulatory control device shall be made in accordance with an indicated, or a manufacturer's approved, wiring diagram.
5. Provide the selector switch with means for locking in any position.
6. The controller disconnecting means shall be capable of being locked in the "open" position. For each motor not in sight of the controller, provide a manually operated, nonfused switch which will disconnect the motor from the source and which is placed within sight of the motor location.
7. Overload protective devices shall give adequate protection to the motor windings, be of the thermal inverse-time-limit type, and include a manual-reset type pushbutton on the outside of the motor controller case.
8. Provide each magnetic starter with a control transformer located within the starter enclosure and with wiring extended to associated accessories and to terminal boards for remotely located accessories.

2.02 MAGNETIC FULL VOLTAGE STARTERS

A. General: Conform to the requirements of paragraph, "Starters: General".

B. Type: Provide starters of the full voltage magnetic across-the-line type, with undervoltage release

and auxiliary contacts indicated or specified, and of sizes indicated on the drawings.

C. Single Phase Protection: Provide single phase protection in each magnetic starter.

2.03 MANUAL STARTERS

A. General: Conform to the requirements of "Starters: General", article, of this Section.

B. Maximum Size: Use manual starters for motors less than 1/2 horsepower unless otherwise indicated.

C. Type: Provide manual starters as follows:

1. Manually operated quick-make, quick-break toggle mechanism.
2. One piece melting alloy thermal switch.
3. Double break silver alloy contacts.
4. Red run pilot light.
5. Arrange for padlocking "Off".
6. Horsepower rate per NEMA standards.
7. NEMA Type 1 general purpose enclosure unless otherwise indicated or specified.

2.04 MANUFACTURERS

A. Square D or Allen-Bradley only.

PART 3 - EXECUTION

3.01 INSTALLATION OF STARTERS

A. Standard: Install motor starter where indicated, in accordance with manufacturer's written instructions and in conformance with NFPA 70 and NEMA standards.

B. Coordination: Coordinate starter accessories such as pushbutton switches or H-O-A switches and auxiliary contacts with automatic control sequencing requirements.

C. Mounting: Bolt wall mounted panels to walls or mount on lightweight structural steel bolted to the wall. Mount floor supported starters on structural steel welded frames of 1-1/2-inch by 1-1/2-inch by 1/4-inch welded steel, two vertical posts with crossarm, and bolt to the floor. Construct feet of 6-inch by 6-inch by 3/8-inch thick steel plate bolted to the floor.

D. Location: Locate starters within sight of their associated motors. Where starter is not within sight of the motor, provide a heavy duty disconnect switch at the motor.

E. Fuses: No Fused Disconnect Switches.

END OF SECTION

SECTION 16510 - LED LIGHTING FIXTURES

PART 1 - GENERAL

1.01 SUMMARY

A. Scope: Extent of lighting fixture work is indicated on drawings and schedules, by requirements of this Section, and Section 16010, "Electrical Basic Requirements".

1.02 QUALITY ASSURANCE

A. Manufacturers: Provide products of firms regularly engaged in the manufacture of lighting fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than two (5) years.

B. The lighting fixtures have been scheduled on the drawings by manufacturer and catalog number. This information shall set the required fixture performance and level of quality. Fixture performance and quality specified elsewhere in this specification shall rule, if there is an implied conflict between the specification and the catalog number used. Fixtures of equal performance and quality as judged by the Owner will be accepted.

C. National Fire Protection Association (NFPA): Comply with NFPA 70, "National Electrical Code", as applicable to construction and installation of interior building lighting fixtures and emergency lighting.

D. Underwriters Laboratories, inc. (UL): Provide interior and exterior lighting fixtures which have been UL, listed, and labeled.

1.03 SUBMITTALS

Submit the following:

A. Shop Drawings:

a. Submit the following information for each type of lighting fixture designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of lighting fixture designation.
b. Material and construction details, include information on housing and optics system.
c. Physical dimensions and description.
d. Wiring schematic and connection diagram.
e. Installation details.
f. Energy efficiency data.
g. Photometric data based on laboratory tests complying with IES Lighting Measurements testing and calculation guides.
h. US DOE LED Lighting Facts label, and IES L70 rated life.
i. Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in order of luminaire "Type" designation with proposed fixture and accessories clearly indicated on each sheet.
j. Submit shop drawings 30-days after date of notice to proceed.

PART 2 - PRODUCTS

2.01 GENERAL

A. Lighting Fixture Requirements: Provide fixtures, which meet the requirements of these specifications and the project drawings.

B. General Requirements: Provide lighting fixtures of sizes, types, and ratings indicated.

2.02 LED LIGHT FIXTURES

A. General:

a. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.

b. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.

c. LED drivers shall include the following features unless otherwise indicated:
   i. Minimum efficiency: 85% at full load.
   ii. Minimum Operating Ambient Temperature: Interior, -20˚ C. (-4˚ F.); Exterior, -40˚ C. (-40˚ F.)
   iii. Input Voltage: 120V (±10%) at 60 Hz.
   iv. Integral short circuit, open circuit, and overload protection.
   v. Power Factor: ≥ 0.95.
   vi. Total Harmonic Distortion: ≤ 20%.
   vii. Comply with FCC 47 CFR Part 15.

d. LED modules shall include the following features unless otherwise indicated:
   i. Comply with IES LM-79 and LM-80 requirements.
   ii. Minimum CRI 80 and color temperature 4000˚ K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
   iii. Minimum Rated Life: 50,000 hours per IES L70.
   iv. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

PART 3 - EXECUTION

3.01 INSTALLATION

Setting and Securing: Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved shop drawings. Conform to the requirements of NFPA 70.

A. Mounting: Mounting heights specified are indicated to the bottom of the fixture for suspended and ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting fixtures on the job before installation is commenced and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed.

B. Coordination: Coordinate with other trades as appropriate to properly interface installation of lighting fixtures with other work.

C. Grounding: Ground non-current-carrying parts of electrical equipment. Where the copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.02 ADJUST AND CLEAN

A. Clean: Clean lighting fixtures of dirt and debris upon completion of installation.

B. Protection: Protect installed fixtures from damage during remainder of construction period.

C. Adjust: Adjust light fixtures as directed by the Owner.

3.03 FIELD QUALITY CONTROL

A. Tests: Upon completion of installation of lighting fixtures, and after building circuits have been energized, apply electric energy to demonstrate capacity and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

B. At completion of project, replace all defective components of the lighting fixtures at no cost to the Owner.

END OF SECTION

SECTION 16573 - SHORT CIRCUIT AND ARC FLASH STUDIES

1. GENERAL

1.01 SCOPE

A. Perform a Short Circuit / Equipment Evaluation, Time Current Coordination Study, and Arc Flash Analysis Study. The limits of the Study shall be begin at the Utility Primary Source of Connection and end at (including but not limited to) all Three Phase Panel boards, Switchboards, Fused Switches, Motor Starters and Serviceable Enclosures/Equipment containing exposed live parts. Standby Power Generators and associated Equipment shall also be included in this Study.

1.02 METHODS

A. The Study shall be performed with the aid of a digital computer program designed for such purposes and shall be accomplished in accordance with the latest applicable references and standards as defined below.

1.03 REFERENCES

A. The Study shall be performed in accordance with the latest published version of the following Codes, Standards and Industry recommendations:

B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

1. IEEE 141 - Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems (Red Book)
2. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (Buff Book)
3. IEEE 399 - Recommended Practice for Industrial and Commercial Power System Analysis
4. IEEE 241 - Recommended Practice for Electric Power Systems in Commercial Buildings
5. IEEE 1015 - Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems (Blue Book)

C. American National Standards Institute (ANSI):

1. ANSI C57.12.00 - Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
2. ANSI C37.13 - Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
3. ANSI C37.010 - Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
4. ANSI C 37.41 - Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

D. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code.
2. NFPA 70B - Recommended Practice for Electrical Equipment Maintenance.
3. NFPA 70E - Standard for Electrical Safety Requirements for Employee Workplaces.

E. Miscellaneous Literature:

1. Industrial Power Systems Handbook, Beeman
2. Electrical Transmission and Distribution Reference Book by Westinghouse

1.04 QUALIFICATIONS

A. The Study shall be completed under the responsible charge and approval of a Registered Professional Electrical Engineer licensed in the State of Virginia. All studies shall bear a signed and dated professional engineering seal.

B. The Electrical Engineer proposed to complete the Study shall have completed an OSHA approved instructor led training class including NFPA 70E training which includes proper selection and use of PPE.

C. The Electrical Engineer proposed to complete the Study shall have a minimum of five (5) years' experience performing electrical power studies including arc flash hazard analysis studies.

1.05 STUDY

A. Required system data shall be comprised of actual equipment nameplate and test results. The following minimum requirements shall apply:

1.06 DATA COLLECTION

A. Field data collection shall be performed to ensure accurate system modeling.

B. Obtain from Dominion Power, the operating voltages level, three phase short circuit MVA and X/R ratio and line-to-ground MVA and X/R ratio at the customer point of connection to the utility.

C. Typical conductor impedances shall be based on IEEE Standards 141-1993.

D. Typical transformer design impedances shall be used when actual test or nameplate impedances are not available

2. PRODUCTS

2.01 SHORT CIRCUIT / EQUIPMENT EVALUATION STUDY

A. The Study shall include the following information and data:

1. Calculation methods and assumptions
2. Selected base per unit quantities
3. One-line diagram of the system being evaluated
4. Source impedance data, including electric utility system and motor fault contribution characteristics.
5. Typical calculations
6. Tabulations of calculated quantities
7. Results, conclusions, and recommendations.

B. Short-circuit momentary and interrupting duties for a three-phase bolted fault shall be calculated at each of the following locations as applicable:

1. Electric utility's supply termination point
2. Incoming switchgear
3. Unit substation primary and secondary terminals
4. Low voltage switchgear
5. Motor control centers
6. Standby generators and automatic transfer switches
7. Branch circuit and distribution panel boards
8. Other significant locations throughout the system.

C. For grounded systems, a bolted line-to-ground fault current study shall be provided for areas as defined for the three-phase bolted fault short-circuit study above.

D. Short circuit calculations shall include fault contribution from all connected motors.

E. Equipment Evaluation:

1. Equipment and protective devices shall be evaluated for proper short circuit ratings.
2. Switchgear, motor control centers, and panel board bus bars shall be evaluated to withstand short-circuit stresses.
3. Transformer windings shall be evaluated to withstand short-circuit stresses
4. Cable and busway sizes shall be evaluated for ability to withstand short-circuit heating.
5. Circuit protective devices improperly rated for the calculated available fault current shall be identified.

2.02 TIME CURRENT COORDINATION STUDY

A. Proposed protective device coordination time-current curves shall be graphically displayed on log-log scale paper.

B. A complete title and one-line diagram with legend identifying the specific portion of the system covered shall be included on each curve sheet.

C. Device characteristic curves shall be terminated at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.

D. Devices associated with each curve shall be identified by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. The following characteristics shall be plotted on the curve sheets, where applicable:

1. Electric utility's protective device
2. Medium voltage equipment relays
3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands

5. Transformer full-load current, magnetizing inrush current, and ANSI transformer withstand parameters
6. Conductor damage curves
7. Ground fault protective devices, as applicable
8. Pertinent motor starting characteristics and motor damage points
9. Pertinent generator short-circuit decrement curve and generator damage point
10. Other system load protective devices for the largest branch circuit and the largest feeder circuit breaker in each motor control center.

2.03 ARC FLASH ANALYSIS

A. Arc flash analysis shall be in accordance with IEEE 1584 equations and methods.

B. Arc Flash calculations shall be in conjunction with Short Circuit, Equipment Evaluations and Protective Device Coordination Studies defined herein.

C. Calculate Arc Flash incident energy (IE) levels (cal/cm2), Flash Hazard Boundaries and required Personal Protection Equipment (PPE) category requirements at significant locations in the electrical system where work may be performed on energized parts including, but not necessarily limited to switchgear, switchboards, motor control centers, panel board, and disconnect switches. The lower limit of the study shall be as defined in Part 1 Scope.

D. For each piece of ANSI rated equipment (i.e. Metal Clad Switchgear) with a main device contained in an isolated compartment or cubicle, two calculations shall be made. One calculation shall be made for the main cubicle, sides or rear; and shall be based on the immediate upstream overcurrent device to clear the arcing fault. A second calculation shall be made for the front cubicles; and shall be based on the equipment's main protective device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required that is based on the immediate upstream overcurrent device to clear the arcing fault.

E. Arc flash calculations shall be based on actual over-current protective device clearing times. A maximum clearing time of two seconds shall be used based on IEEE 1584-2002 Annex B.1.2 where it is shown that personnel are likely to move outside of the flash boundary during an arc flash incident. Where it is not physically possible to move out of the flash hazard boundary in less than two seconds during an arc flash incident, the actual over-current protective device clearing times shall be used.

2.04 FORMAL REPORT

A. The results of the short circuit, protective device coordination and arc flash hazard analysis shall be summarized in a final report. The final report shall include the following sections:

B. Executive Summary:

1. Shall include a comprehensive restatement of the document's purpose, scope, methods, results, conclusion, findings, and recommendations.

C. Introduction

1. Purpose, basis and scope of the study

D. System Description

1. The system shall be defined including the limits of the Study.

E. Oneline Diagram

1. The oneline diagram shall include all equipment and devices identified and included in the study from the Source to the Load

F. Short-Circuit Study Results:

1. The solution method for the short circuit study shall be defined. Results of the short circuit study shall be provided in table form and include the following for each device:
   a) PASS or FAIL status
   b) Description
   c) Voltage
   d) Interrupting Duty calculation
   e) Close and Latch calculated duty
   f) Fault rating percentage

G. Time Current Coordination Study Results:

1. Time Current results shall include a brief description of the logic employed in the solutions. Time Current graphs of each device shall be provided. The graphs shall illustrate the degree of coordination of the various parts of the system being studied. A discussion page with the same title as the graph shall be included with each graph. Tables of results and recommended protective device settings shall be provided as follows:
   a) Phase and Ground Relays:
      i. Current transformer ratio
      ii. Current setting
      iii. Time setting
      iv. Instantaneous setting
      v. Specialty non-overcurrent device settings
   b) Circuit Breakers:
      i. Adjustable pickups and time delays (long time, short time, ground)
      ii. Adjustable time-current characteristic
      iii. Adjustable instantaneous pickup
      iv. Trip setting, if applicable.

H. Arc Flash Analysis

1. Results shall include the following information for the system:
   a) PPE recommendations presented in clear, tabular format.
   b) Tabular results of Flash Boundaries and working distances.
   c) Tabular results of Incident Energy (IE) levels.
   d) Written report of findings

I. Arc Flash Labels

1. Furnish and install NFPA 70E compliant arc flash hazard warning labels for equipment identified in the Study. Label data shall include the following information:
   a) PPE Level
   b) Flash Protection Boundary

c) Contract Number
d) Date Installed

2. Labels shall be thermal transfer type of high adhesion polyester with no field markings.

3. Labels shall be provided for equipment identified in the study per the following:
   a) Floor Standing Equipment - Labels shall be provided on the front of each individual section. Equipment requiring rear or side access shall have labels provided on each individual section access area. Equipment with multiple incident energies and flash protection boundaries shall be labeled as applicable.
   b) Wall Mounted Equipment - Labels shall be provided on the front cover or a nearby adjacent surface depending on equipment configuration.

4. Labels shall be field installed by the Contractor.

5. Sample labels shall be provided for the owner's approval prior to printing.

J. Summary

1. A complete analysis of the results shall be provided at the end of the report. Conclusions shall be included based on the final results. Areas of concern that shall be addressed are Life Safety, Equipment Protection and Selectivity requirements.

K. Assumptions

1. All assumptions utilized for the Study shall be identified.

L. Backup Data

1. Backup data and documentation shall be provided for reference.

3. EXECUTION

3.01 DELIVERABLES

A. Final Report

1. The results of the Study shall be summarized in a final report. One (1) bound copy of the completed final report shall be submitted to the Owner along with one pdf electronic copy.

2. Studies shall be signed and sealed by the engineer of record licensed to provide engineering services in the State of Virginia.

B. Field Adjustments

1. The Contractor shall be responsible for adjusting any relay and protective device settings based on any recommendations included in the protective device coordination study.

2. Notify Owner of any required minor modifications to equipment to accomplish conformance with the short circuit and protective device coordination studies.

3. Notify Owner of any required major equipment modifications identified in the Study.

END OF SECTION

SECTION 16612 - EMERGENCY GENERATOR SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish, install and connect a complete natural gas emergency generator system including generator, NEMA 3R weatherproof enclosure, prime mover, muffler, exhaust system, cranking battery, battery charger, control panel, lube cube fuel tank, antifreeze to -20 degrees Fahrenheit (F), generator-mounted circuit breaker, automatic transfer switch, outlet boxes, junction boxes, wire, conduit, and all other necessary material required to complete the system.

B. Generator Requirements: The generator shall be capable of starting and operating continuously the following loads

1. (1) Booster Pump
2. All Heat
3. All Heat Pump
4. All station incidental loads

C. Generator Rating:

Minimum KW:	250
KVA:	312.5
Power Factor:	0.8
Hz	60
RPM:	1,800
Volts:	480Y/277
Phase:	3
Wire:	4
Job Site Elevation:	Per Location
Ambient Temperature:	120ºF

D. Transfer switch equipment shall include the following:

Type:	Automatic
Poles:	3
Amps:	400
Volts:	480Y/277

E. Accessories:

Programmed Transition
AC Meters
Manual/Auto Switch
Signal Module
Normal Source Available
Emergency Source Available

F. Outdoor weather-protective enclosure:

1. The generator set shall be provided with an outdoor enclosure, with the entire package listed

under ul2200. The package shall comply with the requirements of the national electrical code for all wiring materials and component spacing. The total assembly of generator set and enclosure shall be designed to be lifted into place using spreader bars. Housing shall provide ample airflow for generator set operation at rated load in an ambient temperature of 100^0F. The housing shall have hinged access doors as required to maintain easy access for all operating and service functions. All doors shall be lockable, and include retainers to hold the door open during service. Enclosure roof shall be cambered to prevent rainwater accumulation. Openings shall be screened to limit access of rodents into the enclosure. All electrical power and control interconnections shall be made within the perimeter of the enclosure.

2. Provide stationary louvers with gravity type back draft dampers.

3. Inlet ducts shall include rain hoods.

4. Sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color using a two-step electro-coating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating that meets the following requirements:

   a. Primer thickness, 0.5-2.0 mils. Top coat thickness, 0.8-1.2 mils.
   b. Gloss, per astm d523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
   c. Crosshatch adhesion, per astm d3359-93, 4b-5b.
   d. Impact resistance, per astm d2794-93, 120-160 inch-pounds.
   e. Salt spray, per astm b117-90, 1000+ hours.
   f. Humidity, per astm d2247-92, 1000+ hours.
   g. Water soak, per astm d2247-92, 1000+ hours.

5. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be stainless steel, and designed to minimize marring of the painted surface when removed for normal installation or service work.

6. Enclosure shall be constructed of minimum 12 gauge aluminum for framework and 14 gauge aluminum for panels. All hardware and hinges shall be stainless steel.

7. A factory-mounted hospital grade exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.

8. The enclosure shall include the following maintenance provisions:

   a. Flexible coolant and lubricating oil drain lines, that extend to the exterior of the enclosure, with internal drain valves
   b. External radiator fill provision.

9. Provide an external emergency stop switch that is protected from accidental actuation.

1.02 QUALITY ASSURANCE

A. Standards: The engine generator set, and all accessories, shall meet the requirements of:

   U.L. - Underwriters' Laboratory (1008)

N.E.C.	-	National Electrical Code
N.E.M.A.	-	National Electrical Manufacturer's Association
N.F.P.A.	-	National Fire Protection Associations (Pamphlets 30, 31, 37, and 110)
MIL-STD	-	705 B
IEEE	-	Institute of Electrical and Electronic Engineers (519, 587)

B. It is intended that all products specified herein be of standard rating; therefore, the KW and KVA ratings, ampere ratings, withstand and closing rating, etc. shall be the manufacturer's next larger size or rating when the specifications cannot be exactly met.

C. Quality Control:

1. All components of the emergency generator system shall be new and of the most current and proven design.

2. The complete system shall be of a type which has been in satisfactory service for at least one year under automatic emergency system conditions.

3. The emergency standby electrical generating system (including prime mover and transfer switch) equipment shall be the standard production of a single manufacturer. It shall be factory built, tested, and shipped by this single manufacturer.

4. The Supplier shall be a factory-trained and certified manufacturer's representative and shall maintain a complete service facility. The service facility shall be capable of making delivery to the generator set site all generator set parts within 48 hours of placing the order. The Supplier shall employ a manufacturer trained and certified technician on a full-time basis at the service facility capable of making repairs and responding to service calls within 24 hours of notice. Certified proof of this requirement shall be made available from the Supplier.

5. The Supplier shall provide initial start-up services, to include programming of both generator and transfer switch, conduct field acceptance testing, and warranty service on all equipment supplied. JCSA staff shall be present during start-up, programming, testing. etc.

D. Testing:

1. Prototype tests performed on a generator set of the same size and type, required by these specifications, shall be submitted and approved with the shop drawings required below. The test procedures and results shall be certified by an independent testing laboratory. The tests shall be performed in accordance with NFPA 110 and shall document the following:

   a. Maximum power level
   b. Maximum motor starting capacity
   c. Voltage dip
   d. Fuel consumption
   e. Engine-generator cooling airflow
   f. Governor response time
   g. Alternator temperature rise per NEMA MG1- 22.40
   h. Harmonic analysis and voltage Wave Form Deviation per MIL-STD-705 B, method 601.4.
   i. Three (3) phase short circuit test for mechanical and electrical strength.

2. Factory tests of the generator set to be supplied shall be conducted in accordance with procedures certified by an independent testing laboratory. The manufacturer shall successfully test the

generator set to be supplied, document Items 1.02.D.1.a-i, above and submit the test results for approval before shipping the generator set to the job site. A two-hour load bank test shall be performed and the results submitted before shipping the generator set to the job site.

3. Acceptance Tests:

   a. Acceptance testing of the installed generator set shall be conducted by a factory-trained representative of the generator set manufacturer. An authorized representative of JCSA shall witness the acceptance tests. The test results shall be submitted to and approved by JCSA before the generator set is accepted. The Supplier shall furnish all testing equipment, materials, etc., including fuel needed to demonstrate the set is in compliance with the specification. Any deficiencies brought to the attention of the supplier shall be corrected and, if warranted or requested by JCSA, the test shall be re-performed prior to acceptance. Final O & M Manuals shall be submitted before the acceptance tests commence.

   b. The acceptance tests shall be performed during a four-hour field test during which the manufacturer's representative shall demonstrate that the system performs in complete compliance with the specifications. As a minimum, a load bank test performed in accordance with NFPA 110 Section 5-13-2 and vibration tests shall be conducted in accordance with ANSI S 2.41- 1985. The load tests shall use dry-type load banks specifically utilized for this purpose. The load bank will be capable of definite and precise incremental loading and shall not be dependent on the generator control instrumentation to read voltage and amperage of each phase. The test instrumentation will serve as a check of the generator set meters. Load bank testing shall be performed for a period of four (4) hours at the full rated load of the generator. Saltwater brine tank load banks are not acceptable for this purpose and are disallowed and will not be utilized for this test.

1.03 SUBMITTALS

A. Shop Drawings: Shop drawings shall be complete in all respects and shall indicate all dimensions, installation methods, size, weight, capacity, ratings, integral controls and types of materials, evaluations, and sections. Shop drawings shall include manufacturer's literature and complete information including the following:

1. Engine generator system plan, elevation and dimensional drawings clearly indicating all aspects of the system including points for each of the interconnections required.
2. Engine generator/exciter control cubicle layout and component descriptions.
3. Fuel consumption rate curve at various loads, ventilation and combustion CFM requirements.
4. Exhaust muffler, vibration isolator, and wall thimble descriptions.
5. Schematic ladder and control wiring diagrams for the generator system.
6. Printed literature and brochures describing the system including all sizing requirements and components specified.
7. The weight of the engine, generator, and complete system.
8. Points of measurement and maximum vibration readings (measured as velocity) for the installed system recommended by the manufacturer.
9. Battery, battery rack and battery charger literature and description.
10. Fuel tank, piping schematic and fuel connection information for the generator.
11. Automatic transfer switch.
12. The specified standby KW of the generator shall be for continuous electrical service during interruption of the normal utility power source and this shall be certified to this effect by the manufacturer for the actual unit supplied.
13. Factory prototype test results performed on a unit of this size and type documenting Items (a)

through (i) listed in 1.02.D.1 above.

14. Transfer switch withstand and closing ratings with over-current device specifications.
15. Specifications and data sheets showing ratings and operating schedules, operating performance, cooling system data, and engine and generator data.
16. Itemized list of all exceptions taken to this specifications.
17. Manufacturer's warranty documents.

B. Operation and Maintenance Manuals: Prepare and Submit O&M Manual in accordance with Section 01020 – Operation and Maintenance Data/Manual. The O&M shall include but not limited to the following for the engine, generator and transfer switch:

1. Operators Manual
2. Installation Manual
3. Parts Manual
4. Field Service Manual

C. Installation Certificate:

1. A factory technician shall inspect the installed generator system and certify in writing to JCSA that it is installed in accordance with the manufacturer's recommendations before the system is initially started.

2. The technician shall be present for the initial start-up and make recommendations to resolve any defects experienced.

3. A copy of the installation certificate must be submitted to Owner before the generator set is conditionally accepted.

D. Manufacturer:

1. The manufacturer of the generator set and transfer switch shall be Onan Corporation, Minneapolis, Minnesota.

2. Warranty: The complete electrical power system (generator set, controls, and associated switches, switch gear and accessories), as provided by the single source manufacturer, shall be warranted by the manufacturer against defects in materials and workmanship for a period of one year from the date of acceptance of the overall project. Coverage shall include parts, labor, travel expenses, and labor to remove/reinstall the equipment, per the manufacturer's standard published limited warranty.

3. Technical Support: The manufacturer shall provide factory-trained service and parts support available through a factory-authorized distributor.

4. Instruction shall be provided for the JCSA personnel as deemed necessary in support of their troubleshooting responsibility for the unit.

5. Approval of Substitute Equipment: If approved, the Contractor shall be responsible for the charges of any necessary revisions to the plans and specifications, drawings, and project documentation; and charges related to the equipment spacing, mounts, electrical wiring, ventilation equipment, fuel, exhaust components, etc.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Engine: The engine shall be the water-cooled in-line or V-type, four-stroke cycle compression ignition diesel. It shall meet specifications when operating on No. 2 diesel fuel. The engine shall also include the following accessories:

1. The engine shall be equipped with filters for fuel, lube oil, intake air, lube oil cooler, fuel transfer pump, fuel priming pump, one foot of flexible fuel line between engine and rigid supply, and gear-driven water pump.

2. The engine shall be equipped with automatic safety controls which will shut down the engine in the event of low oil pressure, high water temperature, over-speed and over-crank.

3. The engine shall be remote starting with a two (2) wire, solenoid shift electric starter. The electric starter(s) shall be capable of three complete cranking attempts without overheating, before over-crank shutdown (75 seconds).

4. Rotating parts shall be guarded against accidental contact. Each guard shall be designated for removal during maintenance services.

5. The engine shall be cooled by a unit-mounted closed loop radiator system including belt-driven pusher fan, coolant pump and thermostat temperature control. The cooling system shall be rated for full-rated load operation in 122 degrees F (50 degrees C) room ambient condition with the ambient temperature as measured at the generator air inlet. The cooling capability of the generator set shall be demonstrated by prototype tests on a representative generator set model conducted by the generator set manufacturer; calculated data from the radiator manufacturer only is not sufficient.

6. Engine shall be equipped with a jacket water heater manufactured by Kim Hotstart. Jacket water heater shall operate on 120 volt, 1 phase power and shall be locked out by oil pressure switch.

7. Radiators shall be provided with a duct adaptor flange permitting the attachment of an air discharge duct to direct the radiator air outside according to the manufacturer's instructions. The cooling system shall be filled with 50/50 Propylene glycol/water mixture by the equipment supplier.

8. Positive displacement, mechanical, full pressure, lubrication oil pump. Full-flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.

9. An engine driven, mechanical, positive displacement fuel pump. Fuel/water separator. Fuel filter with replaceable spin-on canister element. Replaceable dry element air cleaner with restriction indicator. Flexible supply and return fuel lines.

10. Engine-mounted battery charging alternator, 45 ampere, and solid-state voltage regulator.

B. Engine-Generator Set: Performance shall be as follows:

1. The generator set manufacturer shall verify the diesel engine as capable of driving the generator with all accessories in place and operating, at the generator set KW rating after derating for the range of temperatures expected in service and the altitude of the installation.

2. The manufacturer shall provide documentation demonstrating satisfactory prototype test results for the model specified and production test results for equipment supplied for this project. Generator sets that have not been factory tested at 0.8 PF will not be acceptable.

3. Voltage regulation shall be +/- 2.0 percent of rated voltage for any constant load between no load and rated load.

4. Electronic Governor: Frequency regulation shall be designed with a 3 percent to 5 percent adjustable drop from steady-state no load to steady-state full rated load.

5. Total Harmonic Distortion: The sum of AC voltage wave form harmonics, from no load to full linear load, shall not exceed 5 percent of rated voltage (L-N, L-L) and no single harmonic shall exceed 3 percent of rated voltage.

6. Telephone Influence Factor: TIF shall be less than 50 per NEMA MG1-22.43.

7. The diesel engine-generator set shall be capable of single step load pickup of 100 percent nameplate KW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.

8. After an initial instantaneous voltage dip not to exceed 20 percent, the generator set shall be capable of sustaining a minimum of 90 percent of rated no load voltage with the specified KVA load at near zero power factor applied to the generator set.

C. AC Generator:

1. AC generator, exciter and voltage regulator shall be designed and manufactured by the engine-generator set manufacturer as a complete generator system.

2. The AC generator shall be; synchronous, four pole, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc(s). The stator shall have skewed lamination of insulated electrical grade steel, two-thirds pitch windings. The rotor shall have amortissuer (damper) windings. The rotor shall be dynamically balanced. The exciter shall be brushless, three phase, with full wave silicon diodes mounted on the rotating shaft and a surge suppressor connected in parallel with the field winding. Generator pitch windings shall be 2/3.

3. All insulation system components shall meet NEMA MG1 standard temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 125 degrees Centigrade.

4. A permanent magnet generator (PMG) shall provide excitation power to the automatic voltage regulator for immunity from voltage distortion caused by non-linear SCR controlled loads on the generator. The PMG shall sustain main field excitation power for optimum motor starting and to sustain short circuit current for selective operation and coordination of system overcurrent devices.

5. The alternator shall be 105 degrees C rise at standby rating.

D. Starting System:

1. The engine shall be equipped with a DC electric starting system of sufficient capacity to crank

the engine at a speed which will allow full diesel starting of the engine. The motor voltage shall be as recommended by the engine manufacturer.

2. Fully automatic generator start/stop controls shall be provided in the generator control panel to start the generator automatically from a contact in the automatic transfer switch.

    a. Batteries: A lead-calcium storage battery set of the heavy-duty starting type shall be provided. Battery voltage shall be compatible with the starting system. The battery set shall be rated for a minimum of 172 hours and shall be of sufficient capacity to provide for 1-1/2 minutes total cranking time without recharging. It shall be sized for the cold cranking amps as recommended by the battery manufacturer. A wood bottom, fiberglass treated, battery rack and necessary cables and clamps shall be provided. The battery rack shall be isolated from the engine to protect it from excessive vibration, and shall be readily accessible for service and/or removal.

    b. Battery Charger:

        (1) The battery charger shall be compatible with the lead-calcium maintenance free battery. The charging unit shall have a DC output adjustment and analog meter. The DC output adjustment shall not be located external of the cabinet. The battery charger shall provide rapid recharging and maintenance charging. An ON/OFF switch, or other means of charger disconnect, shall be installed for battery replacement. The charger cannot be solely, the "trickle charger" type.

        (2) The battery charger shall be capable of maintaining the battery terminal voltage at a minimum of 13.3 V for 12 V systems, and 26.6 V for 24 V systems.

        (3) The battery charger supply voltage shall be fed from a dedicated 120 volt AC source.

        (4) Battery charger shall be Marinco model #28210.

E. Fuel System: (Lube Cube)

1. The fuel tank shall be Lube Cube type as manufactured by Containment Solutions of Glen Bernie, MD or, if required, the fuel tank shall be a subbase, skid mounted belly tank, double wall construction, UL listed with a float between the walls for indication of a fuel leak.

    a. The tank (subbase tank) shall be constructed in such a manner so as to facilitate the removal of sediment and moisture collecting at the lowest point of the tank. Moisture and sediment access shall be provided through appropriate piping to include a gate valve and pipe cap. The gate valve, drain, and cap shall be located at the opposite side of the radiator for ease of access.

2. The fuel tank capacity shall be designed for a minimum of 24-hour operation at full load. Minimum size shall be 480 gallons.

3. The fuel tank controls (Lube Cube only) shall be Pneumercator LC 1003 with control panel and alarm panels provided with the following:

    a. ON/OFF switch and indicator lamps
    b. Low fuel (red) - latching fault, indicates valve failure or operating float switch failure, closes

N/O dry contacts.
   c. One option lamp (red) - with N/O and N/C dry contacts.
   d. Fuel leak (red).
   e. Horn, test button and reset button.

4. Piped for interior filling. External fuel gauge/alarm panel shall be type E-14-1 manufactured by Pnuemercator liquid level control systems of Farmingdale, New York.

5. Piped for outside ventilation with approved mushroom vent cap.

6. Fuel lines shall be constructed of black iron pipe and flexible products compatible with diesel fuels.

7. Fuel filter shall be a RACOR 445 R-2 micron filter or equal with a transparent bowl and fuel priming attachment.

8. All fuel connections at the engine shall be made using wire reinforced flexible hose compatible with diesel fuels.

9. The generator low fuel and leak normally open contacts shall be wired to the Programmable Logic Controller for generator alarm status.

F. Exhaust System:

1. Provide a hospital grade exhaust silencer, including stainless-steel flexible exhaust fitting, properly sized according to the manufacturer's recommendations. Silencer shall be manufactured by Maximum or equal.

   Exhaust pipe shall be of sufficient size to ensure that exhaust back-pressure does not exceed the maximum limitations specified by the generator set manufacturer.

2. Provide taps for drainage with a pet cock drain valve, a suitable wall thimble, drip cap, rain cap, and accessories.

3. Paint exhaust piping with aluminum paint capable of withstanding temperatures of 600 deg F.

4. Exhaust piping shall be insulated 1,500 degrees F insulation, as manufactured by Manville Corporation or equal. Insulation shall be 4" thick hydrous calcium silicate (Thermo-12), with 0.032" thick aluminum jacket with vapor barrier and 3/16" cross corrugations as manufactured by Childers Product Co. or equal.

5. Provide generator exhaust pipe wall thimble.

G. Engine Generator Set Mountings:

1. The engine generator shall be mounted in perfect alignment on an all welded preformed structural steel I-beam or C channel skid type sub-base which shall provide for attachment of all specified engine and generator accessories.

H. Generator Control Panel:

1. Provide a generator-mounted NEMA 4 control panel. The control panel shall be mounted on the

generator terminal box and shall be vibration isolated.

2. The generator control panel shall contain, but not be limited to, all generator and metering switching devices.

3. Engine monitor with individual ½ amp relay signals and common external alarm contact for each of the following:

4. Run, pre-warning low oil pressure, pre warning for high coolant temp, low oil pressure shutdown, high coolant temp shutdown, overcrank shutdown, overspeed shutdown, switch off, low coolant temperature, low fuel, fuel tank leak, two customer selected faults.

5. AC meter package.

6. Provide a digital control panel with integrated automatic voltage regulator and engine speed governor. Provide both digital and analog metering of voltage, amperage, and KW.

7. The generator shall be provided with a common generator fail contact which shall be wired to the programmable controller for alarm monitoring.

8. The generator shall be provided with a relay indicating the generator is running. A normally open contact from the relay shall be wired to the programmable controller for status monitoring.

I. Generator Circuit Breaker:

1. A main line molded case 3-pole circuit breaker shall be installed as a load circuit interrupting and protection device. It shall operate both manually as an isolation switch and automatically during overload and short circuit conditions.

2. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection. The circuit breaker shall meet standards established by Underwriters' Laboratories, National Electrical Manufacturer's Association, and National Electrical Code.

3. The circuit breaker shall be mounted in a NEMA 4-type enclosure, adjacent to the generator control panel.

J. Painting:

1. The complete generator set shall be painted with the manufacturer's standard prime and finish paint system. Observed nicks, damage, rust, etc., to the paint system of the installed generator set shall be prepared, primed and finish coated in the field prior to conditional acceptance.

K. Automatic Transfer Switch:

1. The emergency standby power system shall include an automatic transfer switch. The transfer switch equipment shall be designed, built, tested, furnished, and warranted by the manufacturer of the generator set to ensure one source of responsibility for the complete emergency standby power system.

2. All transfer switches shall be UL listed per UL Standard 1008, and CSA approved.

3. Ratings: Main power switch contacts shall be rated for 600 Volts AC minimum on transfer switches 40 through 1000 amperes; and 480 Volts AC minimum on transfer switches 1200 through 3000 amperes.

4. Transfer switches shall be contactor type (NEMA Type A, IEC Type PC) and shall be rated to carry 100 percent of rated current continuously in the enclosure. Circuit breaker type transfer switches do not meet this specification.

5. Transfer switches shall be rated for continuous operation in ambient temperatures of - 40 degrees C (- 40 degrees F) to + 50 degrees C (+ 122 degrees F), relative humidity of up to 95 percent (non-condensing), and altitudes of up to 10,000 feet (3048 meters).

6. Where the line side over-current protection is provided by molded case circuit breakers, transfer switch equipment shall have a minimum withstand and closing rating (RMS symmetrical amperes) at the specified voltage as shown in the transfer switch equipment schedule herein. The circuit breaker manufacturer and type shall be as listed by UL and as specified by the transfer switch equipment manufacturer. The rating of the circuit breaker shall not exceed the maximum rating listed by UL and as specified by the transfer switch equipment manufacturer.

7. Where the line side over-current protection is provided by current limiting fuses, transfer switch equipment shall have a minimum withstand and closing rating (RMS symmetrical amperes) at the specified voltage as shown in the transfer switch equipment schedule herein. The fuse shall be a UL Class as listed by UL and as specified by the transfer switch equipment manufacturer. The rating of the fuse shall not exceed the maximum rating listed by UL and as specified by the transfer switch equipment manufacturer.

8. The withstand and closing rating shall be equal or greater than the available fault currents shown on the drawings. Withstand and closing ratings shall be verified by UL witnessed test and shall be the ratings listed by UL for the transfer switch equipment supplied.

9. Construction: Transfer switches shall be double-throw construction, positively electrically and mechanically interlocked by a mechanical beam to prevent simultaneous closing (for break before make operation), and mechanically held in both normal and emergency positions.

10. Transfer switches rated through 1,000 amperes shall be equipped with permanently attached operating handles and quick-break, quick-make contact mechanisms suitable for manual operation under load. Transfer switches over 1,000 amperes shall be equipped with manual operators for service use only under de-energized conditions.

11. Main switch contacts shall be high-pressure silver alloy contacts to resist burning and pitting for long life operation. Contact assemblies shall have arc chutes of heat absorbing material and metal leaves for positive extinguishing of arcs. Arc chutes shall have insulating covers to prevent interphase flash over.

12. Transfer switches shall have one Form C, 10 Amp 250-Volt AC auxiliary switch on both normal and emergency sides, operated by the transfer switch.

13. Terminal lugs, UL listed and CSA approved as suitable for copper conductors, shall be provided for normal, emergency, and load connections. Wire bend space shall comply with NEC Article 373.

14. Transfer switches shall be mounted in enclosures as designated in the schedule herein. Where

specified by NEMA type, separate enclosures shall be UL listed. The cabinet shall provide NEC required wire bend space at point of entry as shown on the drawings. Manual operating handles and all control switches (other than key-operated switches) shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches with manual operating handles and/or non key-operated control switches located on outside of cabinet do not meet this specification and are not acceptable.

15. Automatic Controls: Control shall be solid-state and mounted inside of key-locking front door.

    a. Control disconnect plugs shall be provided to de-energize control circuits to avoid shock hazard while making control adjustments.

    b. The control shall be designed for a high level of immunity to power line surges and transients and tested to IEEE Standard 587- 1980. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs.

16. Solid-state under-voltage sensors shall simultaneously monitor all phases of the normal source and all phases of the emergency source. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase of normal where motor feedback voltages exist. Pickup setting shall be adjustable from minimum of 85 percent to maximum of 98 percent of nominal voltage. Dropout settings shall be adjustable from minimum of 75 percent to maximum of 98 percent of pickup setting with fixed dropout time delay of 0.5 second. Voltage sensors shall have provision for field calibration where supply voltage is higher or lower than nominal system voltage.

17. Controls shall signal the engine generator set to start upon signal from normal source voltage sensors. Solid-state time delay start, adjustable from 0 to 15 seconds (factory set at 2 seconds), shall avoid nuisance start-ups on momentary voltage dips for momentary interruptions. Start contacts for the engine control shall be gold type, dry contacts wired to a terminal block and compatible with the generator set control equipment furnished.

18. Provide a programmed transition: to slow switch operation for an adjustable delay period, to provide an open period during transfer and retransfer for a duration of up to 7.5 seconds. In Phase monitor will not be acceptable.

19. The switch shall transfer the load to the emergency power system after the generator set reaches proper voltage and frequency. Solid-state time delay transfer, adjustable from 0 to 120 seconds (factory set at 2 seconds), shall allow the engine-generator set to stabilize before application of load.

20. The switch shall retransfer the load to the normal source after normal power restoration. Solid-state time delay retransfer, adjustable from 0 to 30 minutes (factory set at 15 minutes), shall allow normal power to stabilize before retransfer and shall allow staggered retransfer of loads to multiple transfer switch systems.

21. Controls shall signal the engine-generator set to stop after load retransfer to normal source. Solid-state time delay stop, adjustable from 0 to 10 minutes (factory set at 5 minutes), shall maintain availability of emergency source in event that normal source fails shortly after retransfer and shall permit engine to run unloaded for cool down before shutdown.

22. The operating power for transfer and retransfer shall be obtained from the source to which the load is being transferred. Controls shall provide an automatic retransfer of the load from

emergency source to normal source if emergency source fails when normal source is available.

23. Controls shall provide built-in "control mode status indicators," consisting of light emitting diodes to indicate a sequence of functions such as the following:

    a. Source 1 OK
    b. Start Gen Set
    c. Source 2 OK
    d. Transfer Timing
    e. Transfer Complete
    f. Retransfer Timing
    g. Retransfer Complete
    h. Timing for Stop

These indicators shall allow the operator to determine that the controls are properly sequencing and shall assist in determining sequence of any malfunctions that might occur.

24. The control shall include provisions for remote transfer inhibit and area protection. Opening the transfer inhibit terminals shall prevent the transfer switch from operating from the normal source to the emergency source, even if the emergency source is good and the normal source is not. Closing the area protection/remote test terminals shall cause the control to sense a normal power failure, start the generator set, and transfer to the emergency source.

25. Front Panel Devices: Provide devices mounted on cabinet front consisting of:

    a. Transfer switch position indicator lamps; Normal and Emergency. Provide normal source available and emergency source available indicator lamps.

26. A key-operated selector switch to provide the following positions and functions:

    a. Test - Simulated normal power loss to control unit for testing of generator set, including transfer of load. Controls shall provide for a system test without load transfer. Controls shall include provisions to automatically return the system to the normal power source if the generator set fails during any test or exercise period.

    b. Normal - Normal operating position; restores the load to the normal source after test and after time delays.

    c. Retransfer - Momentary position to override retransfer time delay and cause immediate return to normal source after test or actual outage.

27. The transfer switch shall be provided with two 3-phase power monitors. One monitor shall be connected to the normal terminals to provide a contract closure for normal (utility) power fail. The second monitor shall be connected to the load terminals to provide a contact closure for station (3-phase) power fail. The power monitor contacts shall be wired to the programmable controller for alarm monitoring.

28. The transfer switch shall be provided with a position relay with dry contracts which close based on switch position. When the switch is in the emergency position, the relay shall close a contact which is wired to the programmable controller for alarm monitoring.

PART 3 - EXECUTION

3.01 FIELD SERVICES

A. Installation:

1. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

2. Provide branch circuits and motor starters, where required, from the emergency panel for the generator set auxiliaries.

3. Provide and install emergency system conductors in a raceway system completely separate from other wiring. Control interconnection wiring shall be properly sized and run in a raceway separate from power cables.

B. Testing:

1. To provide proven reliability of the system, three series of tests shall be performed: Prototype Model Tests, Production Model Tests, and Field Tests. The manufacturer shall provide documentation demonstrating satisfactory prototype and production test results. Generator sets that have not been prototype tested and factory tested at 0.8 PF will not be acceptable.

2. Generator Set Factory Prototype Tests and Evaluation:

a. These tests and evaluations must have been performed on a prototype generator set representative of the Model specified. A summary of the generator set testing results shall be submitted for review. The manufacturer's standard series of component development tests on the generator system, engine, and other major components shall also be performed and available for review, but shall not be acceptable as a substitute for prototype testing on the complete representative generator set prototype.

b. Torsiograph Analysis and Test: The manufacturer of the generator set shall verify that the engine-generator set, as configured, is free from harmful torsional stresses. The analysis shall include correlation of empirical data from tests on a representative prototype. The empirical data must include spectrum analysis of the torsional transducer output within the operating speed range of the engine-generator set. Calculations based on engine and generator separately are not acceptable.

c. Temperature Rise Test: Complete thermal evaluation of a prototype generator rotor and stator must include actual measurement of internal generator and exciter temperatures by embedded detector method, and measurement of average temperature rise by resistance method. No position measured any place in the windings may exceed the temperature rise limits of NEMA for the particular type of insulation system used. Resistance method temperature rise data shall be confirmed by a full load test on the generator set prototype to include conducted and radiated heat from the engine.

d. Short Circuit Test: A test on a prototype generator set shall have demonstrated that the generator set is designed to withstand the mechanical forces associated with a short circuit condition. With the generator set operating at rated load and speed, the generator terminals must be short circuited on all three phases for a duration of 20 seconds. At the conclusion of this test, the generator set must be capable of full load operation.

e. Endurance Run Test: A minimum of five hundred (500) continuous hours of endurance testing with a representative generator set prototype operating as defined by the manufacturer's standby rating shall have been performed. Endurance testing shall be used to verify structural soundness and durability.

f. Maximum Power Test: With the prototype generator set at normal operating temperature and with all power consuming auxiliaries in place, the maximum power available at rated speed shall be determined with the governor set at its fuel stop. The generator set shall maintain this power for a minimum of two minutes.

g. Linear Vibration Test: A test for in-line motion of components occurring along a repeatable path shall meet the manufacturer's acceptance criteria.

h. Cooling System Test: A cooling system test shall demonstrate the ability of the generator set cooling system to maintain normal operating temperature while operating a full rated load and power factor at the highest ambient temperature of the system rating. Cooling air requirements, radiator airflow and maximum allowable restriction at radiator discharge, shall be verified by this test.

i. Maximum Motor Starting KVA: Motor starting KVA shall be determined by test, based on a sustained RMS recovery voltage of at least 90 percent of no load voltage with the specified load KVA at near zero power factor applied to the generator set.

j. Transient Response, Steady-state Speed Control, and Voltage Regulation: Prototype generator set tests shall demonstrate consistent performance as follows; stable voltage and frequency at all loads from no load to full rated load, consistent frequency bandwidth with steady-state load, maximum voltage and frequency dip on load acceptance and rejection, and restoration to steady-state after sudden load changes. Transient response is a complete generator set (engine, generator, exciter, and regulator) performance criteria and cannot be established based on generator data alone.

3. Transfer Equipment Prototype Tests: Prototype samples, representative of the production transfer switches supplied, shall have been tested as defined in UL 1008, including but not limited to:

a. Overload tests for the capability to make and break six (6) times the transfer switch rated current at low power factor without any electrical or mechanical malfunction.

b. Temperature rise test at 100 percent of rated current without exceeding temperature rise limits. Transfer switches incorporating integral over-current devices in the main power circuit and tested at 80 percent of rating shall not be permitted.

c. Endurance tests for a minimum of 3,000 mechanical operation cycles.

d. A dielectric voltage withstand test of 1,000 volts plus twice rated for one minute.

e. Withstand and Closing tests with specific over-current devices. All withstand and closing tests shall be performed with the over-current protective devices located external to the transfer switch. Tests conducted with over-current protective devices internal to the switch, in such a manner that the transfer switch interrupts the current than withstanding the current, are not acceptable under this definition of withstand.

f. The entire transfer switch shall be performance tested per the requirements of IEEE-587-1980, for voltage surge withstand capability.

4. Factory Tests:

   a. Generator set factory production tests: on the equipment to be shipped, shall be performed at rated load and 0.8 PF for one hour. These tests shall include run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and safety shutdowns.

   b. Provide a factory certified test record of the production testing.

5. Transfer equipment production model tests: Each production model transfer switch supplied shall be factory tested before shipment. Factory tests shall include a complete functional test of the transfer switch control, including calibration of the voltage sensor potentiometers.

6. On-Site Acceptance Test:

   a. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer and JCSA representatives shall be notified in advance and shall have the option to witness the tests. Installation acceptance tests to be conducted on-site shall include a "cold start" test, a four (4) hour full load test, and a one step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.

END OF SECTION

SECTION 16690 - VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install a variable frequency AC drive for each Pump as shown on the Drawings and specified herein.

B. Special Requirements: The variable frequency drives shall be furnished by the Pump Control Panel Supplier, who shall be responsible for coordinating the drive start/stop and speed controls with the controls in the Pump Control Panel.

1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

UL	- Underwriters Laboratories, Inc.
NEC	- National Electrical Code
NEMA	- National Electrical Manufacturers Association
ANSI	- American National Standards Institute

The drive shall be built to applicable NEMA standards and be suitable for use as a component to meet NEC requirements. Drive is to be listed by Underwriters Laboratories (UL) and Canadian Underwriters Laboratories (CUL).

B. Quality Control:

1. The drive manufacturer shall be ISO9001 certified. The drives shall be manufactured in the United States.

2. All variable frequency drives shall be new and limited to products regularly produced and recommended for service ratings in accordance with engineering data or other comprehensive literature. In all cases where device, or devices, or part of equipment is herein referred to in singular, reference shall apply to as many items as required to complete installation.

3. All incoming material shall be inspected and/or tested for conformance to quality assurance specifications. All chips (CMOS, TTL, LINEAR, etc.) shall be functionally tested.

4. All subassemblies shall be inspected and/or tested for conformance to vendor's engineering and quality assurance specifications.

5. Parts shall be electrically screened before insertion, checking function, speed, and other parameters.

6. The bare circuit board shall be electrically inspected by automated machinery.

7. Surface mount circuit boards shall be temperature cycled for two hours after construction is completed. Boards shall be automatically moved between –30 degrees and +90 degrees centigrade chambers every half hour.

8. Finished products shall be fully tested before installed in the drive.

9. IGBT H_{fe} and other characteristics shall be individually tested before installation.

10. In the case of parallel applications, H_{fe} and T_{rr} codes shall be stamped on the IGBTs.

11. The inverter main and control power terminals shall be AC hipot tested.

12. Each drive shall be full load tested with a motor. Stall current shall also be recorded during this process.

13. All drives shall have a separate outgoing QC inspection to ensure all required tests are completed.

14. All control printed circuit boards shall be dynamically tested for a minimum of 22 hours while heat cycled 1 hour at each temperature setting from 32ºF (0ºC) to 140ºF (60ºC) back to 32ºF (0ºC).

15. The completed drive shall be functionally tested with a motor before shipment to assure proper operation per specification.

1.03 SUBMITTALS

A. Shop Drawings: Shop drawings shall be complete in all respects and shall indicate all dimensions, installation methods, size, weight, capacity, ratings, integral controls, elevations, and sections. Shop drawings shall include manufacturer's literature and complete information on the following:

1. Variable Frequency Drives
2. Drive Enclosure Layout
3. Main Disconnect Switch
4. Fuses
5. Line Reactors
6. Isolation Contactor
7. RF/EMI Filter
8. Long Lead Output Filter
9. Control Transformer
10. Relays
11. Wiring Diagrams and Connection Diagrams
12. Nameplate Schedules
13. Spare Parts

B. Operation and Maintenance Manuals: Prepare and Submit Operation and Maintenance (O&M) Manuals and Field Service Manual in accordance with Section 01020 – Operation for the variable frequency drives.

1.04 MANUFACTURER

A. The Variable Frequency Drives shall be Toshiba G9 or approved equal.

PART 2 - PRODUCTS

2.01 VARIABLE FREQUENCY DRIVES

A. General:

1. The variable frequency drives shall convert a fixed frequency, three phase input power to an adjustable AC frequency and voltage source for controlling the speed of a standard, NEMA Design B, AC induction motor.

2. The drives shall be fully digital, microprocessor controlled and shall incorporate a diode bridge rectifier and a transistorized inverter section. IGBT (insulated gate bipolar transitors) type power transistor modules shall be utilized in the inverter section to invert a fixed DC bus voltage to a symmetrical three phase pulse-width modulated (PWM) output voltage. The manufacturer of the drives and the transistors shall be the same.

3. The drives shall accept incoming 480 VAC, 60 Hz line power, and shall not be affected by voltage fluctuations of ±10% or frequency fluctuations of ±2%. The drive shall include phase-to-phase and phase-to-ground protection.

4. Each variable frequency drive shall be designed to operate a 460 volt, 3 phase, 1800 RPM AC induction motor. Each drive shall be rated for duty equivalent to the power rating of the pump motor.

5. The drive shall operate under the following ambient conditions:

Ambient temperature:	14ºF to 104ºF.
Altitude:	3,300 feet maximum without derating.
Relative Humidity:	95% maximum (no condensation allowed)
Vibration:	0.6G maximum.

B. Drive Enclosure:

1. Each variable frequency drive shall be mounted in a NEMA 4 enclosure sized to dissipate the heat generated by the unit. Provide forced air ventilation with filtered intake and exhaust louvers.

2. A main power disconnect switch (non-fused), with a flange mounted operator handle, shall be mounted in the drive enclosure. The disconnect switch shall be sized for the full output current rating of the drive and shall disconnect power to the drive.

C. Drive Input and Output Contactors: An electrically operated drive input contactor shall be provided between the disconnect switch and the drive. An electrically operated drive output contactor shall be provided. The contactor shall close when the drive is powered up and will open after the drive is shut down.

D. Drive Operating Characteristics:

1. The drive operation shall be fully digital with microprocessor control of frequency, voltage and current. All drive set-up operations and adjustment shall be digital and stored in a non-volatile memory (EEPROM).

2. To control the rate of change of output frequency for a step change in input reference, the drive shall have two independently adjustable acceleration and deceleration rates (0.1 to 6000 seconds) with auto tuning for optimum setting with choice of linear, S, or C curve.

3. The drive shall have a foldback current limiting circuit. During acceleration, the circuit shall automatically reduce the acceleration rate to a slower rate should the load inertia cause excessive currents.

4. The drive shall have a selectable deceleration voltage limiting circuit. The circuit shall extend the set deceleration ramp should the bus voltage approach high limits due to regeneration.

5. The drive output frequency shall be adjustable from 0-60 Hz.

6. The drive shall have a fully programmable volts per hertz ratio selectable for constant torque, variable torque, Auto-Torque Boost, Auto-Torque Boost with Auto-Energy Savings, Vector Control, Vector Control with Auto-Energy Savings.

7. The drive shall maintain set frequency to within 0.6 Hz during power line fluctuations.

8. The drive shall have a speed regulation of approximately 3% in PWM mode, 0.1% - 0.5% in True Torque Control mode.

9. The drive shall have frequency resolution of 0.01Hz digital and 0.1Hz analog.

10. The drive shall have frequency accuracy of ±0.01% of maximum frequency for the digital input and ±0.2% of maximum frequency for the analog input (at 25ºC±10ºC).

11. The drive speed reference signal shall be an analog 4-20 mA signal from a PLC output module or a signal received from the keypad.

12. The drive shall have 2 programmable 4-20mA analog outputs (programmable to 13 choices), 3 programmable relay outputs (programmable to 62 choices), and 8 programmable digital inputs (programmable to 52 choices).

13. The drive shall be capable of maintaining 110% of rated output current continuously, and shall be capable of delivering 150% of rated output current for up to two minutes.

14. The drive shall be capable of restoring motor operation after a 0.5 second line loss without shutting down on a fault.

15. The drive input circuitry shall not generate line notches or large voltage transients on the incoming line.

16. The drive shall present a displacement power factor of 0.95 or better to the AC line at any speed or load.

17. The drive efficiency at rated load and frequency shall be 97.5% or better.

E. Drive Controls:

1. Each variable frequency drive shall be furnished with start-stop controls and speed controls as indicated on the Drawings and in the Sequence of Operation. These controls shall include, but not be limited to, the following:

    a. Drive Run Contact
    b. Common Drive Fault Contact

c. Isolated Analog Input Board
d. 120 VAC Control Interface Board

2. The drive run and fail contacts shall be wired to the programmable controller for VFD status monitoring.

F. Keypad Display:

1. A keypad display shall be mounted on the drive enclosure for digital set-up of the drive, drive parameter review and drive fault annunciation. The keypad shall have a two line backlit 20 character LCD display and with a digital speed pot for local control of the drive speed.

2. Provide a clear plexiglass window in the NEMA 12 drive enclosure in front of the keypad display. The window shall provide visual access to the display.

G. Drive Protection and Diagnostics:

1. Each variable frequency drive shall incorporate internal diagnostic and fault sensing circuits as an integral part of the drive. The following drive protection functions shall be monitored:

a. Momentary Overload Instantaneous Overcurrent Protection. - Adjustable from 20 to 115% of Drive Rating
b. Electronic Thermal Motor Overload Protection 10-100%.
c. Undervoltage Sensing
d. Overvoltage Sensing
e. Phase Protection
f. Drive Overtemperature
g. Ground Fault Detection
Each of the above fault conditions shall be annunciated on the digital display panel, and shall shut down the drive.

2.02 DRIVE CONTROL COMPONENTS

A. Line Reactors: Provide line reactors in the drive enclosure for each drive to eliminate nuisance overvoltage tripping and to reduce harmonic distortion. The line reactors shall be iron core, 5% impedance, Class H insulation, 115°C rise, copper wound. The line reactors shall be sized for the full load amps of the drive and shall be manufactured by TCI.

B. Provide “Real Time Clock” option.

C. RF/EMI Filter: Provide an RF/EMI filter in each drive enclosure to limit high frequency noise from being transmitted back on the electrical distribution system. The RF/EMI filter shall be sized for the full load amps of the drive and shall be manufactured by TCI.

D. Long Lead Output Filter: Provide an output filter in each drive enclosure, as required by motor manufacturer, to limit voltage spikes caused by long motor leads. The output filters shall be three phase and shall be constructed of copper wire wound on a steel core. The output filter shall have Class H insulation and a maximum temperature rise of 115°C. The output filters shall be sized for the full load amps of the drive and shall be manufactured by TCI. Long Lead Output Filters will be required for the well pump motors. Install Long Lead Output Filters on Booster pumps VFDs only if

required by motor manufacturer.

E. Control Transformer: Provide a control power transformer for each drive control circuit. Control transformers shall be 480 volts to 120 volts and shall be protected according to code. Size shall be as required plus 250 VA additional capacity.

F. PLC/Keypad Selector Switch:

1. Provide a PLC/Keypad selector switch on each drive enclosure. When the switch is in the "keypad" position, the drive will power up and operate from the keypad independent of the PLC. When the selector switch is in the "PLC" position, the drive will be controlled from the PLC.

2. The selector switches shall be 30.5mm, heavy duty, maintained contact type. Switches shall have double-break silver contacts and shall be Allen-Bradley Bulletin 800H, NEMA Type 4X or Square D Class 9001, Type SK.

G. Drive Bypass Reduced Voltage Starter and Contactors:

1. The VFDs shall be furnished with a drive bypass reduced voltage stater and contactors to bypass the drive and operate the motor with the reduced voltage starter. The contactors shall be TEC type and shall be electrically interlocked so that only one contactor can be energized at a time, The contactors shall be Allen-Bradley Bulletin 100, or equal.

2. Provide a thermal overload relay for motor protection while operating in the bypass mode.

3. Provide a VFD-OFF-BYPASS selector switch in the drive enclosure to manually select whether the pump is controlled by the VFD or the reduced voltage starter.

H. Relays: Relays shall be heavy-duty general purpose type with 10 amp contacts. Relays shall have terminals which plug-in to a socket, mounted to the inside of the drive enclosure. Contact configuration shall be 3PDT. Relay coils shall operate on 120 volts AC, unless indicated otherwise on the Drawings. Relays shall have an indicator light to indicate the relay coil is energized. Relays shall be Idec.

I. Control Terminal Block: Provide a NEMA type control terminal block in the drive enclosure to terminate all control wiring from the field.

J. Nameplates: Provide an engraved lamacoid nameplate on the drive enclosure. Nameplate shall be white with black letters and shall be engraved as follows: "PUMP NO. 1 (2) VFD".

K. Provide elapsed time meter on face of VFD panel.

2.03 SPARE PARTS

A. Provide one set of the following spare parts for the variable frequency drives provided:

1. DC Bus Fuse
2. Control Fuse
3. Main IGBT’s full set
4. Base Drive Board

5. Cooling fan

All spare parts shall be packaged individually in boxes that are clearly labeled with part name and manufacturer's part number.

PART 3 - EXECUTION

3.01 FIELD SERVICES

A. Start-up and Testing:

1. Provide the services of a manufacturer's representative to program start-up, adjust and test each variable frequency drive. Demonstrate start/stop control, fault diagnostics and variation of motor speeds in response to both the manual and automatic variable speed controls. Verify accuracy of speed variation and speed indication by means of a strobotach which utilizes a light beam focused on the motor shaft. Strobotach shall be furnished by the manufacturer's representative.
2. All start-up and testing shall be performed in the presence of JCSA and the Engineer.

B. Training:

1. Provide eight (8) hours of on-site training for JCSA personnel on the variable frequency drives. Training shall be specific for the VFDs provided and shall include theory of operation, maintenance and troubleshooting procedures. All training shall be performed by a qualified manufacturer's representative.

END OF SECTION

SECTION 16920 - PROGRAMMABLE LOGIC CONTROLLER

PART 1 – GENERAL

1.01 DESCRIPTION

A. This specification has been developed to establish minimum requirements for a solid-state programmable controller designed to provide high reliability in industrial applications. The internal wiring of the controller is to be fixed with the logic functions it must perform in a given application to be programmed into its memory. The controller shall be supplied with the CPU, input/output scanner, input/output modules, 1747 PIC unit, battery, EEPROM backup memory, power supply, and all power and interface cables necessary to function as a complete and operable programmable controller system. PLC to be Compact Logix 1769-L33ER by Allen Bradley.

B. PLC shall be installed to meet all requirements of manufacturer and in strict adherence to Rockwell Automation Document #9655 and Compact Logix manual (or most current edition).

C. The objective of the programmable controller will be to improve reliability, maintainability and efficiency by reducing operating costs and downtime.

D. The specification shall be followed in controller with the contract and all areas of questions or noncompliance shall be submitted to the purchaser for review and approval.

PART 2 - PRODUCTS / EXECUTION

2.01 SERVICE

A. The supplier shall provide operating manuals in accordance with Section 01020 – Operation and Maintenance Data/Manual, with adequate information pertaining to the following:

1. System specifications.
2. Electrical power requirements
3. Applicator considerations
4. Assembly and installation procedures
5. Power up procedures
6. Troubleshooting procedures
7. Programming procedures
8. Explanation of internal fault diagnostics
9. Shut down procedures
10. Recommended spare parts list
11. Manuals on all PLC components

B. The systems control shop/programmer shall provide a copy of all working programs in thumb drive format. The thumb drive of PLC program shall be submitted and approved by the County with regard to ladder logic descriptions and labeling prior to installation. Communication and integration with the County provided SCADA shall be through Modbus TCP-IP.

C. The Program shall include all required interfacing and development work to make the facility fully functional with the County's SCADA system. The systems control shop/programmer shall coordinate with the County's SCADA system sub-consultant, Dorsett Controls, Inc. for all software and hardware requirements between the PLC and SCADA system.

D. The system control shop/supplier shall provide a network of field sales and support personnel located within 75-mile radius of the well facilities with 2-hour response time to provide telephone consultation, prompt on-site service, and field replacement stock.

E. The supplier shall provide product application assistance by trained and experienced engineers to assist the customer with program and system development through telephone consultation and on-site check-out, debug, start-up assistance.

F. The supplier shall provide a customer training program designed to teach the customer's personnel in the understanding and application of the programmable controller. The training program shall include training manuals and "hands-on" programming experience, and factory PLC training and troubleshooting and maintenance of the PLC for two employees (48 hours).

G. The supplier shall have the capability to conduct on-site training programs at a location provided by the customer.

2.02 ASSEMBLED SYSTEMS

A. A supplier shall assume single source responsibility for system assembly. An assembled system may include mounting and wiring of relays, motor starters, transformers, and disconnecting means, or other control devices as specified by customer-supplied documentation.

B. The supplier shall provide mounting, wiring, and programming of the programmable controller system in a NEMA type 4 or other enclosure that may be specified.

C. If specified, the enclosure shall be able to accommodate an electrical service of 460 volt, 3 phase, 60 Hz. The enclosure shall have sufficient room for a 460 VAC (primary) to 115 VAC (secondary) control transformer to service the processor, inputs, and outputs.

D. The supplier shall be able to provide a sealed plastic window in the NEMA 4 enclosure door(s) for observing the processor and I/O status indicating lights.

E. The supplier shall have the capacity to supply an enclosure with special paint and graphic displays.

F. The supplier shall wire all programmable controller inputs and outputs to customer-specified terminal blocks.

G. The assembled system shall include fuse blocks as sized by the customer's application.

H. Within the enclosure all I/O racks, processor racks, and power supplies shall be grounded to meet the manufacturer's specifications.

I. All outputs from the PLC shall be fused between PLC and terminal block in panel.

J. If more than one controller is mounted within an enclosure, the capability must exist to share a single programming panel or line printer.

K. All pushbuttons, switches and other operator devices must be UL listed and/or CSA approved and sufficiently large and durable to provide dependable, long-life operation.

L. All cables (with associated plugs, connectors and receptacles) requiring user field installation, shall be designed for commercial use to withstand an industrial environment.

M. Upon receipt of the purchase order. Prior to the start of the manufacturing of the equipment, the supplier shall submit drawings of the complete assembled system for approval by the purchaser or their consultant.

N. Drawings which are returned to the supplier for correction or revision shall be resubmitted for approval before starting fabrication of the work in question unless marked "approved as noted".

O. All drawings shall include page, sheet, and line numbers.

P. The first page of all drawings and schematics shall be a cover sheet consisting of a Bill of Material, purchase order number, manufacturer's job number, user's name, location, application, and shipping address.

Q. The drawings shall include a mechanical layout detailing the overall external dimensions the enclosure. The drawings shall include such pertinent information as location of door handles, windows, lifting lugs, and enclosure mounted items such as tachometer or current meters, cooling fans, etc.

R. The supplier shall provide documentation detailing the mounting of the processor, I/O racks, motor starter, disconnect switch, fuse blocks, wireways, etc. All materials shall be labeled to provide easy cross-reference to Bill of Material listing.

S. Electrical prints detailing all hardwiring, done by the supplier, to devices such as relays, motor starters, disconnect switches, fuse blocks, etc. shall be provided with individual wire numbers and relay contact cross-reference designations.

T. Sections describing inputs shall designate input modules by name, slot module, and terminal location.

U. The last sheet in the set shall be for terminal block designations each containing their individual terminal location.

V. At the time the equipment is shipped, one (1) reproducible copy of each drawing mentioned above shall be provided with the equipment.

W. The supplier shall provide a print out of PLC ladder logic.

X. The supplier shall provide a minimum of four (4) spare slots in the PLC or as detailed on the Contract Drawings.

2.03 DESIGN DESCRIPTION

A. A major consideration of the programmable controller system shall be its modular, field expandable design allowing the system to be tailored to the customer's machine and/or process control application. The capability shall exist to allow for expansion of the system by the addition of hardware and/or user software.

B. The processor plus input and output circuitry shall be of a modular design with interchangeability provided for all similar modules.

C. Modules are defined as devices which plug into a chassis and are keyed to allow installation in only one direction. The design must prohibit upside down insertion of the modules. The programmable controller systems must be able to determine the correctness of the module and chassis configuration prior to executing the user program.

D. The programmable controller shall have downward compatibility whereby all new module designs can be interchanged with all similar modules in an effort to reduce obsolescence.

E. All hardware of the programmable controller shall operate at an ambient temperature of 0° to 60°C (32° to 140°F), with an ambient temperature rating for storage of -40° to + 85°C (-40° to +185°F).

F. The programmable controller hardware shall function continuously humidity range of 5% to 95% with no condensation.

G. The programmable controller system shall be designed and tested to operate in the high electrical noise environment of an industrial plant.

H. The CPU shall have the capability of addressing up to 4096 input and 4096 output points.

I. Each input and output module shall be a self-contained unit.

J. The programmable controller system shall include the capability of addressing remote input and output modules up to 10,000 cable feet from the processor as an optional module. The communication link between the module and any remote input and output distribution chassis shall be via a 20 AWG tinned copper twin axial cable with braided and foil shields. The communications baud rate to the remote locations shall be at least 57.6 Kbaud and user selectable on a per module basis. If the maximum distance is reduced to 5000 cable feet, the communications speed shall increase to 230.4 Kbaud. These communication rates shall be translated into the I/O rack scan rates of 10.6 and 4 millisecond per adapter or logical rack, respectively.

K. The programmable controller shall use multiple independent scans designated for processing of input and output information, program logic, and background processing of other processor tasks. Discrete input and output modules located in the same backplane (slots 1-30) as the CPU should be scanned in under 32 microseconds per modules. The processing of a typical logic program shall not exceed 0.5 to 2 milliseconds for 1024 instructions with a maximum overhead of 0.6 milliseconds.

L. The Programmable controller shall execute Boolean conditional instructions (or contacts) within 0.45 microseconds each. The Programmable controller shall execute Boolean output instructions (or coils) within 0.64 microseconds each. The Programmable controller shall execute 3 operand (x 16 bit). Add and Subtract instructions within 1.71 microseconds each. The Programmable controller shall execute 3 operand (x 16 bit) circular comparison (or limit) instructions within 1.96 microseconds each. The Programmable controller shall execute 2 operand (x 16 bit) Move instructions within 1.26 microseconds each.

2.04 MAIN FRAME HARDWARE

A. The CPU shall be a self-contained unit, and will provide Ladder Rung program execution and support remote or local programming. This device will also supply 1/0 scanning and inter-processor and peripheral communication functions.

B. The operating system shall be contained in permanently mounted yet reprogrammable devices which allow for easy field upgrades without the need of tools.

C. In a single chassis system all system and signal power to the CPU, support modules shall be distributed on a single motherboard or backplane. No interconnecting wiring between these modules via plug-terminated jumpers shall be acceptable.

D. The CPU within the system shall perform internal diagnostic checking and give visual indication to the user by illuminating a "green" indicator when no fault is detected and a "red" indicator when a fault is detected.

E. All system modules, main and expansion chassis shall be designed to provide for free air flow convection cooling.

F. The main chassis front panel shall include indicators showing the following status information:

1. Non-Run or Run mode of the CPU
2. The fault status of the CPU
3. Battery status
4. Communications status for channels 0 and 1
5. Forces Present/Active

G. Processor mode shall be selected by a keyswitch mounted on the front panel of the CPU. The key shall select the following modes: RLTN - No ladder edits possible, program always executing; PROGRAM - Programming allowed, program execution disabled; and REMOTE - Programming terminal can make edits and change processor mode, including TEST mode, whereby the logic executes and inputs are monitored, but output states are not changed.

H. Non-volatile memory shall store the operating system information to protect against loss in the case of power loss or system shut-down. Only at the time of a hardware change shall this configuration status be altered or re-entered.

2.05 POWER SUPPLIES

A. The programmable controller shall operate in compliance with an electrical service of either 120 VAC, single phase, in the frequency range from 47 to 63 Hz, 240 VAC, single phase, in the frequency range from 47 to 63 Hz, or 24 VDC.

B. The manufacturer shall be able to provide as standard equipment a system power supply capable of converting 120 VAC line power to the DC power required to operate the programmable controller system. Provide two 24 VDC power supplies in the control panel to provide power for the 24 VDC programmable controller inputs and for the pressure transmitters. The power supplies shall be wired in an on-line/backup configuration using a 24 VDC relay. The power supplies shall be Siemens SITOP or Idec.

C. A single main power supply shall have the capability of supplying power to the CPU and local input/output modules. Auxiliary power supplies shall provide power to each expansion chassis.

D. The power supply shall automatically shut down the programmable controller system whenever its output current is detected as being excessive.

E. When the power supply is wired to utilize 120 VAC power, the system shall function properly within the range of 85 to 132 VAC. The power supply shall provide surge protection, isolation, and outage carry-over of at least I cycle of the AC line.

F. Install a constant voltage transformer having a sinusoidal output waveform.

G. Design features of the programmable controller power supply shall include diagnostic indicators mounted in a position to be easily viewed by the user. These indicators shall provide the operator with the status of AC and DC power applied.

H. At the time of power-up, the power supply shall inhibit operation of the processor and 1/0 modules until the DC voltages are within specifications.

I. The power supply shall provide fuse protection.

J. Provide a transient voltage surge suppressor in the control panel for component protection.

2.06 PROGRAM STORAGE

A. The program storage medium shall be of a solid-state battery backed RAM type.

B. The programmable controller system shall be capable of addressing up to 16 K words, where each word is comprised of 16 data bits.

C. Memory shall be available in 12 K with additional 4 K data word segments of RAM memory.

D. Memory shall contain battery back-up capable of retaining all stored program data through a continuous power outage for 24 months under worst case conditions. The capability shall exist to replace the CPU's battery without incurring a loss of user program. A low battery condition must be detectable in ladder logic, but shall not automatically generate a major fault.

E. The programmable controller system shall be supplied with SD card as a backup for volatile memory up to the full capacity of the controller. System shall be programmed to load on power cycling to processor.

F. The operator should be able to backup volatile memory, including data and program logic onto either a thumb drive or hard disk, at their option.

G. All user memory in the processor not used for program storage shall be allocable from main memory for the purpose of data storage, The programmable controller system shall be capable of storing the following data types:

1. External Output Status
2. External Input Status
3. Timer Values
4. Counter Values
5. Signed Integer Numbers (16 bit)
6. Binary Numbers

7. BCD Numbers
8. Direct and Indexed addressing
9. Internal Processor Status Information
10. ASCII Character Data

The above listed data types shall be distinguishable to the CPU by the addressing format. Management of the data types into memory subsections shall be an automatic function of the CPU operating system. Any data can be displaced in Binary, Octal, Hexadecimal, Decimal, or ASCII radices. Function-specific data types such as PID, Message, or Processor Status shall have dedicated displays available annotating the meaning of specific control bits and words within them and allowing for selective control where appropriate. Complete PLC logic addressing to be supplied to the Owner.

H. If contacts or entire rungs are intentionally deleted from an existing logic program, the remaining program shall be automatically repositioned to fill this void. Whenever contacts or entire rungs are intentionally inserted into an existing program, the original program shall automatically be repositioned to accommodate the enlarged program.

I. To reduce the effective scan time in order to detect short pulse duration inputs, it shall be possible to program a select logic rung more than once into memory.

J. The number of times a normally open (N. 0.) and/or normally closed (N.C.) contact of an internal output can be programmed shall be limited only by the memory capacity to store these instructions.

K. Ladder logic programs shall have immediate access to the subelements of control structures by address and subelement mnemonic, such as timer accumulator value or timer done bit.

2.07 INPUT AND OUTPUT – GENERAL

A. Each input or output module shall be a self-contained unit housed within an enclosure.

B. The input/output enclosure (chassis) with its respective modules shall be of universal and compatible with several programmable controllers manufactured by the supplier. Racks shall be sized to accommodate I/0 in increments of 4, 7, 10, or 13 slots per chassis. A maximum of 3 chassis may be interconnected and directly controlled by the local CPU I/0 scan.

C. Isolation shall be used between all internal logic and external power circuits. This isolation shall meet the minimum specification of 500 VRMS.

D. It shall be possible to replace any 16- or 32-point input or output module without disturbing field wiring.

E. Each I/0 module shall contain a visual indicator to display ON/OFF status of individual input or output points.

F. All user wiring to I/0 modules shall be through a heavy-duty terminal strip, Pressure-type screw terminals shall be used to provide fast, secure wire connections.

G. All 16-point, 32 point, and specialty input/output modules shall be color coded and titled with a distinctive label.

H. All input modules shall have a specified filter time constant to limit the effects of voltage transients.

I. The input/output enclosure shall be capable of expansion to accommodate an additional 20% of each type of input and output specified.

2.08 INPUT AND OUTPUT MODULES

A. The programmable controller manufacturer shall offer discrete input/output hardware consisting of the following types:

Inputs:

1. AC/DC input for devices which operate at 24 VAC, 50/60 Hz. or 24 VDC.

2. AC input for devices which operate at 120 Or 240 VAC. 50/60 Hz.

3. DC input for devices which operate at 5 to 30 VDC.

4. TTL (5-volt DC) input for transistor-transistor logic with low true logic, compatible with input devices such as solid-state control and measuring equipment.

Outputs:

1. AC output for devices which operate at 120 VAC, 50/60 Hz.

2. AC output for devices which operate at 220/240 VAC, 50/60 H7,

3. AC output for devices which operate at 24 VAC, 50/60 Hz.

4. DC output for devices which operate at 10 to 60 VDC.

5. Isolated Contact output which provides eight (8) isolated outputs capable of switching 120 VAC, 220 VAC, or 24 VDC power.

6. TTL (5-volt DC) output which provides transistor-transistor logic with low true logic, compatible for operating 5 VDC level electronic devices.

7. Combination Contact Output and 120 VAC Input available in two (2) in two (2) out, four (4) in four (4) out, or six (6) in six (6) out configuration.

8. All outputs to be fused at terminal strip.

B. Analog I/O modules of the following types shall be offered by the manufacturer.

1. Analog input which accepts analog signals and converts them to sixteen (16) bit binary values. Digital resolution shall be available in I part in 65536 voltage or I part in 32767 current Analog inputs shall be differential. Analog inputs shall be available in the following ranges:

   a. Voltage range: -10 to +10 VDC.
   b. Current range: -20 to +20 mA.

2. Analog output which converts a fifteen (15) bit current or sixteen (16) bit voltage binary number (14-bit resolution) into an equivalent single-ended analog output signal. Analog outputs shall be available in the following ranges:

    a. Voltage range: -10 to +10 VDC.
    b. Current range: 0 to +20 ma,

C. Encoder module capable of accepting input pulses up to 50 KHz in either a single or quadrature form from an encoder shall be available. Inputs to the module shall be TTL compatible (5 VDC). Each module shall have four output terminals with open collector outputs. The counting format of the module shall be 15 bit binary.

D. Specialized input modules of the following types shall be available:

    1. Thermocouple input module that reads millivolt signals generated by thermocouple or millivolt devices. These signals shall be displayed as either 14 bit binary, 16 bit binary, tenths of a degree, whole degrees, hundredths of a millivolt or tenths of a millivolt. Thermocouple types E, J, K, T, B, R, N, and S are compatible with this module. Over-range, Under-range, and open circuit detection will be provided as standard status to the CPU. Up to four types of thermocouples can be connected to a single card simultaneously.

E. An axis positioning module shall be available.

    1. A module shall be available to control the motion of a closed-loop servo motor axis. It shall be able to interface to differential line driver encoders and TTL encoders and shall provide scaleable +10 V signal for various drives. It shall include hardware and software commands for features such as E-Stop, jog forward, and jog reverse. It shall provide software configuration for parameters such as number of encoder lines, resolution, gain, and speed.

F. A 1/0 module that can contain BASIC programs in its resident. Battery-backed memory shall be available. Non-volatile UVPROM or EEPROM memory will be optional. This module shall interface to various devices through RS-232-C, RS-422, or RS-423A. Multiple peripheral devices shall interface to the module at one time.

2.09 INTERFACING AND PERIPHERALS

A. The programming means shall be an IBM or compatible, portable-, or industrial quality programming terminal. The terminal shall include a monochrome or color CRT screen and a keyboard for program entry, editing, search, and monitoring functions.
B. The terminal keyboard shall allow for loading of the program format and ASCII characters.

C. The terminal shall be able to function as a stand-alone ASCII (alphanumeric) data terminal with an RS-232-C interface allowing connection to an in-house computer, data terminal, or modem.

D. The programming terminal shall be compatible for interfacing, with an electrical service of either 120 VAC, 50/60 Hz. or 220 VAC, 50/60 Hz.

E. The terminal shall provide for selecting the communication rate between 10 and 19200 baud for RS-232-C communications.

F. The terminal shall be capable of displaying a minimum of thirty (30) graphic (line drawing) characters.

G. The programming terminal shall be capable of displaying a rung consisting of a maximum of seven (7) series elements and six (6) parallel elements,

H. The programming terminal shall have the capability to be remotely located a maximum of 4000 cable feet from the processor.

I. The means to indicate contact or output status shall be by intensification of the contact or output on the CRT screen. Each element's status shall be shown independently, regardless of circuit configuration.

J. The programmable controller system shall be able to interface with a data terminal which is RS-232-C compatible (up to 19200 baud) to generate hard copy logic diagrams and/or message generation.

K. The system shall have the capability to interface to a thumb drive and/or a hard disk for loading a user program into, or recording the contents of, the processor's memory. It shall be possible to load or record the entire contents or selected portions of memory.

L. The manufacturer shall offer a multi-point communication network providing a data transfer path for up to 32 programmable controllers and/or mini/micro-computers. The communicating stations shall be distributed anywhere along a single bus that extends a maximum of 4,000 cable feet in length. The communication network shall support the following features:

1. Token passing system
2. Peer-to-peer communication
3. Message error checking
4. Retries of unacknowledged messages
5. Diagnostic checks on other stations
6. Interface to more than one network
7. A user-oriented command language for manipulation of data structures of variable size and organization, such as setting or resetting bits, word and file transfers, and program loading.
8. Bi-directional communication between the programmable controllers and the communication network via a standard modern interface. The protocols shall meet EIA RS-232-C electrical standards and ANSI standard communication protocols.
9. The ability to communicate with all other models of programmable controller manufactured by said manufacturer.
10. The ability to monitor the status of any processor remotely via the network.

2.10 PROGRAMMING TECHNIQUES

A. The programming format shall be traditional relay ladder diagram. The programming shall be accomplished using RS Logix by Rockwell Automation.

B. It shall be possible to program a maximum instruction matrix containing as many as 128 instructions.

C. The capability shall exist to change a contact from normally open to normally closed, add instructions, change addresses, etc. It shall not be necessary to delete and reprogram the entire rung.

D. It shall be possible to insert relay ladder diagram rungs anywhere in the program, even between existing rungs, insofar as there is sufficient memory to accommodate these additions.

E. A single program command or instruction shall suffice to delete an individual ladder diagram rung from memory. It shall not be necessary to delete the rung contact by contact.

F. It shall be necessary to issue a two-part command in order to delete all relay ladder rungs from memory. This will provide a safeguard wherein the operator must verify, their intentions before erasing the entire program.

G. A clock/calendar feature shall be included within the CPU. Access to the time and date shall be from the programming terminal, user program, or message generation.

H. Latch functions shall be internal and programmable.

I. The system shall have the capability to address software timers and software counters in any combination and quantity up to the limit of available memory. All management of these instructions into memory shall be handled by the CPU. Instructions shall permit programming timers in the "ON" or "OFF" delay modes. Timer programming shall also include the capability to interrupt timing without resetting the timers. Counters shall be programmable using up-increment and down-increment.

J. Timer instructions shall include selectable time bases in increments of 1.0 second and 10 milliseconds. The timing range of each timer shall be from 0 to 32,767 increments. It shall be possible to program and display separately the timer's preset and accumulated values.

K. The programmable controller shall use a signed integer format ranging from -32,768 to +32,767 for data storage of the counter preset and accumulated values.

L. The programmable controller shall store data in the following formats:

1. Signed Integer Numbers ranging from -32,768 to +32,767.

M. The programmable controller shall have support for integer signed math functions consisting of addition, subtraction, multiplication, divisions and square root,

N. When using modules such as analog where multiple channels are terminated on one module, it shall be possible to transfer the current status of all channels to the CPU upon execution of one program instruction. This instruction shall be bi-directional to include data transfer from the CPU to the module or from the module to the CPU.

O. Instructions shall be provided for grouping contiguous 16-bit data words into a file. The system shall address up to 256 files with up to 256 words per file. File manipulation instructions such as high speed "file copy" and "file fill", "file to file" move, "element to file" move, "file to element" move, and "first in-first out" shall be supported by the system. The four function math instructions and instructions for performing "logical OR!', "logical AND", "exclusive OR!', and comparison instructions such as "less than", "greater than", and "equal to" shall be included within the system. All instructions shall execute on either single words or files.

P. The system shall contain instructions which will construct synchronous 16-bit word shift registers. Additional instructions shall be provided to construct synchronous bit shift registers.

Q. The programmable controller shall have a jump instruction which will allow the programmer to jump over portions of the user program to a portion marked a matching label instruction.

R. In applications requiring repeatable logic rungs it shall be possible to place such rungs in a subroutine section. Instructions which call the subroutine and return to the main program shall be included, within the system. It shall be possible to program several subroutines and define each subroutine by a unique label. The processor will support nesting of subroutines up to eight levels deep. The program format as displayed on the CRT shall clearly define the main program and all subroutines.

S. The program format shall display all instructions on a CRT programming panel with appropriate mnemonics to define all data entered by the programmer, The system shall be capable of providing a "HELP" instruction which when called by the programmer will display on the CRT a list of instructions and all data required to enter an instruction into the system memory.

T. At the request of the programmer, data contained in system memory shall be displayed on the CRT programming panel. This monitoring feature shall be provided for input/output status, timer/counter data, files, and system status. Ladder logic rungs shall be displayed on the CRT with rung numbers in sequential order.

U. The system shall have the capability to enter rung comments above ladder logic rungs. These comments may be entered at the same time the ladder logic is entered.

V. The capability shall exist for adding, removing, or modifying ladder logic rungs during program execution. When changes to ladder logic are made or new logic rungs are added, it shall be possible to test the edits of such rungs before removal of the prior logic rung is executed.

W. It shall be possible to manually set (force) either on or off all hardwired input or output points or Analog values from the CRT programming panel or the main chassis front panel. Removal of these forced 1/0 points shall be either individually or totally through selected keystrokes. The programming terminal shall be able to display forced 1/0 points,

X. The execution of the program logic shall be accelerated by scanning the rung only until a positive decision as to the state of the outputs has been made. In many cases this will mean slopping over logic elements if the output condition has been predetermined.

Y. A means to program a fault recovery routine shall exist. When a major system fault occurs in the system, the fault recovery routine shall be executed and then the system shall determine if the fault has been eliminated. If the fault is eliminated, program execution resumes. If the fault still exists, the system will shut down.

Z. An interrupt routine shall be programmable such that the routine shall be executed regularly. The interval at which the routine is executed shall be user-specified in the range of 1 to 32767 milliseconds. This routine must be able to close an asynchronous control loop consisting of 32 Input points, 32 output points, 100 contact/coils, 10 addition instructions, 10 subtraction instructions and 32 circular comparison (Limit) instructions while never exceeding a 2-millisecond interval. The measurement of this interval is from the Input filter delay time to the time that the physical output transitions.

AA. The ability to program ladder logic via symbols from the global database of the programmable controller shall exist.

BB. An instruction shall be supported to incorporate closed loop control systems. The "proportional", "Integral", and "derivative" elements shall be accessible to the user in order to tune a closed loop system.

CC. The CPU shall support indexed addressing of inputs and outputs, along with all data table words (integer, binary, timers, and counters) for the software instruction set,

DD. The system shall support both bit and word level diagnostic instructions.

EE. To facilitate conditional event detection programming, output instructions shall include a "one shot" instruction which may be triggered on the low-to-high (rising) rung condition.

FF. The processor shall support Master Control Reset (Relay) type functionality to selectively disable sections of relay ladder logic.

GG. An interrupt routine shall be programmable such that the routines shall be executed based upon the input conditions of up to eight discrete hardware inputs in the processor chassis, The routine will be executed within 500 microseconds of the detection of the input signals. The 8 inputs will be repetitively examined/scanned within a 100-microsecond time period.

HH. Ladder logic shall feature full and detailed documentation. Each bit, rung, instruction, and block shall include written description of that item and details of its function in the control routine.

2.11 QUALITY REQUIREMENTS

A. The programmable controller processor shall be able to withstand conducted susceptibility tests as outlined in NEMA ICS 2-230.

2.12 TELEWORKER GATEWAY

A. Install Cisco Meraki Z3 cloud managed teleworker gateway, model Z3-HW-US on the PLC control panel. The PLC will plug into this switch. The Cox cable modem shall be mounted on top of the PLC control cabinet and will also plug into this switch.

END OF SECTION

SECTION 16950 - DESCRIPTION OF OPERATION

PART 1 - CONTROL SYSTEM CONFIGURATION

1.01 DESCRIPTION

A. The control system for the Old Stage Road Booster Pump Station consists of a motor control center, control panels, programmable logic controller (PLC), and instrumentation, all of which will be integrated to form a complete control system for the operation of the Facility.

B. All system and facility controls shall be input and output through the PLC.

C. The control system builder shall be located within a 75-mile radius of the facility, with a response time of 2-hours for consultation and prompt on-site service. The control system builder shall provide all necessary labor and accompanying travel for start up and adjustments and fine tuning of controls. The control system builder shall be on site during installation of the control panels and control system equipment.

D. The recommended Control System Builder shall be Systems East Inc. of Newport News, Virginia, ESSCO Sales of Chesapeake, Virginia, or Control Corporation of America of Richmond, Virginia.

1.02 MOTOR CONTROL CENTER / PUMP CONTROL PANEL

A. A motor control center (MCC) and control panels shall be provided as shown on the Drawings to house the main breaker for the facility circuit breakers, motor starters for the facility equipment, and an alarm annunciator and associated controls for the booster pump facility equipment.

B. Quality Assurance:

1. Regulations and Standards:

UL	Underwriters' Laboratories
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
ANSI	American National Standards Institute
IEEE	Institute of Electrical and Electronic Engineers
ISA	Instrument Society of America

2. All control panel components shall be of the most current and proven design. Specifications and Drawings call attention to certain features but do not purport to cover all details entering into the design of the control panels. The components provided by the panel supplier shall be compatible with the functions required and shall form a complete working system.

3. The control panel shall be UL listed as a complete assembly in accordance with UL-508.

1.03 SUBMITTALS

A. Shop Drawings: Submit detailed shop drawings on the pump control panel. Shop drawings shall be complete in all respects and shall include a complete bill of material, catalog information, descriptive literature of all components, wiring diagrams, programmable controller software, and panel layout drawings showing dimensions to all devices.

B. Operation and Maintenance Manuals: Prepare and Submit Operation and Maintenance (O&M) Manuals for the pump control panel in accordance with Section 01781 – Operation and Maintenance Data/Manual. The O & M manual shall be complete in all respects and shall include all information provided in the shop drawings plus O & M literature, as-built wiring diagrams and a copy of the final PLC program. The final PLC program shall be furnished as a print-out and on a computer disk.

1.04 MEETINGS

A. The motor control center / pump control panel supplier and PLC/SCADA Programmer shall attend an initial kick-off meeting at the office of the Isle of Wight Division of Utility Services to review the SCADA System, MCC, pump controls, and the Variable Frequency Drives.

1.05 PROGRAMMABLE CONTROLLER

A. Programmable logic controllers (PLC) shall be located as shown on plans to provide automatic control and alarm monitoring for the Booster Pump Facility equipment. The PLC system provided shall be designed to interface with existing and proposed equipment as indicated on the Contract Drawings and as described below. All programming and interface shall be provided to accomplish all functions in description of operation section below.

B. The programmable controller will receive and output signals in response to the control logic programmed in the memory of the programmable controller.

C. The Control System Builder shall provide Modbus TCP-IP between the PLC and the County provided SCADA system for communications to remote sites. All PLC alarm, supervisory, and control points shall be connected to the SCADA system for remote control and monitoring from the SCADA control center and SCADA system at the elevated water storage tank. The Control System Builder shall coordinate with the County's SCADA system sub-consultant, Dorsett Controls, Inc. for all programming and hardware requirements between the PLC and SCADA system.

D. All controls and monitoring, including environmental, shall function through the PLC.

PART 2 - DESCRIPTION OF OPERATION

2.01 BOOSTER PUMPS

A. The Booster Pump Facility will be equipped with two (2) 50 HP Booster Pumps. The two (2) Booster Pumps are Patterson horizontal split case potable water pumps.

B. The two (2) booster pumps will be controlled by the individual H/O/A selector switches located in the MCC. The "hand" and "off" positions of the H/O/A switches provide manual start/stop control of the pumps. The "hand" position by-passes the PLC control and is directed to starter/VFD. When the H/O/A switches are in the "auto" position, the booster pumps will be automatically controlled by the electronic pressure transducer on the discharge piping, the liquid level transmitter in the off-site elevated storage tank, and the programmable controller as follows:

1. The two (2) booster pumps shall have variable frequency drives (VFD).

2. The "ramp up", ramp down", and operating speed of each booster pump shall be programmable through the VFD and controlled by the PLC program.

3. The two (2) Booster Pumps shall operate in an alternating sequence.

4. In no case shall both booster pumps operate at the same time.

C. Booster pump on/off status shall be controlled by the level transmitter in the off-site elevated storage tank. Primary/Secondary and On/Off level settings for the booster pumps will be determined by the Owner at the time of start up and programmed by the Contractor.

D. Booster pump operation shall lockout when liquid level in the off-site elevated storage tank is at "booster pump lockout" level setting based on input to the PLC from the level transmitter. "Booster pump lockout" level will be determined by the Owner at the time of start up and programmed by the Contractor. Individual pump lockouts shall be provided for the booster pumps.

E. Booster pump operation shall restart (after lockout) when liquid level in the off-site elevated storage tank is at "booster pump restart" level based on input to the PLC from the pressure transmitter. "Booster pump restart" level will be determined by the Owner at the time of start up and programmed by the Contractor. Individual pump start levels shall be provided for booster pumps.

F. Station flow shall be monitored by the PLC through input from the flow meter discharging to the off-site elevated storage tank.

G. The VFD's shall be programmed such that the nameplate amperage rating of each pump will not be exceeded.

H. PLC programming shall be such that if any one pump fails to start, the next pump in sequence starts.

I. The booster pumps shall be provided with a "Lead Pump No. 1/Alternate /No. 2" selector switch to allow the operator to select automatic alternation of the pumps or to select Pump No. 1 or Pump No. 2 as the lead pump. This switch shall have two normally open contacts that shall be wired to the programmable controller.

2.02 WATER STORAGE TANKS

A. The level transmitter at the off-site elevated water storage tank shall measure liquid level with input being transmitted to the PLC to indicate storage tank level. The control set points will be determined by the Owner at the time of start up and programmed by the Contractor.

2.03 PUMP CONTROL

A. The booster pump VFDs shall be programmed for Accel and Decel as directed by the Owner at startup. Booster pump controls shall be programmed such that on/off level set points are satisfied for a County approved run time period and on/off sequence.

2.04 PROGRAMMABLE CONTROLLER INPUTS AND OUTPUTS

A. The programmable control inputs and outputs for the system will be wired to and from the PLC located in the Station Control Panel. The Contractor shall furnish and install all electrical and mechanical equipment and components necessary to obtain inputs and outputs as specified.

B. PLC inputs/outputs shall include, but not be limited to the below items, additional I/O may be required:

1. Digital Inputs (24 vdc):

	Description	Origination Point
(1)	Booster Pump No. 1 In Auto Mode	HOA Switch On MCC
(2)	Booster Pump No. 1 Run Status	Motor Starter In MCC
(3)	Booster Pump No. 1 Start Fail	Pump Control Panel
(3)	Booster Pump No. 1 Pump Fail	Check Valve Limit Switch
(4)	Booster Pump No. 1 Lead	Booster Pump No. 1/No. 2/Alternate Selector Switch
(5)	Booster Pump No. 2 In Auto Mode	HOA Switch On MCC
(6)	Booster Pump No. 2 Run Status	Motor Starter In MCC
(7)	Booster Pump No. 2 Start Fail	Pump Control Panel
(8)	Booster Pump No. 2 Pump Fail	Check Valve Limit Switch
(9)	Booster Pump No. 2 Lead	Booster Pump No. 1/No. 2/Alternate Selector Switch
(10)	24 Vdc Power On Primary	PLC Power Supply
(12)	Lamp Test P/B	MCC Instrumentation Panel
(13)	Alarm Reset P/B	MCC Instrumentation Panel
(14)	Control Room Door Open	Magnetic Door Switch
(15)	Control Room Roll-up Door Open	Magnetic Door Switch
(16)	Chemical Room Door Open	Magnetic Door Switch

(17)	Chemical Room Roll-up Door Open	Magnetic Door Switch
(18)	Utility Power Available	Generator Transfer Switch
(19)	Station On Emergency Power	Generator Transfer Switch
(20)	Generator Set Run Status	Generator Control Panel
(21)	Generator Set Failure	Generator Control Panel
(22)	3-Phase Monitor Power Fail	Transfer Switch
(23)	Man in Station P/B	MCC Instrumentation Panel
(24)	Booster Pump No. 1 Motor Overtemperature	Booster Pump No. 1 Overtemperature Switch
(25)	Booster Pump No. 1 Bearing Overtemperature	Booster Pump No. 1 Bearing Overtemp. Switch
(26)	Booster Pump No. 2 Motor Overtemperature	Booster Pump No. 1 Overtemperature Switch
(27)	Booster Pump No. 2 Bearing Overtemperature	Booster Pump No. 1 Bearing Overtemp. Switch

2. Analog Inputs (4-20 mA):

	Description	Origination Point
(1)	Off-site Elevated Storage Tank Level	Storage Tank Level Transmitter Via SCADA System
(2)	Station Discharge Line Pressure	Discharge Line Electronic Pressure Transmitter
(3)	Station Flow	Flow Meter Chemical Injection Manhole
(4)	Booster Pump No. 1 VFD speed	Booster Pump No. 1 VFD
(5)	Booster Pump No. 2 VFD speed	Booster Pump No. 2 VFD

3. Digital Outputs (120 Vac):

	Description	Destination Point

(1)	Booster Pump No. 1 Start/Stop	Motor Control Circuit In MCC
(2)	Booster Pump No. 1 Run P/L	Alarm Annunciator In VFD
(3)	Booster Pump No. 1 Fail P/L	Alarm Annunciator In VFD
(4)	Booster Pump No. 2 Start/Stop	Motor Control Circuit In MCC
(5)	Booster Pump No. 2 Run P/L	Alarm Annunciator In VFD
(6)	Booster Pump No. 2 Fail P/L	Alarm Annunciator In VFD
(7)	24 Vdc Primary Fail P/L	Alarm Annunciator Light In Control Panel
(8)	PLC Fail P/L	Alarm Annunciator Light In Control Panel
(9)	Generator Start/Stop	Generator Control Panel
(10)	Communication Fail P/L	Alarm Annunciator Light In Control Panel
(11)	Control Power Normal P/L	Alarm Annunciator Light In Control Panel
(12)	Discharge Pressure High P/L In Control Panel	Alarm Annunciator Light
(13)	Discharge Pressure Low P/L In Control Panel	Alarm Annunciator Light
(14)	Man in Station P/L In Control Panel	Alarm Annunciator Light
(15)	Man in Station Horn In Control Panel	Alarm Annunciator Horn
(16)	Control Room Door Open	Alarm Annunciator Light
(17)	Control Room Roll-up Door Open	Alarm Annunciator Light
(18)	Chemical Room Door Open	Alarm Annunciator Light
(19)	Chemical Room Roll-up Door Open	Alarm Annunciator Light

(20)	Booster Pump No. 1 Motor Overtemperature	Alarm Annunciator Light
(21)	Booster Pump No. 1 Bearing Overtemperature	Alarm Annunciator Light
(22)	Booster Pump No. 1 Flow Fail	Alarm Annunciator Light
(23)	Booster Pump No. 2 Motor Overtemperature	Alarm Annunciator Light
(24)	Booster Pump No. 2 Bearing Overtemperature	Alarm Annunciator Light
(25)	Booster Pump No. 2 Flow Fail	Alarm Annunciator Light

4. Analog Outputs (4-20mA)

	Description	Destination Point
(1)	Booster Pump No. 1 Speed Control	Booster Pump No. 1 VFD
(2)	Booster Pump No. 2 Speed Control	Booster Pump No. 2 VFD
(3)	Off-site Elevated Storage Tank Level	Control Panel Annunciator Digital Display Via SCADA System
(4)	Station Discharge Line Pressure	Control Panel Annunciator Digital Display
(5)	Station Flow	Control Panel Annunciator Digital Display

END OF SECTION

APPENDIX A

Statement of Special Inspections

Appendix A

HAMPTON ROADS AREA STATEMENT OF SPECIAL INSPECTIONS

PROJECT

Route 10 Water Main Extension and Pump Station

Isle of Wight County

PERMIT APPLICANT

PRIMARY RDP OF RECORD

Timmons Group

2901 S Lynnhaven Road, Suite 200

Virginia Beach, Virgina 23452

STRUCTURAL ENGINEER OF RECORD

This Statement of Special Inspections is submitted as a condition for permit issuance in accordance with the International Building Code (IBC) as stated in the Virginia Uniform Statewide Building Code (USBC). It includes a Schedule of Special Inspections applicable to this project as well as the name of the Special Inspector, and the identity of other testing laboratories or agencies intended to be retained for conducting these inspections or tests.

The Special Inspector shall keep records of all inspections, and shall furnish inspection reports to the Building Official, appropriate Registered Design Professional(s) (RDP(s)), Owner and Contractor. All discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and appropriate RDP(s). Interim reports shall be submitted to the Building Official, Owner, Contractor, and the appropriate RDP(s) according to the *Hampton Roads Regional Special Inspection Guidelines and Procedures*.

Jobsite safety is solely the responsibility of the contractor. Materials and activities to be inspected are not to include the contractor's equipment and methods used to erect or install the materials listed. **All fees/costs related to the performance of Special Inspections shall be the responsibility of the Owner. Additionally, the undersigned (RDP or SER) are only acknowledging that the items enumerated on the Schedule of Special Inspections are consistent with the required design elements, the applicable sections of the Uniform Statewide Building Code, and their area of expertise.**

REVIEW, AUTHORIZATION & ACCEPTANCE

Permit Applicant *(General Contractor)***:**

Signature / date:

Printed Name:

Owner's Authorization:

Signature / date:

Printed Name: Isle of Wight County c/o Donald Jennings, P.E.

Signature / date:

Printed Name: Town of Smithfield c/o Jack Reed

Primary RDP of Record:(Review and Acceptance of Schedule)

Signature / date:

Printed Name: Timmons Group c/o Kenneth Turner, P.E.

SER of Record:(Review and Acceptance of Schedule)

Signature / date:

Printed Name:

Building Official's Acceptance: Signature / date:

Printed Name:

SCHEDULE OF SI PREPARED BY:

Virginia RDP Seal of SSI Preparer

Printed Name of the Preparer of the Schedule (on line above)

Special Inspector:

Signature / date:

Printed Name:

SI Company Name:

SCHEDULE OF SPECIAL INSPECTIONS

MATERIAL/ACTIVITY	TYPE OF INSPECTION	APPLICABLE TO THIS PROJECT			
		Y/C/P/N	EXTENT/REFERENCE	AGENT	COMPLETED
GENERAL					
Pre-construction conference	Meeting with parties listed in Section 6 of HRRSIGP to discuss Special Inspection procedures	Y	Scheduled by SI with the Contractor prior to commencement of work; VCC 113.4	1, 2, and 4	
EARTHWORK					
Site preparation (structure)	Field testing and inspection	Y/P	Field Review; VCC 1705.6	2	
Fill material (structure)	Review submittals, field testing and inspection	Y/P	Field Review; VCC 1705.6	2	
Fill compaction (structure)	In-place density tests, lift thickness	Y/C	Field Review; VCC 1705.6	2	
Excavation	Field inspection and verification of proper depth	Y/P	Field Review; VCC 1705.6	2	
Foundation sub-grade (structure)	Field inspection of foundation subgrade prior to placement of concrete	Y/P	Field Review; VCC 1705.6	2	
DEEP FOUNDATION ELEMENTS					
Materials	Review product, sizes, and lengths	Y	Submittal and Field Review; VCC 1705.7, 1705.8, 1705.9	1	
Test piles	Monitor driving of test piles	N	Field Review; VCC 1705.8, 1704.9 or 1704.10	2	
Installation	Monitor drilling, placement, plumbness, driving of piles, including recording blows per foot, cut off, and tip elevation	Y/P	Field Review; VCC 1705.2, 1705.3, 1705.7	2	
Load test	Monitor pile load test	N	Field Review; VCC 1705.8, 1704.9 or 1704.10	2	
CONCRETE					
Materials	Review product supplied versus certificates of compliance and mix design	Y	Submittal & Field Review; ACI 318: Ch. 19, 26.4.3, 26.4.4; VCC 1705.3, 1903.2, 1908.2, 1903.4	1	
Installation of reinforcing steel, including welding, as well as prestress tendons, anchor bolts, and fiber-reinforcement	Field inspection of placement	Y/C	Submittal and Field Review; ACI 318: Ch. 20, 25.2, 25.3, 26.5.1-26.5.3; AWS D1.4; VCC 1705.3, 1901.3, 1908.4	1 and 2	
Formwork installation	Field inspection	Y	Field Review; ACI 318; VCC 1705.3	1	
Concreting operations and placement	Field inspection of placement/sampling	Y/C	Field Review; ACI 318: 26.5.2, 26.12.3; ASTM C 172, C 31; VCC 1705.3, 1908.6, 1908.7, 1908.8, 1908.10	2	
Concrete curing	Field inspection of curing process	Y/P	Field Review; ACI 318: 26.5.3, 26.5.4; VCC 1705.3, 1908.9	1 and 2	
Concrete strength	Evaluation of concrete strength	Y/P	Laboratory Testing; ACI 318: 26.12; VCC 1705.3	2	

MATERIAL/ACTIVITY	TYPE OF INSPECTION	APPLICABLE TO THIS PROJECT			
		Y/C/P/N	EXTENT/REFERENCE	AGENT	COMPLETED
Application of forces for prestressed concrete	Field inspection	N	Field Review; ACI 318: 26.10.2 (c); VCC 1705.3	1	
Grouting of prestress tendons	Field inspection	N	Field Review; ACI 318: 19.4.1, 20.6.4, 26.13.3.2(b); VCC 1705.3	2	
PRECAST CONCRETE					
Verify fabrication/quality control procedures	In-plant inspection of fabrication/quality control procedures**	Y	Submittal or Field Review; VCC 1705.3	1	
Erection and installation	Review submittals and as-built assemblies; Field inspection of in-place precast	Y	Submittal and Field Review; ACI 318; VCC Table 1705.3	1	
MASONRY (Level_____; Building Risk Category ____)					
Materials	Review of products supplied versus certificate of compliance and material submitted	N	Submittal & Field Review; ACI 530/ASCE 5; ACI 530.1/ASCE 6; VCC 1705.4, 1709	1	
Strength	Testing/review of strength	N	Submittal & Field Review; ACI 530/ASCE 5; ACI 530.1/ASCE 6; VCC 1705.4, 2105.	2	
Mortar and Grout	Inspection of proportioning and mixing. Placement of mortar only.	N	Submittal & Field Review; VCC 1705.4; ACI 530/ASCE 5; ACI 530.1/ASCE 6	2	
Grout placement, including prestressing grout	Verification to ensure compliance	N	Field Review; VCC 1705.4; ACI 530/ASCE 5; ACI 530.1/ASCE 6	2	
Grout space	Verification to ensure compliance	N	Field Review; VCC 1705.4; ACI 530/ASCE 5; ACI 530.1/ASCE 6; TMS 602	2	
Mortar, grout, and prism specimens	Observe Preparation	N	Field Review; VCC 1705.4, ACI 530.1; ASCE 6	2	
Reinforcement, prestressing tendons, and connections	Inspect condition, size, location, and spacing	N	Field Review; VCC 1705.4; ACI 530/ASCE 5; ACI 530.1/ASCE 6	1	
Welding of reinforcing bars	Inspection and testing of welds	N	Field Review; VCC 1705.3.1, 1705.4; ACI 530/ASCE 5; ACI 530.1/ ASCE 6	2	
Prestressing force	Verify application and measurement	N	Field Review; VCC 1705.4; ACI 530/ASCE 5; ACI 530.1/ASCE 6	1	
Protection	Inspect procedures for protection during cold and hot weather	N	Field Review; VCC 1705.4; ACI 530/ASCE 5; ACI 530.1/ASCE 6	1 and 2	
Anchorage	Inspection of anchorages	N	Field Review; VCC 1705.4;ACI 530.1/ASCE 6; ACI 530/ASCE 5	1	
Masonry installation	Inspection of placement of masonry and joints	N	Field Review; VCC 1705.4; ACI 530/ASCE 5; ACI 530.1/ASCE 6	1 and 2	
STRUCTURAL STEEL					
Verify fabrication/quality control procedures	In-plant inspection of fabrication/quality control procedures** or submit Certificate of Compliance	Y	Submittal or Field Review; VCC 1704.2.5, 1704.2.5.1, 1705.2	1	
Bolts, nuts, and washers – materials	Material identification markings; Review of Certificate of Compliance	Y	Submittal & Field Review; VCC 1705.2.1, 1706; ASTM; AISC 360, Section A3.3	1	

MATERIAL/ACTIVITY	TYPE OF INSPECTION	APPLICABLE TO THIS PROJECT			
		Y/C/P/N	EXTENT/REFERENCE	AGENT	COMPLETED
Bolts, nuts, washers – installation	Inspection of in-place high-strength bolts, snug-tight joints, pre-tensioned and bearing type, and slip critical connections	Y	Submittal & Field Review; VCC 1705.2.1, 2204.2; AISC 360 Section M2.5	1 or 2	
Structural steel – materials	Material identification markings and review of Certificate of Compliance	Y	Submittal & Field Review; VCC 1705.2.1, 1706; ASTM A6, A568; AISC 360 Section A3.1	4	
Structural steel details – installation	Inspection of member locations, structural details for bracing, connections, and stiffening	Y	Submittal & Field Review; VCC 1705.2.1, 1705.2.2, AISC 360	1 and 2	
Open-web steel joists and joist girders – installation	Inspection of end connections and bridging	N	Submittal & Field Review; VCC 1705.2.3	1 and 2	
Weld filler materials and welder certification	Review of identification markings, certificate of compliance, and welder certifications	N	Submittal & Field Review; ASTM; AISC 360 A3.5	4	
Welds	Inspection and testing of welds	N	Field Review; VCC 1705.2, 2204.1; AWS D1.1, D1.3	4	
Cold-formed metal deck – materials	Review of identification marking manufacturer's certified test results	N	Submittal & Field Review; VCC 1705.2.2; ASTM	1	
Cold-formed metal deck – installation	Review laps and welds	N	Submittal & Field Review; IBC 1705.2.2, AWS D1.3	1 and 2	
Cold-formed light frame construction – welds	Review welding operation	N	Field Review; VCC 1705.11, 1705.11.2, 1705.11.3	2	
Cold form light frame construction wind resistance – screws	Review screw attachment bolting, anchoring hold downs, bracing, diaphragms, struts	N	Field Review; VCC 1705.11, 1705.11.2, 1705.11.3	1	
Cold-formed steel trusses spanning 60' or greater	Inspection of temporary and permanent restraints/bracing	N	Submittal & Field Review; VCC 1705.2.4	1	
WOOD					
Verify fabrication/quality control procedures	In-plant inspection of fabrication/quality control procedures** or submit Certificate of Compliance	N	Submittal or Field Review; VCC 1704.2.5, 1704.2.5.1, 1705.5	1	
Metal plate connected wood/metal trusses spanning 60' or more	Review approved submittal and installation of restraint/bracing	N	Submittal & Field Review; VCC 1704.2.5, 1704.2.5.1, 1705.5, 1705.5.2	1	
Joist Hangers – Materials/Installation	Review manufacturer's material and test standards,	N	Field Review; ASTM D 1761	1	
High-Load Diaphragms - Installation	Review submittal and as-built assemblies; Inspection of sheathing, framing size, nail and staple diameter and length, number of fastener lines, and fastener spacing.	N	Submittal & Field Review; VCC 1705.5, 1705.5.1	1	
Wood Shear Walls – installation	Review nailing, bolting, anchoring, fastening, diaphragms, struts, braces, and hold downs when fasteners are $\leq$ 4" on center.	N	Field Review; VCC 1705.11.1	1	

MATERIAL/ACTIVITY	TYPE OF INSPECTION	APPLICABLE TO THIS PROJECT			
		Y/C/P/N	EXTENT/REFERENCE	AGENT	COMPLETED
MAIN WIND FORCE RESISTING SYSTEM					
Wind requirements	Review of the system components and installation for wood construction, cold-formed steel light frame construction, components, and cladding	N	Submittal & Field Review; VCC 1609.1.2, 1704.6.2, 1705.11, 1709	1	
SEISMIC FORCE RESISTING SYSTEMS					
Seismic requirements	Review of the designated seismic systems and seismic force resistance systems	N	Submittal & Field Review; VCC 1613, 1704.6.1, 1705.12, 1705.13; ASCE 7	1	
SMOKE CONTROL					
Special Inspection of smoke control systems	Leakage testing and recording of device location; pressure difference testing, flow measurement and detection, and control verification	N	Field Review; VCC 1705.18, 1705.18.1, 1705.18.2	3	
SPRAYED FIRE RESISTIVE MATERIAL, FIRE RESISTANT PENETRATIONS; JOINTS, MASTIC AND INTERMESCENT FIRE RESISTANT COATING					
Structural member surface conditions	Field review of surface conditions prior to application	N	AWCI 12-B; VCC 1705.14, 1705.14.1, 1705.14.2	2	
Application/thickness/density/bond strength	Field review of application operations, thickness, and density	N	ASTM E605, AWCI 12-B; VCC 1705.14.1, 1705.14.2, 1705.14.3, 1705.14.4, 1705.14.5, 1705.14.6	2	
Mastic & Intumescent Fire Resistant Coating	Field review of application operations and thickness	N	AWCI 12-B; VCC 1705.15	2	
EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS)					
Application	Field Review of application/installation	N	ASTM E2570, VCC 1705.16	2	
SPECIAL CASES					
Retaining Walls	Field review of installation of pre-manufactured structural components	N	Field Review; VCC 113.4, 1705.1.1	1 or 2	
Sprinkler system hangers/supports	Field review of placement and anchorage	N	Field Review; VCC 903.3.1.1, 1705.1.1; NFPA 13: 9.2	1 or 2	
Alternative Materials and Systems	As requested by Building Official, review system and installation	N	VCC 113.4, 1705.1.1	1 or 2 or 3	

INSPECTION AGENTS	FIRM	ADDRESS	TELEPHONE
1. Special Inspector:			
2. Materials and Testing Laboratory:	GET Solutions, Inc.	5465 Greenwich Rd, Virginia Beach, VA 23462	(757) 518-1703
3. Special Inspector Smoke Control System:	N/A	N/A	N/A
4. (Additional Agents)			

Note: * The Qualifications of the Special Inspector and Testing Laboratories are subject to the Approval of the Building Official.
** Inspection of quality control procedures required only if fabricator is not regularly inspected by an Approved independent inspection agency.
***For construction projects in seismic regions, the Schedule of Special Inspections shall be expanded to include Architectural, Mechanical, and Electric components, as well as Storage Racks and Isolation Systems. Items in VCC Section 1705.12

FINAL REPORT OF SPECIAL INSPECTIONS

PROJECT

_____
_____
_____
_____

PERMIT APPLICANT

_____
_____
_____
_____

PRIMARY RDP OF RECORD

_____
_____
_____

STRUCTURAL ENGINEER OF RECORD

_____
_____
_____

To the best of my information, knowledge, and belief, the Special Inspections required for this project, and itemized in the Statement of Special Inspections submitted for permit, have been completed. Attached to this final report are the Certificates of Compliance for shop fabricated load bearing members and assemblies. (Include this statement only if applicable).

Interim reports submitted prior to this final report, and numbered _____ to _____, form a basis for, and are to be considered an integral part of this final report.

Respectfully submitted,

_____
Signature

_____
Date

_____
Type or Print Name **(Agent 1)**

Seal of SI

Upon completion of all Special Inspections and testing, the SI shall submit a Final Report of Special Inspections to Building Official for review and approval. The Building Official review and approval is required prior to final building inspection approval or issuance of a Certificate of Occupancy.

APPENDIX B

Old Stage Road Booster Pump Station SWPPP

OLD STAGE ROAD BOOSTER PUMP STATION

Isle of Wight County, Virginia

Stormwater Pollution Prevention Plan (SWPPP)

In compliance with:

General VPDES Permit for Discharges of Stormwater from Construction Activities
General Permit No. VAR10
Virginia Stormwater Management Program (VSMP)

Prepared By:

Timmons Group
2901 S Lynnhaven Road, Suite 200
Virginia Beach, VA 23452

Prepared For:

Isle of Wight County
17090 Monument Cir #138
Isle of Wight, VA 23397

March 2022

Timmons Group QA/QC
Prepared By: Gina Huang
Checked By: Ken Turner

OLD STAGE ROAD BOOSTER PUMP STATION

Isle of Wight County, Virginia

Stormwater Pollution Prevention Plan (SWPPP)

In compliance with:

General VPDES Permit for Discharges of Stormwater from Construction Activities
General Permit VAR10
Virginia Stormwater Management Program (VSMP)

SWPPP Coordinator:

_____
(Signature)

_____
(Name of Person)

_____
(Title)

_____
(Company)

_____
(Phone #)

_____
(Responsible Land Disturber #)

"I certify under penalty of law that I have read and understand this document in accordance with the General VPDES Permit for Discharges of Stormwater from Construction Activities. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

OLD STAGE ROAD BOOSTER PUMP STATION

Stormwater Pollution Prevention Plan

TABLE OF CONTENTS

I Introduction

A) Plan Purpose

This Stormwater Pollution Prevention Plan (Plan) has been developed as a requirement of the Virginia Stormwater Management Program (VSMP) General VPDES Permit for Discharges of Stormwater from Construction Activities (Permit), as defined in 9VAC25-880. The purpose of this Plan is to:

1) Identify potential sources of pollution that may reasonably be expected to affect the quality of stormwater discharges from the construction site, and,

2) To describe and ensure the implementation of practices that will be used to reduce pollutants in stormwater discharges from the construction site and to assure compliance with the conditions of the Permit.

Implementation of the components of this Plan is required as a condition of the Permit (Appendix A). DEQ is the regulatory authority overseeing the implementation of this Plan via the VSMP program.

B) Background - Construction General Permit No. VAR10

The Permit has a fixed term of 5 years from the effective date of July 1, 2019 and is required for all projects that will disturb 1 or more acres of total land area. To obtain a Permit, operators must submit a Registration Statement (Appendix B) prior to commencing construction activities (clearing, grading, or other activities that result in soil disturbance). A Registration Statement is considered to be submitted once it is postmarked.

The Permit authorizes the discharge of stormwater from construction activities until the Permit's expiration date. The Permit also authorizes the discharge of stormwater from offsite support activities, provided that certain conditions are met as outlined in the Permit. Certain non-stormwater discharges are also authorized by the Permit provided the conditions contained in the Permit are met.

Once a definable area has been stabilized, the operator may mark this on the SWPPP and no further SWPPP or inspection requirements apply to that portion of the site (e.g., earth disturbing activities around one of three buildings in a complex are done and the area is finally stabilized; one mile of a roadway or pipeline project is done and finally stabilized, etc.).

A Notice of Termination (Appendix C) shall be submitted to the Department when: final stabilization has been achieved, another operator has assumed control areas which have not reached final stabilization and obtained coverage for the discharges, coverage under an alternative VPDES or state permit has been obtained, or a residential construction site has reached temporary stabilization and the residence has transferred to the homeowner. The Notice of Termination must be submitted within 30 days of site stabilization. Authorization to discharge terminates at midnight on the date that the Notice of Termination is submitted.

II Plan Requirements

A) General Requirements

1) Deadlines

The Plan shall be prepared prior to the submittal of the Registration Statement and shall provide for compliance with the terms and schedule of the Permit beginning with the initiation of construction activities.

2) Incorporation of Other Plans

The Plan requirements of the Permit are satisfied by incorporating by reference other plans developed for this construction activity, *provided that the other plans meet or exceed the requirements of Part II.A. of the Permit*. The construction plans developed for this project, Old Stage Road Booster Pump Station, have been approved by all local authorities having jurisdiction. The construction plans meet current plan approving authority requirements regarding erosion and sediment control and stormwater management, and also comply with State regulatory requirements as presented in the Virginia Erosion and Sediment Control Handbook, Third Edition. All plans incorporated by reference into the Plan are enforceable under the Permit.

3) Plan Administration

The Plan shall be certified in accordance with the Permit (the certification statement is presented in the beginning of this Plan). Copies of the Plan shall be kept on-site and be made available to the Department, or other regulatory agencies having authority, upon request. The Plan must also be available to all operators identified as having responsibilities to carry out provisions contained in the Plan. The active, up-to-date SWPPP for each site must be made publicly available upon request by the public. Access to the SWPPP may be arranged upon request at a time and publicly accessible location convenient to the operator but shall be no less than one per month and shall be during normal business hours. If a copy of the SWPPP is provided to the requestor, the requestor shall be responsible for the costs of reproduction. The active SWPPP can be made accessible electronically. The website address or contact person for access to the SWPPP shall be posted conspicuously near the main entrance of the construction entrance along with the permit coverage letter and registration number for the construction activity.

4) Plan Updates

The Plan shall be amended whenever there is a change in design, construction, operation, or maintenance of the construction site that has a significant effect on the potential for the discharge of pollutants to surface waters and that has not been addressed in the normal implementation of the Plan. The Plan shall also be updated whenever it is found to be ineffective in meeting the requirements of the Permit. In

the event the Department notifies the permittee that the Plan does not meet one or more of the provisions of the Permit, within a period of 7 days the permittee must make the required changes to the Plan and submit a certification to the Department stating that the required changes have been made.

5) Potential Construction Site Stormwater Pollutants:

The plan is focused upon limiting the pollution potential from the following:

Table 1
Potential Construction Site Stormwater Pollutants

Trade Name Material	Chemical/Physical Description	Stormwater Pollutants
Pesticides (insecticides, fungicides, herbicides, rodenticides)	Various colored to colorless liquid, powder, pellets, or grains	Chlorinated hydrocarbons, organophosphates, carbamates, arsenic
Fertilizer	Liquid or solid grains	Nitrogen, phosphorous
Plaster	White granules or powder	Calcium sulphate, calcium carbonate, sulfuric acid
Cleaning solvents	Colorless, blue, or yellow green liquid	Perchloroethylene, methylene chloride, trichloroethylene, petroleum distillates
Asphalt	Black solid	Oil, petroleum distillates
Concrete	White solid	Limestone, sand
Glue, adhesives	White or yellow liquid	Polymers, epoxies
Paints	Various colored liquid	Metal oxides, Stoddard solvent, Talc, calcium carbonate, arsenic
Curing compounds	Creamy white liquid	Naphtha
Wastewater from construction equipment washing	Water	Soil, oil & grease, solids
Wood preservatives	Clear amber or dark brown liquid	Stoddard solvent, petroleum distillates, arsenic, copper, chromium
Hydraulic oil/fluids	Brown oily petroleum hydrocarbon	Mineral oil
Gasoline	Colorless, pale brown or pink petroleum hydrocarbon	Benzene, ethyl benzene, toluene, xylene, MTBE
Diesel Fuel	Clear, blue-green to yellow liquid	Petroleum distillate, oil & grease, naphthalene, xylenes
Kerosene	Pale yellow liquid petroleum hydrocarbon	Coal oil, petroleum distillates
Antifreeze/coolant	Clear green/yellow liquid	Ethylene glycol, propylene glycol, heavy metals (copper, lead, zinc)
Erosion	Solid Particles	Soil, Sediment

B) Specific Requirements

1) Site Description

The items required by the Permit regarding the general information (Part II A.1., Appendix A) can be found in the project design plans, Old Stage Road Booster Pump Station, which is incorporated by reference into this Plan. A summary of the required elements is provided in Table 1, with a reference to the sheet number in the design plans where the required element can be located:

Table 1.
Site Description Elements
Please refer to the referenced location in Isle of Wight County or as referenced elsewhere

Permit Part II B. 1….	***Required Element***	***Location[1,2]***
a.	A signed copy of the registration statement, if required, for coverage under the general VPDES permit for discharges of stormwater from construction activities.	Appendix B
b.	A copy of the notice of coverage under the general VPDES permit for discharges of stormwater from construction activities. (Upon receipt)	Appendix B
c.	A copy of the general VPDES permit for discharges of stormwater from construction activities. (Upon receipt)	Appendix B
d.	A narrative description of the nature of the construction activity, including the function of the project: This project includes a water booster pump station installation. The booster pump station will allow the proposed water main (separate project) to provide water to the Hardy Elementary School water storage tank and provide water service to the school site. Total land disturbance of the project is 0.35 acres.	Appendix F: Sheet C-3
e	A legible site map identifying:	
e.(1)	- Directions of stormwater flow and approximate slopes anticipated after major grading activities Grading and drainage are contained within the plan set and in the narrative. Grading and drainage characteristics will not change extensively throughout the project area with a slight flattening of the pump station site and 3:1 or flatter slopes for a maximum of 2' of elevation drop. Trees will be cleared in a portion of the 0.35 ac disturbance. A landscaping plan is included that incorporates planting, a mulch bed, and a lawn area around the booster pump station. Grading and stormwater will follow the existing flow directions and continue to leave the site as sheet flow. Efforts have been made to honor natural drainage divides and maintain low runoff coefficients within the post-construction conditions for this project.	Appendix F: Sheets C-1 – C-2
e.(2)	- Limits of land disturbance including steep slopes and natural buffers around surface waters that will not be disturbed This project will disturb 0.35 acres. The approximate limits of disturbance for this project are depicted on Sheets C-1 – C-2 and in the narrative on Sheet C-3. No soil disturbance	Appendix F: Sheet C-1 – C-3

	shall occur outside these limits unless approved by a variance or an alternate Erosion and Sediment Control Plan.	
e.(3)	- Locations of major structural and nonstructural control measures The control measures to be used in this project include construction entrance, wire supported silt fence, check dam, mulching, and temporary and permanent seeding. The locations of these devices are shown on Sheets C-1 – C-2. Detail drawings of these devices are located on Sheets C-3 as well as in the Virginia Erosion and Sediment Control Handbook.	Appendix F: Sheets C-1 – C-2
e.(4)	- Locations of surface waters This project includes disturbance draining to waters of the U.S. surface water – the surface water features that drain to the Pagan River and flow into the James River as depicted in the Vicinity Map in Appendix B.	Appendix B: Vicinity Map
e.(5)	- Locations where concentrated stormwater is discharged No concentrated water flows across the site – the entire area has sheet flow. Drainage/Grading plans are located on Sheets C-1 – C-2. Stormwater shall be discharged through the proposed E&S measures prior to flowing overland as sheet flow from the site. In accordance with MS-19 properties, waterways downstream from the development site shall be protected from sediment deposition, erosion and damage due to increases in volume, velocity and peak flow rate of stormwater runoff.	Appendix F: Sheets C-1 – C-2
e.(6)	- Locations of any support activities, including (i) areas where equipment and vehicle washing, wheel wash water, and other wash water is to occur; (ii) storage areas for chemicals such as acids, fuels, fertilizers, and other lawn care chemicals; (iii) concrete wash out areas; (iv) vehicle fueling and maintenance areas; (v) sanitary waste facilities, including those temporarily placed on the construction site; and (vi) construction waste storage.	Appendices G and H
e.(7)	- When applicable, the location of the on-site rain gauge or the methodology established in consultation with the VSMP authority used to identify measurable storm events for inspection as allowed by Part II G 2 a (1) (ii) or Part II G 2 b (2).	N/A

[1]Attach to this Plan any required elements that are not found in the design plans.
[2] The Stormwater Pollution Prevention Plan coordinator is responsible for updating the plan as necessary to maintain compliance

2) Controls and Measures

The Permit requires the implementation of various types of controls and measures that are implemented to control pollutants in stormwater discharges from the project site. The Permit specifically requires the implementation of erosion and sediment control practices (both structural and non-structural), stormwater management practices, and specific other controls to reduce pollutants. All E & S and SWM/BMP controls employed in this project were selected to meet and/or exceed State and local requirements and are detailed in the referenced design plans.

Several requirements of the Permit relating to controls (Part II.B., Appendix A) are not included in the referenced design plans. A description of all the required items (including E&S and SWM/BMP) is presented below, along with how they are addressed in this Plan:

a) Erosion and Sediment Control

The design plans for this project, Old Stage Road Booster Pump Station, contain detailed information regarding erosion and sediment controls used in this project. Specifically, E&S control measures can be found on Sheets C-1 – C-2.

b) SWM/BMP's

(i) The design plans and narrative for this project, Old Stage Road Booster Pump Station, contain detailed information regarding this project as a SWM/BMP control. Specifically Stormwater Management Control Measures are discussed in the narrative and on Sheet C-3. Nutrient credits will be purchased to meet the requirement nutrient reductions and no BMPs will be installed on site.

(ii) Water quality protection. The operator must select, install, implement and maintain best management practices (BMPs) at the construction site that minimize pollutants in the discharge as necessary to meet applicable water quality standards. Impervious area is being reduced on the pump station site and the VRRM sheets in the narrative indicate that further TP load reduction is not required. Where a TMDL waste load allocation (WLA) has been established for pollutants that could be contained in the construction site stormwater runoff the operator must develop a plan consistent with the requirements related to TMDLs contained in Section II B 5. Waters that have been identified as impaired in the 2016 § 305(b)/303(d) Water Quality Assessment Integrated Report will require the operator to implement a strategy consistent with the control measures in Sections II B 5. If there is evidence indicating that the stormwater discharges authorized by this permit are causing, have the reasonable potential to cause, or are contributing to an excursion above an applicable water quality standard, or are causing downstream pollution (as defined in § 62.1-44.3 of the Code of Virginia), the board may take appropriate enforcement action. The VSMP authority may require the operator to: modify or implement additional controls in accordance with Part II B to adequately address the identify water quality concerns; submit valid and verifiable data and information that are representative of ambient conditions and indicate that the receiving water is attaining water quality standards; or submit an Individual permit application in accordance with 9 VAC 25-870-410 B 3.

(iii) Impaired water(s), approved TMDL(s), pollutant(s) of concern, and exceptional waters identified in 9VAC25-260-30 A 3 c must be identified. The operator shall ensure: permanent or temporary soil stabilization shall be applied to denuded areas within seven days after final grade is reached on and portion of

the site; nutrients shall be applied in accordance with manufacturer's recommendations or an approved nutrient management plan and shall not be applied during rainfall events; and a modified inspection schedule shall be implemented in accordance with the Permit.

c) Fuels and Oils

(i) On-site vehicle refueling will be conducted in a dedicated location away from access to surface waters. Since the location of fueling activities will periodically move during construction, the design plans do not contain a specific location. For each phase of work a location will be determined in the field and noted in the Site Inspection Log (Appendix D). Containment berms will be located adjacent to the refueling area that will contain any inadvertent spills until they can be cleaned up. Any on-site storage tanks will have a means of secondary containment. In the event of a spill, it will be cleaned up immediately and the material, including any contaminated soil, will be disposed of according to all federal, state, and local regulations.

(ii) All vehicles on site will be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage.

(iii) Petroleum products will be stored in tightly sealed containers which are clearly labeled.

(iv) Spill kits will be included with all fueling sources and maintenance activities.

(v) Any asphalt substances used onsite will be applied according to the manufacturer's recommendation.

d) Solid Waste

No solid materials shall be discharged to surface water. Solid materials, including building materials, garbage, and debris shall be cleaned up daily and deposited into dumpsters, which will be periodically removed from the site and legally deposited into a landfill.

e) Fertilizer

(i) Fertilizers will be applied only in the minimum amounts recommended by the manufacturer.

(ii) Fertilizers will be worked into the soil to limit exposure to stormwater.

(iii) Fertilizers will be stored in a covered shed and partially used bags will be transferred to a sealable bin to avoid spills.

f) Paint and other Chemicals

(i) All paint containers and curing compounds will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm sewers but will be properly disposed according to the manufacturer's instructions.

(ii) Spray guns will be cleaned on a removable tarp.

(iii) Chemicals used on-site are kept in small quantities and stored in closed containers undercover and kept out of direct contact with stormwater. As with fuels and oils, any inadvertent spills will be cleaned up immediately and disposed of according to federal, state, and local regulations.

g) Concrete

(i) Concrete trucks will not be allowed to wash out or discharge surplus concrete or drum wash water on the site, except in a specially designated concrete disposal area.

(ii) Form release oil used for decorative stonework will be applied over a pallet covered with an absorbent material to collect excess fluid. The absorbent material will be replaced and disposed of properly when saturated.

h) Water Testing

When testing/cleaning of water supply lines, the discharge from the tested pipe will be collected and conveyed to a completed stormwater pipe system for ultimate discharge into a sedimentation basin or SWM/BMP facility.

i) Sanitary Waste

Portable lavatories are located on-site and are serviced on a regular basis by a contractor. They will be located in upland areas away from direct contact with surface waters. Any spills occurring during servicing will be cleaned up immediately, including any contaminated soils, and disposed of according to all federal, state, and local regulations.

j) Grading and E & S Activities

A record of the dates when major grading activities occur, when construction activities temporarily or permanently cease on a portion of the site, and when stabilization measures are initiated shall be maintained and included in this Plan.

3) Spills

Oil, chemical or other hazardous substance spills in excess of reportable quantities, in accordance with the Permit (Appendix A), will be reported to the Department in accordance with Part III G. of the Permit as soon as the discharge is discovered, but no later than 24 hours. A reportable quantity of oil is defined as a discharge to a surface water that causes a sheen, discoloration, and/or an emulsion. Reports will be made to the following:

Virginia Department of Emergency Management
Emergency Operations Center (EOC)
Phone: (800) 468-8892

Materials and equipment necessary for oil or chemical spill cleanup will be kept in the temporary material storage trailer onsite. Equipment will include, but not be limited to, brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, saw dust, and plastic and metal trash containers.

All oil or other chemical spills will be cleaned up immediately upon discovery. Spills large enough to reach the storm sewers will be reported to the National Response Center at 1-800-424-8802.

4) Maintenance

Maintenance of the erosion and sediment controls and the stormwater management/BMP facilities incorporated into this project must be maintained on a regular basis to assure their continued effectiveness; sediment must be removed from sediment traps and sedimentation ponds when the design capacity has been reduced by 25%. This includes repairs to all erosion and sediment controls, including cleanout of all sediment basins and stormwater management facilities at the required intervals. Those controls found to be ineffective during routine inspections (as described in the following section) shall be repaired **before the next anticipated storm event or as soon as practicable.** A more detailed description of the maintenance procedures is contained in the design plans for Old Stage Road Booster Pump Station, Sheet C-3, and is incorporated in this Plan by reference.

5) Inspections

Regular inspections of the construction site shall be performed by personnel familiar with all aspects of the Plan and the employed control practices. Inspections shall include the review of all disturbed areas, structural and non-structural control measures, material storage areas, and vehicular access points. Inspections are to be performed (i) at least once every **5 business days** or (ii) at least once every **10 business days** and not later than **24 hours** following a measurable storm event or on the next business day for when there are more than 24 hours between business days. If discharges from construction activities are to surface waters identified as impaired or for which a TMDL waste load

allocation has been established, inspections are to be performed (i) at least once every **4 business days** or (ii) at least once every **5 business days** and no later than **24 hours** following a measurable storm event. Areas that already have been stabilized or where runoff is unlikely due to frozen or snow-covered ground shall be inspected at least on a monthly basis.

Inspections are intended to identify areas where the pollutant control measures at the site are ineffective and are allowing pollutants to enter surface waters. Receiving waters shall be inspected to ascertain whether control measures are effective in preventing significant impacts. Locations where vehicles enter or exit the site shall be inspected for evidence of offsite sediment tracking.

If as a result of the inspection, the site conditions and/or control measures are found to have changed, the Plan shall be updated within a period of 7 calendar days. If control measures need to be modified to assure effectiveness or if additional measures are determined to be necessary, implementation shall be completed prior to the next anticipated storm event or as soon as practicable.

A report summarizing the inspections and the subsequent maintenance activities must be completed and maintained as part of the Plan. The inspection forms are included in Appendix D. Required elements include major observations (including information on control measure performance and incidents of non-compliance), information on the inspecting personnel and the amount of rainfall at the construction site during land disturbing activities between SWPPP required inspections. If an inspection does not identify any incidents of non-compliance, then the certification statement contained in the inspection form will apply.

Utility line installation, pipeline construction, and other examples of long, narrow linear construction activities may limit the access of inspection personnel to the areas described in Part II G 2 d of the permit (Appendix A). Inspection of these areas could require that vehicles compromise temporarily or even permanently stabilized areas, cause additional disturbance of soils, and increase the potential for erosion. In these circumstances, controls must be inspected on the same frequencies as other construction projects, but representative inspections may be performed. For representative inspections, personnel must inspect controls along the construction site for 0.25 miles above and below each access point where a roadway, undisturbed right-of-way, or other similar feature intersects the construction site and allows access to the areas described above. The conditions of the controls along each inspected 0.25-mile segment may be considered as representative of the condition of controls along that reach extending from the end of the 0.25-mile segment to either the end of the next 0.25-mile segment, or to the end of the project, whichever occurs first. Inspection locations must be listed in the report required by Part II G of the permit (Appendix A).

6) Non-Stormwater Discharges

Allowable sources of non-stormwater discharges (Part I E. of the Permit, Appendix A) must be identified in the Plan. Appropriate measures must be taken to assure that pollution prevention measures for the non-stormwater component of the discharge are implemented. The non-stormwater discharges associated with this project identified at this time are:

a) Discharges from firefighting activities
b) Fire Hydrant flushings;
c) Waters used to wash vehicles where soaps, solvents, or detergents have not been used and the water bas been filtered, settled, or similarly treated prior to discharge;
d) Water used to control dust that has been filtered, settled, or similarly treated prior to discharge;
e) Potable water sources, including uncontaminated waterline flushings;
f) Routine external building wash down where soaps, solvents or detergents have not been used and the wash water has been filtered, settled, or similarly treated prior to discharge;
g) Pavement wash waters where spills or leaks of toxic or hazardous materials have not occurred (or where all spilled or leaked material has been removed prior to washing); and where soaps, solvents or detergents have not been used and the wash water has been filtered, settled, or similarly treated prior to discharge;
h) Uncontaminated air conditioning or compressor condensate;
i) Uncontaminated ground water or spring water;
j) Foundation or footing drains where flows are not contaminated with process materials such as solvents;
k) Uncontaminated excavation dewatering, including dewatering of trenches and excavations that have been filtered, settled, or similarly treated prior to discharge; and
l) Landscape irrigation.

Environmentally friendly washing, flushing and dust controlling procedures shall be practiced during construction to prevent contamination of surface and ground water. These practices will consist of the use of using off-site facilities; washing in designated, contained areas only; eliminating discharges to storm drains by infiltrating the water or routing to the sanitary sewer; and training employees and subcontractors in proper cleaning procedures.

REFERENCES

Virginia Department of Conservation and Recreation. 1992.Virginia Erosion and Sediment Control Handbook. Third Edition. Division of Soil and Water Conservation, Virginia Department of Conservation and Recreation.

Appendix A

General VPDES Permit for Discharges of Stormwater from Construction Activities
General Permit No. VAR 10

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

General Permit No.: VAR10

Effective Date: July 1, 2019

Expiration Date: June 30, 2024

GENERAL VPDES PERMIT FOR DISCHARGES OF STORMWATER FROM CONSTRUCTION ACTIVITIES

AUTHORIZATION TO DISCHARGE UNDER THE VIRGINIA STORMWATER MANAGEMENT PROGRAM AND THE VIRGINIA STORMWATER MANAGEMENT ACT

In compliance with the provisions of the Clean Water Act, as amended, and pursuant to the Virginia Stormwater Management Act and regulations adopted pursuant thereto, operators of construction activities are authorized to discharge to surface waters within the boundaries of the Commonwealth of Virginia, except those specifically named in State Water Control Board regulations that prohibit such discharges.

The authorized discharge shall be in accordance with the registration statement filed with the Department of Environmental Quality, this cover page, Part I - Discharge Authorization and Special Conditions, Part II - Stormwater Pollution Prevention Plan, and Part III - Conditions Applicable to All VPDES Permits as set forth in this general permit.

PART I

DISCHARGE AUTHORIZATION AND SPECIAL CONDITIONS

A. Coverage under this general permit.

1. During the period beginning with the date of coverage under this general permit and lasting until the general permit's expiration date, the operator is authorized to discharge stormwater from construction activities.

2. This general permit also authorizes stormwater discharges from support activities (e.g., concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas) located on-site or off-site provided that:

   a. The support activity is directly related to the construction activity that is required to have general permit coverage for discharges of stormwater from construction activities;

   b. The support activity is not a commercial operation, nor does it serve multiple unrelated construction activities by different operators;

   c. The support activity does not operate beyond the completion of the last construction activity it supports;

   d. The support activity is identified in the registration statement at the time of general permit coverage;

   e. Appropriate control measures are identified in a stormwater pollution prevention plan and implemented to address the discharges from the support activity areas; and

   f. All applicable state, federal, and local approvals are obtained for the support activity.

B. Limitations on coverage.

1. Post-construction discharges. This general permit does not authorize stormwater discharges that originate from the site after construction activities have been completed and the site, including any support activity sites covered under the general permit registration, has undergone final stabilization. Post-construction industrial stormwater discharges may need to be covered by a separate VPDES permit.

2. Discharges mixed with nonstormwater. This general permit does not authorize discharges that are mixed with sources of nonstormwater, other than those discharges that are identified in Part I E (Authorized nonstormwater discharges) and are in compliance with this general permit.

3. Discharges covered by another state permit. This general permit does not authorize discharges of stormwater from construction activities that have been covered under an individual permit or required to obtain coverage under an alternative general permit.

4. Impaired waters and total maximum daily load (TMDL) limitation.

    a. Nutrient and sediment impaired waters. Discharges of stormwater from construction activities to surface waters identified as impaired in the 2016 § 305(b)/303(d) Water Quality Assessment Integrated Report or for which a TMDL wasteload allocation has been established and approved prior to the term of this general permit for (i) sediment or a sediment-related parameter (i.e., total suspended solids or turbidity) or (ii) nutrients (i.e., nitrogen or phosphorus) are not eligible for coverage under this general permit unless the operator develops, implements, and maintains a stormwater pollution prevention plan (SWPPP) in accordance with Part II B 5 of this permit that minimizes the pollutants of concern and, when applicable, is consistent with the assumptions and requirements of the approved TMDL wasteload allocations and implements an inspection frequency consistent with Part II G 2 a.

    b. Polychlorinated biphenyl (PCB) impaired waters. Discharges of stormwater from construction activities that include the demolition of any structure with at least 10,000 square feet of floor space built or renovated before January 1, 1980, to surface waters identified as impaired in the 2016 § 305(b)/303(d) Water Quality Assessment Integrated Report or for which a TMDL wasteload allocation has been established and approved prior to the term of this general permit for PCB are not eligible for coverage under this general permit unless the operator develops, implements, and maintains a SWPPP in accordance with Part II B 6 of this permit that minimizes the pollutants of concern and, when applicable, is consistent with the assumptions and requirements of the approved TMDL wasteload allocations, and implements an inspection frequency consistent with Part II G 2 a.

5. Exceptional waters limitation. Discharges of stormwater from construction activities not previously covered under the general permit effective on July 1, 2014, to exceptional waters identified in 9VAC25-260-30 A 3 c are not eligible for coverage under this general permit unless the operator develops, implements, and maintains a SWPPP in accordance with Part II B 7 of this permit and implements an inspection frequency consistent with Part II G 2 a.

6. There shall be no discharge of floating solids or visible foam in other than trace amounts.

C. Commingled discharges. Discharges authorized by this general permit may be commingled with other sources of stormwater that are not required to be covered under a state permit, so long as the commingled discharge is in compliance with this general permit. Discharges authorized by a separate state or VPDES permit may be commingled with discharges authorized by this general permit so long as all such discharges comply with all applicable state and VPDES permit requirements.

D. Prohibition of nonstormwater discharges. Except as provided in Parts I A 2, I C, and I E, all discharges covered by this general permit shall be composed entirely of stormwater associated with construction activities. All other discharges including the following are prohibited:

1. Wastewater from washout of concrete;

2. Wastewater from the washout and cleanout of stucco, paint, form release oils, curing compounds, and other construction materials;

3. Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance;

4. Oils, toxic substances, or hazardous substances from spills or other releases; and

5. Soaps, solvents, or detergents used in equipment and vehicle washing.

E. Authorized nonstormwater discharges. The following nonstormwater discharges from construction activities are authorized by this general permit when discharged in compliance with this general permit:

1. Discharges from firefighting activities;

2. Fire hydrant flushings;

3. Waters used to wash vehicles or equipment where soaps, solvents, or detergents have not been used and the wash water has been filtered, settled, or similarly treated prior to discharge;

4. Water used to control dust that has been filtered, settled, or similarly treated prior to discharge;

5. Potable water sources, including uncontaminated waterline flushings, managed in a manner to avoid an instream impact;

6. Routine external building wash down where soaps, solvents or detergents have not been used and the wash water has been filtered, settled, or similarly treated prior to discharge;

7. Pavement wash waters where spills or leaks of toxic or hazardous materials have not occurred (or where all spilled or leaked material has been removed prior to washing); where soaps, solvents, or detergents have not been used; and where the wash water has been filtered, settled, or similarly treated prior to discharge;

8. Uncontaminated air conditioning or compressor condensate;

9. Uncontaminated ground water or spring water;

10. Foundation or footing drains where flows are not contaminated with process materials such as solvents;

11. Uncontaminated excavation dewatering, including dewatering of trenches and excavations that have been filtered, settled, or similarly treated prior to discharge; and

12. Landscape irrigation.

F. Termination of general permit coverage.

1. The operator of the construction activity shall submit a notice of termination in accordance with 9VAC25-880-60, unless a registration statement was not required to be submitted in accordance with 9VAC25-880-50 A 1 c or A 2 b for single-family detached residential structures, to the VSMP authority after one or more of the following conditions have been met:

a. Necessary permanent control measures included in the SWPPP for the site are in place and functioning effectively and final stabilization has been achieved on all portions of the site for which the operator has operational control. When applicable, long term responsibility and maintenance requirements for permanent control measures shall be recorded in the local land records prior to the submission of a complete and accurate notice of termination and the construction record drawing prepared;

b. Another operator has assumed control over all areas of the site that have not been finally stabilized and obtained coverage for the ongoing discharge;

c. Coverage under an alternative VPDES or state permit has been obtained; or

d. For individual lots in residential construction only, final stabilization as defined in 9VAC25-880-1 has been completed, including providing written notification to the homeowner and incorporating a copy of the notification and signed certification statement into the SWPPP, and the residence has been transferred to the homeowner.

2. The notice of termination shall be submitted no later than 30 days after one of the above conditions in subdivision 1 of this subsection is met.

3. Termination of authorization to discharge for the conditions set forth in subdivision 1 a of this subsection shall be effective upon notification from the department that the provisions of subdivision 1 a of this subsection have been met or 60 days after submittal of a complete and accurate notice of termination in accordance with 9VAC25-880-60 C, whichever occurs first.

4. Authorization to discharge terminates at midnight on the date that the notice of termination is submitted for the conditions set forth in subdivisions 1 b through 1 d of this subsection unless otherwise notified by the VSMP authority or department.

5. The notice of termination shall be signed in accordance with Part III K of this general permit.

G. Water quality protection.

1. The operator shall select, install, implement, and maintain control measures as identified in the SWPPP at the construction site that minimize pollutants in the discharge as necessary to ensure that the operator's discharge does not cause or contribute to an excursion above any applicable water quality standard.

2. If it is determined by the department that the operator's discharges are causing, have reasonable potential to cause, or are contributing to an excursion above any applicable water quality standard, the department, in consultation with the VSMP authority, may take appropriate enforcement action and require the operator to:

a. Modify or implement additional control measures in accordance with Part II C to adequately address the identified water quality concerns;

b. Submit valid and verifiable data and information that are representative of ambient conditions and indicate that the receiving water is attaining water quality standards; or

c. Submit an individual permit application in accordance with 9VAC25-870-410 B 3.

All written responses required under this chapter shall include a signed certification consistent with Part III K.

PART II

STORMWATER POLLUTION PREVENTION PLAN

A. Stormwater pollution prevent plan.

1. A stormwater pollution prevention plan (SWPPP) shall be developed prior to the submission of a registration statement and implemented for the construction activity, including any support activity, covered by this general permit. SWPPPs shall be prepared in accordance with good engineering practices. Construction activities that are part of a larger common plan of development or sale and disturb less than one acre may utilize a SWPPP template provided by the department and need not provide a separate stormwater management plan if one has been prepared and implemented for the larger common plan of development or sale.

2. The SWPPP requirements of this general permit may be fulfilled by incorporating by reference other plans such as a spill prevention control and countermeasure (SPCC) plan developed for the site under § 311 of the federal Clean Water Act or best management practices (BMP) programs otherwise required for the facility provided that the incorporated plan meets or exceeds the SWPPP requirements of Part II B. All plans incorporated by reference into the SWPPP become enforceable under this general permit. If a plan incorporated by reference does not contain all of the required elements of the SWPPP, the operator shall develop the missing elements and include them in the SWPPP.

3. Any operator that was authorized to discharge under the general permit effective July 1, 2014, and that intends to continue coverage under this general permit, shall update its stormwater pollution prevention plan to comply with the requirements of this general permit no later than 60 days after the date of coverage under this general permit.

B. Contents. The SWPPP shall include the following items:

1. General information.

   a. A signed copy of the registration statement, if required, for coverage under the general VPDES permit for discharges of stormwater from construction activities;

   b. Upon receipt, a copy of the notice of coverage under the general VPDES permit for discharges of stormwater from construction activities (i.e., notice of coverage letter);

   c. Upon receipt, a copy of the general VPDES permit for discharges of stormwater from construction activities;

   d. A narrative description of the nature of the construction activity, including the function of the project (e.g., low density residential, shopping mall, highway, etc.);

   e. A legible site plan identifying:

(1) Directions of stormwater flow and approximate slopes anticipated after major grading activities;

(2) Limits of land disturbance including steep slopes and natural buffers around surface waters that will not be disturbed;

(3) Locations of major structural and nonstructural control measures, including sediment basins and traps, perimeter dikes, sediment barriers, and other measures intended to filter, settle, or similarly treat sediment, that will be installed between disturbed areas and the undisturbed vegetated areas in order to increase sediment removal and maximize stormwater infiltration;

(4) Locations of surface waters;

(5) Locations where concentrated stormwater is discharged;

(6) Locations of any support activities, including (i) areas where equipment and vehicle washing, wheel wash water, and other wash water is to occur; (ii) storage areas for chemicals such as acids, fuels, fertilizers, and other lawn care chemicals; (iii) concrete wash out areas; (iv) vehicle fueling and maintenance areas; (v) sanitary waste facilities, including those temporarily placed on the construction site; and (vi) construction waste storage; and

(7) When applicable, the location of the on-site rain gauge or the methodology established in consultation with the VSMP authority used to identify measurable storm events for inspection as allowed by Part II G 2 a (1) (ii) or Part II G 2 b (2).

2. Erosion and sediment control plan.

a. An erosion and sediment control plan designed and approved in accordance with the Virginia Erosion and Sediment Control Regulations (9VAC25-840), an "agreement in lieu of a plan" as defined in 9VAC25-840-10 from the VESCP authority, or an erosion and sediment control plan prepared in accordance with annual standards and specifications approved by the department.

b. All erosion and sediment control plans shall include a statement describing the maintenance responsibilities required for the erosion and sediment controls used.

c. An approved erosion and sediment control plan, "agreement in lieu of a plan," or erosion and sediment control plan prepared in accordance with department-approved annual standards and specifications, implemented to:

(1) Control the volume and velocity of stormwater runoff within the site to minimize soil erosion;

(2) Control stormwater discharges, including peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion;

(3) Minimize the amount of soil exposed during the construction activity;

(4) Minimize the disturbance of steep slopes;

(5) Minimize sediment discharges from the site in a manner that addresses (i) the amount, frequency, intensity, and duration of precipitation; (ii) the nature of resulting stormwater runoff; and (iii) soil characteristics, including the range of soil particle sizes present on the site;

(6) Provide and maintain natural buffers around surface waters, direct stormwater to vegetated areas to increase sediment removal, and maximize stormwater infiltration, unless infeasible;

(7) Minimize soil compaction and, unless infeasible, preserve topsoil;

(8) Ensure initiation of stabilization activities, as defined in 9VAC25-880-1, of disturbed areas immediately whenever any clearing, grading, excavating, or other land-disturbing activities have permanently ceased on any portion of the site, or temporarily ceased on any portion of the site and will not resume for a period exceeding 14 days; and

(9) Utilize outlet structures that withdraw stormwater from the surface (i.e., above the permanent pool or wet storage water surface elevation), unless infeasible, when discharging from sediment basins or sediment traps.

3. Stormwater management plan.

   a. Except for those projects identified in Part II B 3 b, a stormwater management plan approved by the VSMP authority as authorized under the Virginia Stormwater Management Program (VSMP) Regulation (9VAC25-870), or an "agreement in lieu of a stormwater management plan" as defined in 9VAC25-870-10 from the VSMP authority, or a stormwater management plan prepared in accordance with annual standards and specifications approved by the department.

   b. For any operator meeting the conditions of 9VAC25-870-47 B of the VSMP regulation, an approved stormwater management plan is not required. In lieu of an approved stormwater management plan, the SWPPP shall include a description of, and all necessary calculations supporting, all post-construction stormwater management measures that will be installed prior to the completion of the construction process to control pollutants in stormwater discharges after construction operations have been completed. Structural measures should be placed on upland soils to the degree possible. Such measures must be designed and installed in accordance with applicable VESCP authority, VSMP authority, state, and federal requirements, and any necessary permits must be obtained.

4. Pollution prevention plan. A pollution prevention plan that addresses potential pollutant-generating activities that may reasonably be expected to affect the quality of stormwater discharges from the construction activity, including any support activity. The pollution prevention plan shall:

   a. Identify the potential pollutant-generating activities and the pollutant that is expected to be exposed to stormwater;

b. Describe the location where the potential pollutant-generating activities will occur, or if identified on the site plan, reference the site plan;

c. Identify all nonstormwater discharges, as authorized in Part I E of this general permit, that are or will be commingled with stormwater discharges from the construction activity, including any applicable support activity;

d. Identify the person responsible for implementing the pollution prevention practice or practices for each pollutant-generating activity (if other than the person listed as the qualified personnel);

e. Describe the pollution prevention practices and procedures that will be implemented to:

(1) Prevent and respond to leaks, spills, and other releases including (i) procedures for expeditiously stopping, containing, and cleaning up spills, leaks, and other releases; and (ii) procedures for reporting leaks, spills, and other releases in accordance with Part III G;

(2) Prevent the discharge of spilled and leaked fuels and chemicals from vehicle fueling and maintenance activities (e.g., providing secondary containment such as spill berms, decks, spill containment pallets, providing cover where appropriate, and having spill kits readily available);

(3) Prevent the discharge of soaps, solvents, detergents, and wash water from construction materials, including the clean-up of stucco, paint, form release oils, and curing compounds (e.g., providing (i) cover (e.g., plastic sheeting or temporary roofs) to prevent contact with stormwater; (ii) collection and proper disposal in a manner to prevent contact with stormwater; and (iii) a similarly effective means designed to prevent discharge of these pollutants);

(4) Minimize the discharge of pollutants from vehicle and equipment washing, wheel wash water, and other types of washing (e.g., locating activities away from surface waters and stormwater inlets or conveyance and directing wash waters to sediment basins or traps, using filtration devices such as filter bags or sand filters, or using similarly effective controls);

(5) Direct concrete wash water into a leak-proof container or leak-proof settling basin. The container or basin shall be designed so that no overflows can occur due to inadequate sizing or precipitation. Hardened concrete wastes shall be removed and disposed of in a manner consistent with the handling of other construction wastes. Liquid concrete wastes shall be removed and disposed of in a manner consistent with the handling of other construction wash waters and shall not be discharged to surface waters;

(6) Minimize the discharge of pollutants from storage, handling, and disposal of construction products, materials, and wastes including (i) building products such as asphalt sealants, copper flashing, roofing materials, adhesives, and concrete admixtures; (ii) pesticides, herbicides, insecticides, fertilizers, and landscape

materials; and (iii) construction and domestic wastes such as packaging materials, scrap construction materials, masonry products, timber, pipe and electrical cuttings, plastics, Styrofoam, concrete, and other trash or building materials;

(7) Prevent the discharge of fuels, oils, and other petroleum products, hazardous or toxic wastes, waste concrete, and sanitary wastes;

(8) Address any other discharge from the potential pollutant-generating activities not addressed above;

(9) Minimize the exposure of waste materials to precipitation by closing or covering waste containers during precipitation events and at the end of the business day, or implementing other similarly effective practices. Minimization of exposure is not required in cases where the exposure to precipitation will not result in a discharge of pollutants; and

f. Describe procedures for providing pollution prevention awareness of all applicable wastes, including any wash water, disposal practices, and applicable disposal locations of such wastes, to personnel in order to comply with the conditions of this general permit. The operator shall implement the procedures described in the SWPPP.

5. SWPPP requirements for discharges to nutrient and sediment impaired waters. For discharges to surface waters (i) identified as impaired in the 2016 § 305(b)/303(d) Water Quality Assessment Integrated Report or (ii) with an applicable TMDL wasteload allocation established and approved prior to the term of this general permit for sediment for a sediment-related parameter (i.e., total suspended solids or turbidity) or nutrients (i.e., nitrogen or phosphorus), the operator shall:

   a. Identify the impaired waters, approved TMDLs, and pollutants of concern in the SWPPP; and

   b. Provide clear direction in the SWPPP that:

      (1) Permanent or temporary soil stabilization shall be applied to denuded areas within seven days after final grade is reached on any portion of the site;

      (2) Nutrients shall be applied in accordance with manufacturer's recommendations or an approved nutrient management plan and shall not be applied during rainfall events; and

      (3) A modified inspection schedule shall be implemented in accordance with Part II G 2 a.

6. SWPPP requirements for discharges to polychlorinated biphenyl (PCB) impaired waters. For discharges from construction activities that include the demolition of any structure with at least 10,000 square feet of floor space built or renovated before January 1, 1980, to surface waters (i) identified as impaired in the 2016 § 305(b)/303(d) Water Quality Assessment Integrated Report or (ii) with an applicable TMDL wasteload allocation established and approved prior to the term of this general permit for PCB, the operator shall:

a. Identify the impaired waters, approved TMDLs, and pollutant of concern in the SWPPP;

b. Implement the approved erosion and sediment control plan in accordance with Part II B 2;

c. Dispose of waste materials in compliance with applicable state, federal, and local requirements; and

d. Implement a modified inspection schedule in accordance with Part II G 2 a.

7. SWPPP requirements for discharges to exceptional waters. For discharges to surface waters identified in 9VAC25-260-30 A 3 c as an exceptional water, the operator shall:

   a. Identify the exceptional surface waters in the SWPPP; and

   b. Provide clear direction in the SWPPP that:

      (1) Permanent or temporary soil stabilization shall be applied to denuded areas within seven days after final grade is reached on any portion of the site;

      (2) Nutrients shall be applied in accordance with manufacturer's recommendations or an approved nutrient management plan and shall not be applied during rainfall events; and

      (3) A modified inspection schedule shall be implemented in accordance with Part II G 2 a.

8. Identification of qualified personnel. The name, phone number, and qualifications of the qualified personnel conducting inspections required by this general permit.

9. Delegation of authority. The individuals or positions with delegated authority, in accordance with Part III K, to sign inspection reports or modify the SWPPP.

10. SWPPP signature. The SWPPP shall be signed and dated in accordance with Part III K.

C. SWPPP amendments, modification, and updates.

1. The operator shall amend the SWPPP whenever there is a change in the design, construction, operation, or maintenance that has a significant effect on the discharge of pollutants to surface waters and that has not been previously addressed in the SWPPP.

2. The SWPPP shall be amended if, during inspections or investigations by the operator's qualified personnel, or by local, state, or federal officials, it is determined that the existing control measures are ineffective in minimizing pollutants in discharges from the construction activity. Revisions to the SWPPP shall include additional or modified control measures designed and implemented to correct problems identified. If approval by the VESCP authority, VSMP authority, or department is necessary for the control measure, revisions to the SWPPP shall be completed no later than seven calendar days following approval. Implementation of these additional or modified control measures shall be accomplished as described in Part II H.

3. The SWPPP shall clearly identify the contractors that will implement and maintain each control measure identified in the SWPPP. The SWPPP shall be amended to identify any new contractor that will implement and maintain a control measure.

4. The operator shall update the SWPPP as soon as possible but no later than seven days following any modification to its implementation. All modifications or updates to the SWPPP shall be noted and shall include the following items:

    a. A record of dates when:

        (1) Major grading activities occur;

        (2) Construction activities temporarily or permanently cease on a portion of the site; and

        (3) Stabilization measures are initiated;

    b. Documentation of replaced or modified controls where periodic inspections or other information have indicated that the controls have been used inappropriately or incorrectly and were modified;

    c. Areas that have reached final stabilization and where no further SWPPP or inspection requirements apply;

    d. All properties that are no longer under the legal control of the operator and the dates on which the operator no longer had legal control over each property;

    e. The date of any prohibited discharges, the discharge volume released, and what actions were taken to minimize the impact of the release;

    f. Measures taken to prevent the reoccurrence of any prohibited discharge; and

    g. Measures taken to address any evidence identified as a result of an inspection required under Part II G.

5. Amendments, modifications, or updates to the SWPPP shall be signed in accordance with Part III K.

D. Public notification. Upon commencement of land disturbance, the operator shall post conspicuously a copy of the notice of coverage letter near the main entrance of the construction activity. For linear projects, the operator shall post the notice of coverage letter at a publicly accessible location near an active part of the construction project (e.g., where a pipeline crosses a public road). The operator shall maintain the posted information until termination of general permit coverage as specified in Part I F.

E. SWPPP availability.

1. Operators with day-to-day operational control over SWPPP implementation shall have a copy of the SWPPP available at a central location on-site for use by those identified as having responsibilities under the SWPPP whenever they are on the construction site.

2. The operator shall make the SWPPP and all amendments, modifications, and updates available upon request to the department, the VSMP authority, the EPA, the VESCP authority, local government officials, or the operator of a municipal separate storm sewer system receiving discharges from the construction activity. If an on-site location is unavailable to store the SWPPP when no personnel are present, notice of the SWPPP's location shall be posted near the main entrance of the construction site.

3. The operator shall make the SWPPP available for public review in an electronic format or in hard copy. Information for public access to the SWPPP shall be posted and maintained in accordance with Part II D. If not provided electronically, public access to the SWPPP may be arranged upon request at a time and at a publicly accessible location convenient to the operator or his designee but shall be no less than once per month and shall be during normal business hours. Information not required to be contained within the SWPPP by this general permit is not required to be released.

F. SWPPP implementation. The operator shall implement the SWPPP and subsequent amendments, modifications, and updates from commencement of land disturbance until termination of general permit coverage as specified in Part I F.

1. All control measures shall be properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications. If a site inspection required by Part II G identifies a control measure that is not operating effectively, corrective actions shall be completed as soon as practicable, but no later than seven days after discovery or a longer period as established by the VSMP authority, to maintain the continued effectiveness of the control measures.

2. If site inspections required by Part II G identify an existing control measure that needs to be modified or if an additional or alternative control measure is necessary for any reason, implementation shall be completed prior to the next anticipated measurable storm event. If implementation prior to the next anticipated measurable storm event is impracticable, then additional or alternative control measures shall be implemented as soon as practicable, but no later than seven days after discovery or a longer period as established by the VSMP authority.

G. SWPPP Inspections.

1. Personnel responsible for on-site and off-site inspections. Inspections required by this general permit shall be conducted by the qualified personnel identified by the operator in the SWPPP. The operator is responsible for ensuring that the qualified personnel conduct the inspection.

2. Inspection schedule.

    a. For construction activities that discharge to a surface water identified in Part II B 5 and B 6 as impaired or having an approved TMDL or Part I B 7 as exceptional, the following inspection schedule requirements apply:

        (1) Inspections shall be conducted at a frequency of (i) at least once every four business days or (ii) at least once every five business days and no later than 24 hours following a measurable storm event. In the event that a measurable storm event occurs when

there are more than 24 hours between business days, the inspection shall be conducted on the next business day; and

(2) Representative inspections as authorized in Part II G 2 d shall not be allowed.

b. Except as specified in Part II G 2 a, inspections shall be conducted at a frequency of:

(1) At least once every five business days; or

(2) At least once every 10 business days and no later than 24 hours following a measurable storm event. In the event that a measurable storm event occurs when there are more than 24 hours between business days, the inspection shall be conducted on the next business day.

c. Where areas have been temporarily stabilized or land-disturbing activities will be suspended due to continuous frozen ground conditions and stormwater discharges are unlikely, the inspection frequency described in Part II G 2 a and 2 b may be reduced to once per month. If weather conditions (such as above freezing temperatures or rain or snow events) make discharges likely, the operator shall immediately resume the regular inspection frequency.

d. Except as prohibited in Part II G 2 a (2), representative inspections may be utilized for utility line installation, pipeline construction, or other similar linear construction activities provided that:

(1) Temporary or permanent soil stabilization has been installed and vehicle access may compromise the temporary or permanent soil stabilization and potentially cause additional land disturbance increasing the potential for erosion;

(2) Inspections occur on the same frequency as other construction activities;

(3) Control measures are inspected along the construction site 0.25 miles above and below each access point (i.e., where a roadway, undisturbed right-of-way, or other similar feature intersects the construction activity and access does not compromise temporary or permanent soil stabilization); and

(4) Inspection locations are provided in the inspection report required by Part II G.

e. If adverse weather causes the safety of the inspection personnel to be in jeopardy, the inspection may be delayed until the next business day on which it is safe to perform the inspection. Any time inspections are delayed due to adverse weather conditions, evidence of the adverse weather conditions shall be included in the SWPPP with the dates of occurrence.

3. Inspection requirements.

a. As part of the inspection, the qualified personnel shall:

(1) Record the date and time of the inspection and, when applicable, the date and rainfall amount of the last measurable storm event;

(2) Record the information and a description of any discharges occurring at the time of the inspection or evidence of discharges occurring prior to the inspection;

(3) Record any land-disturbing activities that have occurred outside of the approved erosion and sediment control plan;

(4) Inspect the following for installation in accordance with the approved erosion and sediment control plan, identification of any maintenance needs, and evaluation of effectiveness in minimizing sediment discharge, including whether the control has been inappropriately or incorrectly used:

(a) All perimeter erosion and sediment controls, such as silt fence;

(b) Soil stockpiles, when applicable, and borrow areas for stabilization or sediment trapping measures;

(c) Completed earthen structures, such as dams, dikes, ditches, and diversions for stabilization and effective impoundment or flow control;

(d) Cut and fill slopes;

(e) Sediment basins and traps, sediment barriers, and other measures installed to control sediment discharge from stormwater;

(f) Temporary or permanent channels, flumes, or other slope drain structures installed to convey concentrated runoff down cut and fill slopes;

(g) Storm inlets that have been made operational to ensure that sediment laden stormwater does not enter without first being filtered or similarly treated; and

(h) Construction vehicle access routes that intersect or access paved or public roads for minimizing sediment tracking;

(5) Inspect areas that have reached final grade or that will remain dormant for more than 14 days to ensure:

(a) Initiation of stabilization activities have occurred immediately, as defined in 9VAC25-880-1; and

(b) Stabilization activities have been completed within seven days of reaching grade or stopping work;

(6) Inspect for evidence that the approved erosion and sediment control plan, "agreement in lieu of a plan," or erosion and sediment control plan prepared in accordance with department-approved annual standards and specifications has not been properly implemented. This includes:

(a) Concentrated flows of stormwater in conveyances such as rills, rivulets, or channels that have not been filtered, settled, or similarly treated prior to discharge, or evidence thereof;

(b) Sediment laden or turbid flows of stormwater that have not been filtered or settled to remove sediments prior to discharge;

(c) Sediment deposition in areas that drain to unprotected stormwater inlets or catch basins that discharge to surface waters. Inlets and catch basins with failing sediment controls due to improper installation, lack of maintenance, or inadequate design are considered unprotected;

(d) Sediment deposition on any property (including public and private streets) outside of the construction activity covered by this general permit;

(e) Required stabilization has not been initiated or completed or is not effective on portions of the site;

(f) Sediment basins without adequate wet or dry storage volume or sediment basins that allow the discharge of stormwater from below the surface of the wet storage portion of the basin;

(g) Sediment traps without adequate wet or dry storage or sediment traps that allow the discharge of stormwater from below the surface of the wet storage portion of the trap; and

(h) Land disturbance or sediment deposition outside of the approved area to be disturbed;

(7) Inspect pollutant generating activities identified in the pollution prevention plan for the proper implementation, maintenance, and effectiveness of the procedures and practices;

(8) Identify any pollutant generating activities not identified in the pollution prevention plan; and

(9) Identify and document the presence of any evidence of the discharge of pollutants prohibited by this general permit.

4. Inspection report. Each inspection report shall include the following items:

a. The date and time of the inspection and, when applicable, the date and rainfall amount of the last measurable storm event;

b. Summarized findings of the inspection;

c. The locations of prohibited discharges;

d. The locations of control measures that require maintenance;

e. The locations of control measures that failed to operate as designed or proved inadequate or inappropriate for a particular location;

f. The locations where any evidence identified under Part II G 3 a (6) exists;

g. The locations where any additional control measure is needed;

h. A list of corrective actions required (including any changes to the SWPPP that are necessary) as a result of the inspection or to maintain permit compliance;

i. Documentation of any corrective actions required from a previous inspection that have not been implemented; and

j. The date and signature of the qualified personnel and the operator or its duly authorized representative.

5. The inspection report shall be included into the SWPPP no later than four business days after the inspection is complete.

6. The inspection report and any actions taken in accordance with Part II shall be retained by the operator as part of the SWPPP for at least three years from the date that general permit coverage expires or is terminated. The inspection report shall identify any incidents of noncompliance. Where an inspection report does not identify any incidents of noncompliance, the report shall contain a certification that the construction activity is in compliance with the SWPPP and this general permit. The report shall be signed in accordance with Part III K of this general permit.

H. Corrective actions.

1. The operator shall implement the corrective actions identified as a result of an inspection as soon as practicable but no later than seven days after discovery or a longer period as approved by the VSMP authority. If approval of a corrective action by a regulatory authority (e.g., VSMP authority, VESCP authority, or the department) is necessary, additional control measures shall be implemented to minimize pollutants in stormwater discharges until such approvals can be obtained.

2. The operator may be required to remove accumulated sediment deposits located outside of the construction activity covered by this general permit as soon as practicable in order to minimize environmental impacts. The operator shall notify the VSMP authority and the department as well as obtain all applicable federal, state, and local authorizations, approvals, and permits prior to the removal of sediments accumulated in surface waters including wetlands.

PART III

CONDITIONS APPLICABLE TO ALL VPDES PERMITS

NOTE: Discharge monitoring is not required for this general permit. If the operator chooses to monitor stormwater discharges or control measures, the operator shall comply with the requirements of subsections A, B, and C, as appropriate.

A. Monitoring.

1. Samples and measurements taken for the purpose of monitoring shall be representative of the monitoring activity.

2. Monitoring shall be conducted according to procedures approved under 40 CFR Part 136 or alternative methods approved by the U.S. Environmental Protection Agency, unless other procedures have been specified in this general permit. Analyses performed according to test procedures approved under 40 CFR Part 136 shall be performed by an environmental laboratory certified under regulations adopted by the Department of General Services (1VAC30-45 or 1VAC30-46).

3. The operator shall periodically calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals that will ensure accuracy of measurements.

B. Records.

1. Monitoring records and reports shall include:

   a. The date, exact place, and time of sampling or measurements;

   b. The individuals who performed the sampling or measurements;

   c. The dates and times analyses were performed;

   d. The individuals who performed the analyses;

   e. The analytical techniques or methods used; and

   f. The results of such analyses.

2. The operator shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this general permit, and records of all data used to complete the registration statement for this general permit, for a period of at least three years from the date of the sample, measurement, report or request for coverage. This period of retention shall be extended automatically during the course of any unresolved litigation regarding the regulated activity or regarding control standards applicable to the operator, or as requested by the board.

C. Reporting monitoring results.

1. The operator shall update the SWPPP to include the results of the monitoring as may be performed in accordance with this general permit, unless another reporting schedule is specified elsewhere in this general permit.

2. Monitoring results shall be reported on a discharge monitoring report (DMR); on forms provided, approved or specified by the department; or in any format provided that the date, location, parameter, method, and result of the monitoring activity are included.

3. If the operator monitors any pollutant specifically addressed by this general permit more frequently than required by this general permit using test procedures approved under 40 CFR Part 136 or using other test procedures approved by the U.S. Environmental Protection Agency or using procedures specified in this general permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR or reporting form specified by the department.

4. Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in this general permit.

D. Duty to provide information. The operator shall furnish, within a reasonable time, any information which the board may request to determine whether cause exists for terminating this general permit coverage or to determine compliance with this general permit. The board, department, EPA, or VSMP authority may require the operator to furnish, upon request, such plans, specifications, and other pertinent information as may be necessary to determine the effect of the wastes from his discharge on the quality of surface waters, or such other information as may be necessary to accomplish the purposes of the CWA and the Virginia Stormwater Management Act. The operator shall also furnish to the board, department, EPA, or VSMP authority, upon request, copies of records required to be kept by this general permit.

E. Compliance schedule reports. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this general permit shall be submitted no later than 14 days following each schedule date.

F. Unauthorized stormwater discharges. Pursuant to § 62.1-44.5 of the Code of Virginia, except in compliance with a state permit issued by the department, it shall be unlawful to cause a stormwater discharge from a construction activity.

G. Reports of unauthorized discharges. Any operator who discharges or causes or allows a discharge of sewage, industrial waste, other wastes or any noxious or deleterious substance or a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110, 40 CFR Part 117, 40 CFR Part 302, or § 62.1-44.34:19 of the Code of Virginia that occurs during a 24-hour period into or upon surface waters or who discharges or causes or allows a discharge that may reasonably be expected to enter surface waters, shall notify the Department of Environmental Quality of the discharge immediately upon discovery of the discharge, but in no case later than within 24 hours after said discovery. A written report of the unauthorized discharge shall be submitted to the department and the VSMP authority within five days of discovery of the discharge. The written report shall contain:

1. A description of the nature and location of the discharge;

2. The cause of the discharge;

3. The date on which the discharge occurred;

4. The length of time that the discharge continued;

5. The volume of the discharge;

6. If the discharge is continuing, how long it is expected to continue;

7. If the discharge is continuing, what the expected total volume of the discharge will be; and

8. Any steps planned or taken to reduce, eliminate and prevent a recurrence of the present discharge or any future discharges not authorized by this general permit.

Discharges reportable to the department and the VSMP authority under the immediate reporting requirements of other regulations are exempted from this requirement.

H. Reports of unusual or extraordinary discharges. If any unusual or extraordinary discharge including a "bypass" or "upset," as defined in this general permit, should occur from a facility and the discharge enters or could be expected to enter surface waters, the operator shall promptly notify, in no case later than within 24 hours, the department and the VSMP authority by telephone after the discovery of the discharge. This notification shall provide all available details of the incident, including any adverse effects on aquatic life and the known number of fish killed. The operator shall reduce the report to writing and shall submit it to the department and the VSMP authority within five days of discovery of the discharge in accordance with Part III I 2. Unusual and extraordinary discharges include any discharge resulting from:

1. Unusual spillage of materials resulting directly or indirectly from processing operations;

2. Breakdown of processing or accessory equipment;

3. Failure or taking out of service of some or all of the facilities; and

4. Flooding or other acts of nature.

I. Reports of noncompliance. The operator shall report any noncompliance which may adversely affect surface waters or may endanger public health.

1. An oral report to the department and the VSMP authority shall be provided within 24 hours from the time the operator becomes aware of the circumstances. The following shall be included as information that shall be reported within 24 hours under this subdivision:

    a. Any unanticipated bypass; and

    b. Any upset that causes a discharge to surface waters.

2. A written report shall be submitted within five days and shall contain:

    a. A description of the noncompliance and its cause;

b. The period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and

c. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

The department may waive the written report on a case-by-case basis for reports of noncompliance under Part III I if the oral report has been received within 24 hours and no adverse impact on surface waters has been reported.

3. The operator shall report all instances of noncompliance not reported under Part III I 1 or 2 in writing as part of the SWPPP. The reports shall contain the information listed in Part III I 2.

NOTE: The reports required in Part III G, H and I shall be made to the department and the VSMP authority. Reports may be made by telephone, email, or by fax. For reports outside normal working hours, leaving a recorded message shall fulfill the immediate reporting requirement. For emergencies, the Virginia Department of Emergency Management maintains a 24-hour telephone service at 1-800-468-8892.

4. Where the operator becomes aware of a failure to submit any relevant facts, or submittal of incorrect information in any report, including a registration statement, to the department or the VSMP authority, the operator shall promptly submit such facts or correct information.

J. Notice of planned changes.

1. The operator shall give notice to the department and the VSMP authority as soon as possible of any planned physical alterations or additions to the permitted facility or activity. Notice is required only when:

a. The operator plans an alteration or addition to any building, structure, facility, or installation that may meet one of the criteria for determining whether a facility is a new source in 9VAC25-870-420;

b. The operator plans an alteration or addition that would significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants that are not subject to effluent limitations in this general permit; or

2. The operator shall give advance notice to the department and VSMP authority of any planned changes in the permitted facility or activity, which may result in noncompliance with state permit requirements.

K. Signatory requirements.

1. Registration statement. All registration statements shall be signed as follows:

a. For a corporation: by a responsible corporate officer. For the purpose of this chapter, a responsible corporate officer means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy-making or decision-making functions for the corporation; or (ii) the manager of one or more manufacturing, production, or operating facilities, provided the

manager is authorized to make management decisions that govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for state permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

c. For a municipality, state, federal, or other public agency: by either a principal executive officer or ranking elected official. For purposes of this chapter, a principal executive officer of a public agency includes (i) the chief executive officer of the agency or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

2. Reports and other information. All reports required by this general permit, including SWPPPs, and other information requested by the board or the department shall be signed by a person described in Part III K 1 or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   a. The authorization is made in writing by a person described in Part III K 1;

   b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the operator. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and

   c. The signed and dated written authorization is included in the SWPPP. A copy shall be provided to the department and VSMP authority, if requested.

3. Changes to authorization. If an authorization under Part III K 2 is no longer accurate because a different individual or position has responsibility for the overall operation of the construction activity, a new authorization satisfying the requirements of Part III K 2 shall be submitted to the VSMP authority as the administering entity for the board prior to or together with any reports or information to be signed by an authorized representative.

4. Certification. Any person signing a document under Part III K 1 or 2 shall make the following certification:

5. "I certify under penalty of law that I have read and understand this document and that this document and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant

penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

L. Duty to comply. The operator shall comply with all conditions of this general permit. Any state permit noncompliance constitutes a violation of the Virginia Stormwater Management Act and the Clean Water Act, except that noncompliance with certain provisions of this general permit may constitute a violation of the Virginia Stormwater Management Act but not the Clean Water Act. Permit noncompliance is grounds for enforcement action; for state permit coverage, termination, revocation and reissuance, or modification; or denial of a state permit renewal application.

The operator shall comply with effluent standards or prohibitions established under § 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions or standards for sewage sludge use or disposal, even if this general permit has not yet been modified to incorporate the requirement.

M. Duty to reapply. If the operator wishes to continue an activity regulated by this general permit after the expiration date of this general permit, the operator shall submit a new registration statement at least 60 days before the expiration date of the existing general permit, unless permission for a later date has been granted by the board. The board shall not grant permission for registration statements to be submitted later than the expiration date of the existing general permit.

N. Effect of a state permit. This general permit does not convey any property rights in either real or personal property or any exclusive privileges, nor does it authorize any injury to private property or invasion of personal rights, or any infringement of federal, state or local law or regulations.

O. State law. Nothing in this general permit shall be construed to preclude the institution of any legal action under, or relieve the operator from any responsibilities, liabilities, or penalties established pursuant to any other state law or regulation or under authority preserved by § 510 of the Clean Water Act. Except as provided in general permit conditions on "bypassing" (Part III U) and "upset" (Part III V), nothing in this general permit shall be construed to relieve the operator from civil and criminal penalties for noncompliance.

P. Oil and hazardous substance liability. Nothing in this general permit shall be construed to preclude the institution of any legal action or relieve the operator from any responsibilities, liabilities, or penalties to which the operator is or may be subject under §§ 62.1-44.34:14 through 62.1-44.34:23 of the State Water Control Law or § 311 of the Clean Water Act.

Q. Proper operation and maintenance. The operator shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances), which are installed or used by the operator to achieve compliance with the conditions of this general permit. Proper operation and maintenance also includes effective plant performance, adequate funding, adequate staffing, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems, which are installed by the operator only when the operation is necessary to achieve compliance with the conditions of this general permit.

R. Disposal of solids or sludges. Solids, sludges or other pollutants removed in the course of treatment or management of pollutants shall be disposed of in a manner so as to prevent any pollutant from such materials from entering surface waters and in compliance with all applicable state and federal laws and regulations.

S. Duty to mitigate. The operator shall take all steps to minimize or prevent any discharge in violation of this general permit that has a reasonable likelihood of adversely affecting human health or the environment.

T. Need to halt or reduce activity not a defense. It shall not be a defense for an operator in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this general permit.

U. Bypass.

1. "Bypass," as defined in 9VAC25-870-10, means the intentional diversion of waste streams from any portion of a treatment facility. The operator may allow any bypass to occur that does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to ensure efficient operation. These bypasses are not subject to the provisions of Part III U 2 and 3.

2. Notice.

    a. Anticipated bypass. If the operator knows in advance of the need for a bypass, the operator shall submit prior notice to the department, if possible at least 10 days before the date of the bypass.

    b. Unanticipated bypass. The operator shall submit notice of an unanticipated bypass as required in Part III I.

3. Prohibition of bypass.

    a. Except as provided in Part III U 1, bypass is prohibited, and the board or department may take enforcement action against an operator for bypass unless:

        (1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage. Severe property damage means substantial physical damage to property, damage to the treatment facilities that causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production;

        (2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventive maintenance; and

        (3) The operator submitted notices as required under Part III U 2.

    b. The department may approve an anticipated bypass, after considering its adverse effects, if the department determines that it will meet the three conditions listed in Part III U 3 a.

V. Upset.

1. An "upset," as defined in 9VAC25-870-10, means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based state permit effluent limitations because of factors beyond the reasonable control of the operator. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

2. An upset constitutes an affirmative defense to an action brought for noncompliance with technology-based state permit effluent limitations if the requirements of Part III V 4 are met. A determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is not a final administrative action subject to judicial review.

3. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

4. An operator who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that:

    a. An upset occurred and that the operator can identify the cause of the upset;

    b. The permitted facility was at the time being properly operated;

    c. The operator submitted notice of the upset as required in Part III I; and

    d. The operator complied with any remedial measures required under Part III S.

5. In any enforcement proceeding, the operator seeking to establish the occurrence of an upset has the burden of proof.

W. Inspection and entry. The operator shall allow the department as the board's designee, the VSMP authority, EPA, or an authorized representative of either entity (including an authorized contractor), upon presentation of credentials and other documents as may be required by law to:

1. Enter upon the operator's premises where a regulated facility or activity is located or conducted, or where records shall be kept under the conditions of this general permit;

2. Have access to and copy, at reasonable times, any records that shall be kept under the conditions of this general permit;

3. Inspect and photograph at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this general permit; and

4. Sample or monitor at reasonable times, for the purposes of ensuring state permit compliance or as otherwise authorized by the Clean Water Act or the Virginia Stormwater Management Act, any substances or parameters at any location.

For purposes of this section, the time for inspection shall be deemed reasonable during regular business hours, and whenever the facility is discharging. Nothing contained herein shall make an inspection unreasonable during an emergency.

X. State permit actions. State permit coverage may be modified, revoked and reissued, or terminated for cause. The filing of a request by the operator for a state permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any state permit condition.

Y. Transfer of state permit coverage.

1. State permits are not transferable to any person except after notice to the department. Except as provided in Part III Y 2, a state permit may be transferred by the operator to a new operator only if the state permit has been modified or revoked and reissued, or a minor modification made, to identify the new operator and incorporate such other requirements as may be necessary under the Virginia Stormwater Management Act and the Clean Water Act.

2. As an alternative to transfers under Part III Y 1, this state permit may be automatically transferred to a new operator if:

    a. The current operator notifies the department at least 30 days in advance of the proposed transfer of the title to the facility or property;

    b. The notice includes a written agreement between the existing and new operators containing a specific date for transfer of state permit responsibility, coverage, and liability between them; and

    c. The department does not notify the existing operator and the proposed new operator of its intent to modify or revoke and reissue the state permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in Part III Y 2 b.

3. For ongoing construction activity involving a change of operator, the new operator shall accept and maintain the existing SWPPP, or prepare and implement a new SWPPP prior to taking over operations at the site.

Z. Severability. The provisions of this general permit are severable, and if any provision of this general permit or the application of any provision of this state permit to any circumstance, is held invalid, the application of such provision to other circumstances and the remainder of this general permit shall not be affected thereby.

Appendix B

Copy of Registration Statement
Permit Coverage Letter
Vicinity Map

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
GENERAL VPDES PERMIT FOR DISCHARGES OF STORMWATER FROM CONSTRUCTION ACTIVITIES (VAR10)
REGISTRATION STATEMENT 2019

FOR OFFICE USE ONLY
ID Number: _____
Technical Criteria: **IIB** ☐ **IIC** ☐

NEW ISSUANCE ☒ **RE-ISSUANCE** ☐

MODIFICATION WITH ACREAGE INCREASE ☐ **MODIFICATION WITHOUT ACREAGE INCREASE** ☐

Existing Permit Coverage Number (if applicable, VAR10####): _____

Section I. Operator/Permittee Information.

A. Construction Activity Operator (Permittee). The person or entity that is applying for permit coverage and will have operational control over construction activities to ensure compliance with the general permit. A person with signatory authority for this operator must sign the certification in Section VI. (per Part III. K. of the VAR10 Permit).

Construction Activity Operator Name: _____

Contact person: _____

Address: _____

City, State, Zip Code: _____

Phone Number: _____

Primary Email: _____

CC Email: _____

B. Billing Information (leave blank if same as the Operator identified in Section I. A. above). This entity will receive Annual Permit Maintenance and Permit Modification Fee invoices (if applicable).

Name: _____

Contact Person: _____

Address: _____

City, State Zip Code: _____

Phone Number: _____

Primary Email: _____

CC Email: _____

C. May we transmit correspondence electronically? You must choose **YES** and include a valid email in order to pay by credit card and to receive your permit coverage approval letter via email:

YES ☒ **NO** ☐ *email: _____

Section II. Construction Activity Location Information. Project site information.

A. Include a site map showing the location of the existing or proposed land-disturbing activities, the limits of land disturbance, construction entrances and all water bodies receiving stormwater discharges from the site.

B. Construction Activity Name: Old Stage Road Booster Pump Station

Address: Old Stage Road (Route 10)

City and/or County and Zip Code: Isle of Wight County, Virginia

Latitude and Longitude (6-digit, decimal degrees format): 36.999951, -76.627784

C. Construction Activity Entrance Location (description, street address and/or latitude/longitude in decimal degrees): Access the proposed booster pump station

Section III. Offsite Support Activity Location Information. List all offsite support activities to be included under this permit registration. Enter additional areas on a separate page. Offsite areas not included on this registration may need to obtain coverage under a separate VPDES permit.

A. Offsite Activity Name:

Address:

City and/or County and Zip Code:

Latitude and Longitude (6-digit, decimal degrees format):

B. Offsite Activity Entrance Location (description, street address and/or latitude/longitude in decimal degrees):

Section IV. Site Information.

A. Acreage totals for all land-disturbing activities to be included under this permit coverage. Report to the nearest one-hundredth of an acre.	
Total land area of development (including the entire area to be disturbed as approved in the Stormwater Management Plan):	0.35 acres
Primary estimated area to be disturbed (portions with Erosion and Sediment Control Plan approval only):	0.35 acres
Offsite estimated area to be disturbed (if applicable):	N/A

B. Estimated Project Dates (MM/DD/YYYY)	
Start date:	07/01/2022
Completion date:	12/01/2023

C. Property Owner Status: **FEDERAL** ☐ **STATE** ☐ **PUBLIC** ☐ **PRIVATE** ☒

D. Nature of the Construction Activity Description (i.e. commercial, industrial, residential, agricultural, environmental): Commercial and Residential Water System Improvement

E. Municipal Separate Storm Sewer System (MS4) name (if discharging to a MS4):

F. Is this construction activity part of a common plan of development or sale? **YES** ☐ **NO** ☒

G. 6th Order Hydrologic Unit Code (HUC) and Receiving Water Name(s). Attach a separate list if needed.

HUC	RECEIVING WATERBODY(S)
020802060902	Pagan River - Warren Creek

Section V. Other Information.

A. A stormwater pollution prevention plan (SWPPP) must be prepared in accordance with the requirements of the General VPDES Permit for Discharges of Stormwater from Construction Activities prior to submitting the Registration Statement. By signing the Registration Statement, the operator is certifying that the SWPPP has been prepared.

B. Has an Erosion and Sediment Control Plan been submitted to the VESCP Authority for review? **YES** ☐ **NO** ☒
Erosion and Sediment Control Plan Approval Date (for estimated area to be disturbed).:_____

C. Has land disturbance has commenced? **YES** ☐ **NO** ☒

D. If this project is using approved Annual Standards and Specifications (AS&S), attach the completed AS&S Entity Form. AS&S Entity Name (if different from the Operator identified in Section II. A.):_____

SEE THE FOLLOWING PAGE FOR SIGNATURE

AND CERTIFICATION REQUIREMENTS AND INFORMATION

Section VI. Certification. A person representing the operator as identified in Section I. A. and meeting the requirements of 9VAC25-880-70. Part III. K must physically sign this certification. A typed signature is not acceptable. Please note that operator is defined in 9VAC25-870-10 as follows:

"Operator" means the owner or operator of any facility or activity subject to the Act and this chapter. In the context of stormwater associated with a large or small construction activity, operator means any person associated with a construction project that meets either of the following two criteria: (i) the person has direct operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications or (ii) the person has day-to-day operational control of those activities at a project that are necessary to ensure compliance with a stormwater pollution prevention plan for the site or other state permit or VSMP authority permit conditions (i.e., they are authorized to direct workers at a site to carry out activities required by the stormwater pollution prevention plan or comply with other permit conditions). In the context of stormwater discharges from Municipal Separate Storm Sewer Systems (MS4s), operator means the operator of the regulated MS4 system.

9VAC25-880-70. Part III. K. Signatory Requirements. *Registration Statement. All Registration Statements shall be signed as follows:*

a. For a corporation: by a responsible corporate officer. For the purpose of this chapter, a responsible corporate officer means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy-making or decision-making functions for the corporation; or (ii) the manager of one or more manufacturing, production, or operating facilities, provided the manager is authorized to make management decisions that govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for state permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

c. For a municipality, state, federal, or other public agency: by either a principal executive officer or ranking elected official. For purposes of this chapter, a principal executive officer of a public agency includes: (i) the chief executive officer of the agency or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

Certification: "I certify under penalty of law that I have read and understand this Registration Statement and that this document and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations."

Printed Name: _____

Signature (signed in ink): _____

Date: _____

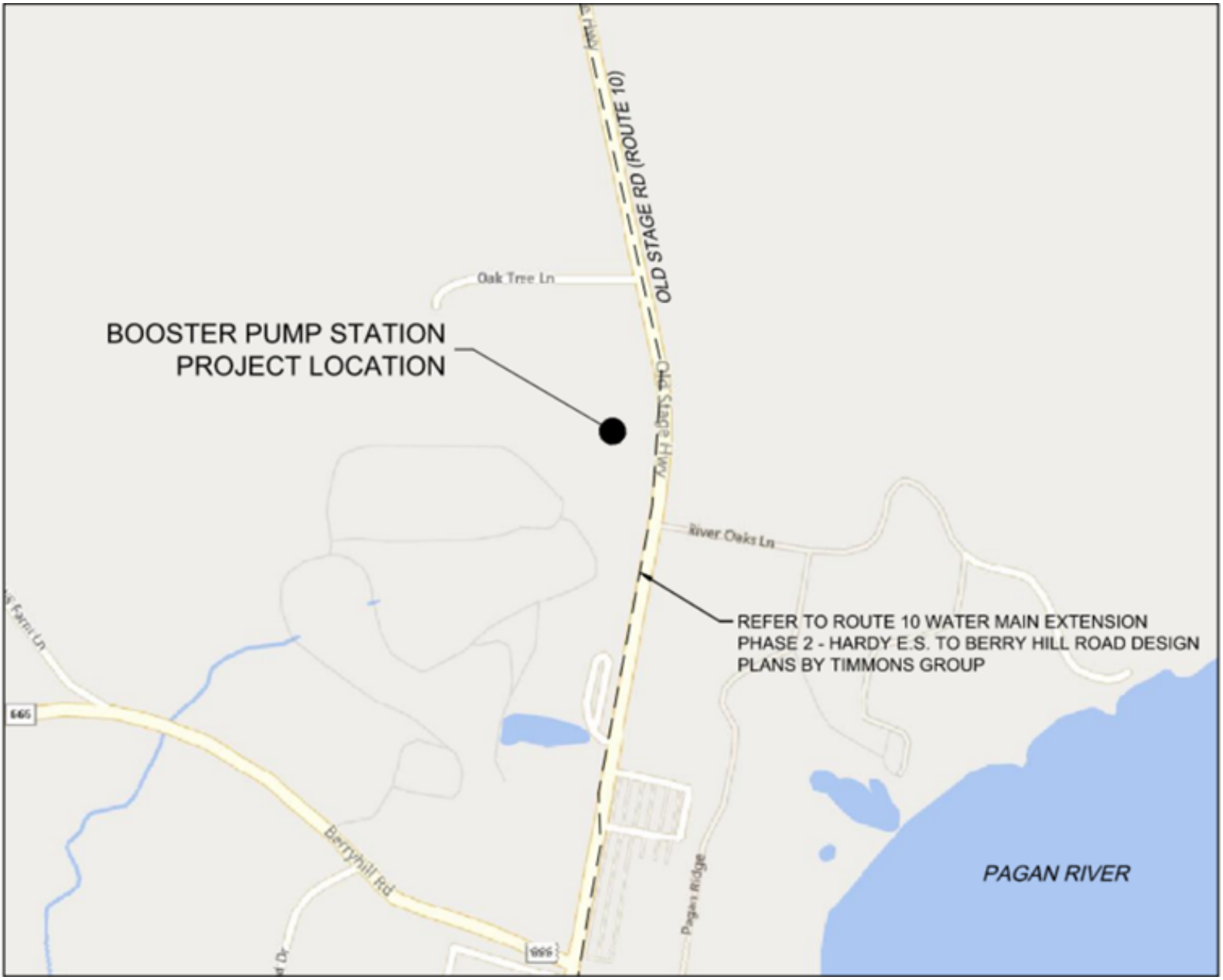
Section VII. Submittal Instructions. Submit this form to the Virginia Stormwater Management Program (VSMP) Authority. If the locality is the VSMP Authority, please send your Registration Statement submittal directly to the locality; do NOT send this form to DEQ. A list of local VSMP Authorities is available here: VSMP Authorities.

If DEQ is the VSMP Authority, please send to:

Department of Environmental Quality
Office of Stormwater Management Suite 1400
PO Box 1105
Richmond VA 23218
constructiongp@deq.virginia.gov

If the locality is the VSMP Authority, please send to:

The Local VSMP Authority *(insert address below)*


OLD STAGE RD (ROUTE 10)
Oak Tree Ln
BOOSTER PUMP STATION
PROJECT LOCATION
River Oaks Ln
REFER TO ROUTE 10 WATER MAIN EXTENSION
PHASE 2 - HARDY E.S. TO BERRY HILL ROAD DESIGN
PLANS BY TIMMONS GROUP
665
Berryhill Rd
Pagan Ridge
PAGAN RIVER

Appendix C

Transfer of Ownership Agreement Form
Notice of Termination

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
GENERAL VPDES PERMIT FOR DISCHARGES OF STORMWATER FROM CONSTRUCTION ACTIVITIES (VAR10)
TRANSFER OF OWNERSHIP AGREEMENT 2019

Permit Coverage Number (VAR10####): _____

Construction Activity Name: _____

Section I. Current Construction Activity Operator/Permittee Information. Operator information as it appears on the current, active permit coverage.

Construction Activity Operator Name: _____

Contact Person: _____

Address: _____

City, State and Zip Code: _____

Phone Number: _____

Primary Email: _____

CC Email: _____

"I (We) hereby agree to the transfer of ownership modification to the referenced General VPDES Permit for Discharges of Stormwater from Construction Activities (VAR10)."

Printed Name: _____

Signature: _____

Date: _____

Section II. New Construction Activity Operator/Permittee Information. Permit coverage will be transferred to this person or entity.

Construction Activity Operator Name (NEW): _____

Contact Person: _____

Address: _____

City, State and Zip Code: _____

Phone Number: _____

Primary Email: _____

CC Email: _____

"I (We) hereby agree to the transfer of ownership modification to the referenced General VPDES Permit for Discharges of Stormwater from Construction Activities (VAR10)."

Printed Name: _____

Signature: _____

Date: _____

Section III. New Construction Activity Operator/Permittee Billing Information. This entity will receive Annual Permit Maintenance and Permit Modification Fee invoices (if applicable). Leave this section blank if same as the New Operator as identified in Section II. A. above.

Billing Entity Name: _____

Contact Person: _____

Address: _____

City, State and Zip Code: _____

Phone Number: _____

Primary Email: _____

CC Email: _____

May we transmit correspondence electronically? You must choose **YES** and include a valid email in order to pay by credit card and to receive your transfer approval letter via email: **YES** ☐ **NO** ☐

Section IV. Instructions.

A properly authorized individual as specified in the General VPDES Permit for Stormwater Discharges from Construction Activities (VAR10), Part III K (Signatory Requirements) must physically sign this Transfer of Ownership Agreement.

Please retain a copy of this agreement form for your records and include a copy in your Stormwater Pollution Prevention Plan (SWPPP).

Submit this form to the VSMP Authority. If the locality is the VSMP Authority, please submit your Transfer of Ownership Agreement directly to the locality; do NOT send this form to DEQ. A list of local VSMP Authorities is available here: VSMP Authorities.

If DEQ is the VSMP Authority, please send to:

Department of Environmental Quality
Office of Stormwater Management Suite 1400
PO Box 1105
Richmond VA 23218
constructiongp@deq.virginia.gov

If the locality is the VSMP Authority, please send to:

The Local VSMP Authority *(insert address below)*

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
GENERAL VPDES PERMIT FOR DISCHARGES OF STORMWATER FROM CONSTRUCTION ACTIVITIES (VAR10)
NOTICE OF TERMINATION 2019

Permit Coverage Number (VAR10####): _____

Section I. Operator/Permittee Information. The person or entity that has active permit coverage approval and operational control over construction activities to ensure compliance with the general permit. A person with signatory authority for this operator must sign the certification in Section VII (per Part III. K. of the VAR10 Permit).

Construction Activity Operator Name: _____

Contact Person: _____

Address: _____

City, State, Zip Code: _____

Phone Number: _____

Primary Email: _____

CC Email: _____

Section II. Construction Activity Location Information. Project site information.

Construction Activity Name: _____

Address: _____

City and/or County and Zip Code: _____

Latitude and Longitude (6-digit, decimal degrees format): _____

Section III. Reason for Terminating Coverage under the General Permit. The operator shall submit a Notice of Termination within 30 days after meeting one or more of the following conditions (select one or more):

☐ **A.** Necessary permanent control measures included in the SWPPP for the site are in place and functioning effectively **and** final stabilization has been achieved on all portions of the site for which the operator is responsible. When applicable, long-term responsibility and maintenance requirements for permanent control measures shall be recorded in the local land records prior to the submission of a Notice of Termination;

☐ **B.** Another operator has assumed control over all areas of the site that have not been finally stabilized and obtained coverage for the ongoing discharge;

☐ **C.** Coverage under an alternative VPDES or state permit has been obtained; or

☐ **D.** For residential construction only, temporary soil stabilization has been completed, the operator has provided written notification to the homeowner about the importance of final stabilization and incorporating a copy of the notification and signed certification statement into the SWPPP, and the residence has been transferred to the homeowner.

Section IV. Participation in a Regional Stormwater Management Plan. If your site discharges to a regional stormwater management facility, provide information related to the regional stormwater management plan. Attach a separate list if discharging to multiple regional facilities.

Regional Stormwater Management Facility Type:	
Address:	
City and/or County and Zip Code:	
Latitude and Longitude (6-digit, decimal degrees format):	
Total Acres Treated by Regional Facility (report to one-hundredth of an acre):	
Impervious Acres Treated by Regional Facility (report to one-hundredth of an acre):	

Section V. Perpetual Nutrient Credits. If your site is utilizing nutrient credits, provide information related to the perpetual nutrient credits that were acquired in accordance with § 62.1-44.15:35 of the Code of Virginia. Attach a separate list if needed.

Nonpoint Nutrient Credit Generating Entity (Bank Name):	
Perpetual Nutrient Credits Acquired (pounds/acres/year):	

Include the affidavit of sale for all nutrient credits acquired. Is the affidavit of sale of nutrient credits attached? ☐**YES** ☐**NO**

Section VI. Permanent Control Measures. If applicable, list the post-development stormwater management facilities or best management practices (BMPs) that were constructed and installed as part of this activity to comply with the stormwater management technical criteria (structural and nonstructural, on-site and off-site). Attach a separate list if needed.

If you have permanent control measures, the following items are required to be included with this form in order to complete your Notice of Termination submittal:

☐ **A.** Engineer's Certification Statement
☐ **B.** As-built plans (construction record drawings) – digital
☐ **C.** As-built plans (construction record drawings) – full-sized, paper
☐ **D.** Stormwater Management Plans – digital
☐ **E.** BMP Maintenance Agreement – notarized original, for public and private projects under DEQ's VSMP Authority

Stormwater Management Facility Types *(please choose from the following bmp types):*

Bioretention 1
Bioretention 2
Bioretention basin
Bioretention filter
Constructed Wetland 1
Constructed Wetland 2
Constructed wetlands
Dry Swale 1
Dry Swale 2
Extended detention (2 x WQ Vol)
Extended Detention Pond 1
Extended Detention Pond 2
Extended detention-enhanced
Filtering Practice 1
Filtering Practice 2
Grass Channel
Grassed swale
Infiltration (1 x WQ Vol)
Infiltration (2 x WQ Vol)
Infiltration 1
Infiltration 2
Other IIB (manufactured treatment device, etc.)
Other IIC (manufactured treatment device, etc.)
Permeable Pavement 1
Permeable Pavement 2
Rainwater Harvesting
Retention basin I (3 x WQ Vol)
Retention basin II (4 x WQ Vol)
Retention basin III (4 x WQ Vol with aquatic bench)
Sand filter
Sheetflow to Vegetated Filter or Conserved Open Space 2
Soil Amendments
Urban Bioretention
Vegetated filter strip
Vegetated Roof 1
Vegetated Roof 2
Wet Pond 1
Wet Pond 2
Wet Swale 1
Wet Swale 2

Stormwater Management Facility #1 BMP Type:	
Date BMP Became Functional:	
Address (if available):	
City and/or County and Zip Code:	
Latitude and Longitude (6-digit, decimal degrees format):	
Receiving Water(s) (outfall discharge):	
Total Acres Treated (report to one-hundredth of an acre):	
Impervious Acres Treated (report to one-hundredth of an acre):	

Stormwater Management Facility #2 BMP Type:	
Date BMP Became Functional:	
Address (if available):	
City and/or County and Zip Code:	
Latitude and Longitude (6-digit, decimal degrees format):	
Receiving Water(s) (outfall discharge):	
Total Acres Treated (report to one-hundredth of an acre):	
Impervious Acres Treated (report to one-hundredth of an acre):	

Stormwater Management Facility #3 BMP Type:	
Date BMP Became Functional:	
Address (if available):	
City and/or County and Zip Code:	
Latitude and Longitude (6-digit, decimal degrees format):	
Receiving Water(s) (outfall discharge):	
Total Acres Treated (report to one-hundredth of an acre):	
Impervious Acres Treated (report to one-hundredth of an acre):	

Section VII. Certification. This Certification must be signed by a person representing the operator identified in Section I. and meeting the requirements of 9VAC25-880-70 Part III K.

Certification: "I certify under penalty of law that I have read and understand this Notice of Termination and that this document and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations."

Printed Name: _____

Signature (signed in ink): _____

Date: _____

Section VIII. Submittal Instructions. Please submit this form to the Virginia Stormwater Management Program (VSMP) Authority that has jurisdiction for your construction activity. If the locality is the VSMP Authority, please submit your form directly to the locality; do NOT send this form to DEQ. A list of local VSMP Authorities is available here: VSMP Authorities.

If DEQ is the VSMP Authority, please send to:

Department of Environmental Quality
Office of Stormwater Management Suite 1400
PO Box 1105
Richmond VA 23218
constructiongp@deq.virginia.gov

If the locality is the VSMP Authority, please send to:

The Local VSMP Authority *(insert address below)*

Permit terminations may be delayed if there are outstanding annual permit maintenance fee balances due.

A complete and accurate Notice of Termination is required for terminating coverage under the General VPDES Permit for Discharges of Stormwater from Construction Activities. Termination shall become effective upon notification from the department that the provisions of termination have been met or 60 days after submittal of a complete and accurate Notice of Termination, whichever occurs first.

Authorization to discharge terminates at midnight on the date that the Notice of Termination is submitted unless otherwise notified by the VSMP authority or the department.

Permit Coverage Number. Include your existing, active permit coverage number. Example: VAR10####.

Section I. Operator/Permittee Information. The construction activity operator (permittee). The permittee with active permit coverage and that has operational control over the construction activities to ensure compliance with the general permit. For companies, use the complete, active, legal entity name as registered with a state corporation commission. Entities that are considered operators commonly consist of the property owner, developer of a project (the party with control of project plans and specifications), or general contractor (the party with day-to-day operational control of the activities at the project site that are necessary to ensure compliance with the general permit). If an individual person is named as the operator, that person (or a representative of) must sign the certification in Section VII.

Section II. Construction Activity Location Information. Project site information. Complete this section with the same information as listed on the current registration statement. A list of active permits and corresponding location information is available on our website.

Section III. Reason for Terminating Coverage under the General Permit. The operator shall submit the Notice of Termination no later than 30 days after one or more of the termination conditions being met. Authorization to discharge terminates at midnight on the date that the Notice of Termination is submitted to the VSMP Authority, unless otherwise notified by the VSMP authority or the Department. Termination of authorizations to discharge for the conditions shall be effective upon notification from the Department that the provisions of termination have been met or 60 days after submittal of the Notice of Terminations, whichever occurs first.

The operator of the construction activity shall submit a Notice of Termination within 30 days after meeting one or more of the following conditions (you may select one or more of these conditions):

- **[A]** Necessary permanent control measures included in the SWPPP for the site are in place and functioning effectively and final stabilization has been achieved on all portions of the site for which the operator is responsible has operational control. When applicable, long-term responsibility and maintenance requirements for permanent control measures shall be recorded in the local land records prior to the submission of a complete and accurate Notice of Termination;
- **[B]** Another operator has assumed control over all areas of the site that have not been finally stabilized and obtained coverage for the ongoing discharge;
- **[C]** Coverage under an alternative VPDES or state permit has been obtained; or
- **[D]** For individual lots in residential construction only, temporary soil final stabilization as defined in 9VAC25-880-1, has been completed and the residence has been transferred to the homeowner.

Section IV. Participation in a Regional Stormwater Management Plan. Where applicable, include information for each regional stormwater management facility to which this site contributes. If your site is contributing to more than one regional facility, please include the information for each facility in a separate list.

The following information shall be included for each regional stormwater management facility installed:

- the type stormwater management facility (see the list of facility types on page 2 of the Notice of Termination);
- the physical location of the facility, including city or county, and latitude and longitude in decimal degrees;
- the receiving water to which the regional facility is discharging; and
- the number of total and impervious acres treated by the regional stormwater management plan to the nearest one-hundredth of an acre. The total of the impervious acreage may equal but not exceed the total acreage.

Section V. Perpetual Nutrient Credits. If your site is utilizing nutrient credits, provide information related to all perpetual nutrient credits acquired in accordance with § 62.1-44.15:35 of the Code of Virginia. Attach a separate list if needed. Attach the affidavit(s) of sale for the purchase of all nutrient credits acquired for this activity.

Section VI. Permanent Control Measures. If applicable, list all post-development stormwater management facilities or best management practices (BMPs) that were constructed and installed as part of this activity to comply with the stormwater management technical criteria (structural and nonstructural, on-site and off-site). Choose the type from the list provided in the Notice of Termination form Section VI. If you have multiple BMPs, attach a separate list if needed.

The following information shall be included for each permanent control measure installed:

- the type of permanent control measure receiving the discharge (choose from list provided);
- the date that it became functional as a permanent control measure (MM/DD/YYYY);
- the location of the BMP, including city or county, and latitude and longitude in decimal degrees;
- the receiving water(s) to which the permanent control measure discharges; and
- the number of total and impervious acres treated by the permanent control measures to the nearest one-hundredth of an acre. The total of the impervious acreage may equal but not exceed the total acreage.

The following items are required to be submitted with the Notice of Termination if you have permanent control measures:

- Engineer's Certification Statement. Signed by a professional registered in the Commonwealth of Virginia, certifying that the stormwater management facilities were constructed in accordance with the approved plan.
- Construction record drawing(s) (as-built plan) in a format as specified by the VSMP authority for permanent stormwater management facilities in accordance with 9VAC25-870-55 D appropriately sealed and signed. One digital and one full-sized paper copy.
- Stormwater management plans (digital)
- BMP Maintenance Agreement. Submit an original, signed and notarized BMP Maintenance Agreement for all public and private permits where DEQ is the VSMP Authority. *Termination is not final until you submit the local court record of receipt to DEQ showing that the signed Stormwater Management Maintenance Agreement was recorded with the land deed.*

Section VII. Certification. This Certification must be signed by a person representing the operator identified in Section I. and meeting the requirements of 9VAC25-880-70. Part III. K.

Section VIII. Submittal Instructions. Submit this form to the VSMP Authority that has jurisdiction for your construction activity. The VSMP Authority may be either DEQ **or** your locality depending on the location and type of project. If your project is under the jurisdiction of a Local VSMP Authority, please contact the locality for additional submittal instructions. A blank area is provided for the Local VSMP Authority to include their mailing address.

Who is the VSMP Authority for my project? DEQ or the locality?

- **DEQ**: DEQ is the VSMP Authority and administers permit coverage for land-disturbing activities that are:
  - within a locality that is not a VSMP Authority;
  - owned by the State or Federal government; or
  - utilizing approved Annual Standards and Specifications.

- **The Locality**: The local government (locality) is the VSMP Authority and administers permit coverage for all other projects not covered by DEQ as listed above. For these projects, please submit permit forms directly to the Local VSMP Authority. A list of Local VSMP Authorities is available on DEQ's website here: Local VSMP Authority List.

DEQ'S CONSTRUCTION GENERAL PERMIT WEBSITE

http://www.deq.virginia.gov/Programs/Water/StormwaterManagement/VSMPPermits/ConstructionGeneralPermit.aspx

Appendix D

Record of Land Disturbance
SWPPP Inspections
Corrective Action Log

Record of Land Disturbance

DATE	Area of Disturbance	Responsible Party for Area	Area Perm/Temp Stabilized	Notes

Record of Land Disturbance

DATE	Area of Disturbance	Responsible Party for Area	Area Perm/Temp Stabilized	Notes

STORMWATER INSPECTIONS FOR VSMP GENERAL PERMIT LAND DISTURBING ACTIVITIES

PROJECT: _____
MONITORING FOR THE WEEK BEGINNING: _____

RAINFALL:

Date of Rain	Amount (inches)	Initials

By this signature, I certify that this report is accurate and complete to the best of my knowledge:

_____
(Signature of Delegated Authority)

EROSION AND SEDIMENT CONTROL FACILITIES INSPECTED: (Inspections shall be conducted according to Part IIF2 of the Permit. However, if the discharges of stormwater from construction activities are to surface waters identified as impaired, inspections shall be conducted according to Part IB4d.)

Facility Identification	Date and Time of Inspection	Operating Properly (Y/N)	Description of inspection observations

OBSERVATION OF RUNOFF AT STORMWATER DISCHARGE OUTFALLS: (Inspections shall be conducted according to Part IIF2 of the Permit. However, if the discharges of stormwater from construction activities are to surface waters identified as impaired, inspections shall be conducted according to Part IB4d.)

Stormwater Discharge Outfall Identification	**Date**	**Clarity**	**Floating Solids**	**Suspended Solids**	**Oil Sheen**	**Other obvious indicators of stormwater pollution** (list and describe)	**Visible sediment leaving the site?** (Y/N)	**If yes, describe actions taken to prevent future releases** (may need to attach additional information)	**Describe measures taken to clean up sediment outside of disturbed limits** (may need to attach additional information)

Clarity: Choose the number which best describes the clarity of the discharge where 1 is clear and 10 is very cloudy.
Floating Solids: Choose the number which best describes the amount of floating solids in the discharge where 1 is no solids and 10 the surface is covered in floating solids.
Suspended Solids: Choose the number which best describes the amount of suspended solids in the discharge where 1 is no solids and 10 is extremely muddy.
Oil Sheen: Is there an oil sheen in the stormwater discharge? Y or N.

STORMWATER INSPECTIONS FOR VSMP GENERAL PERMIT LAND DISTURBING ACTIVITIES

PROJECT: _____
MONITORING FOR THE WEEK BEGINNING: _____

RAINFALL:

Date of Rain	Amount (inches)	Initials

By this signature, I certify that this report is accurate and complete to the best of my knowledge:

_____
(Signature of Delegated Authority)

EROSION AND SEDIMENT CONTROL FACILITIES INSPECTED: (Inspections shall be conducted according to Part IIF2 of the Permit. However, if the discharges of stormwater from construction activities are to surface waters identified as impaired, inspections shall be conducted according to Part IB4d.)

Facility Identification	Date and Time of Inspection	Operating Properly (Y/N)	Description of inspection observations

OBSERVATION OF RUNOFF AT STORMWATER DISCHARGE OUTFALLS: (Inspections shall be conducted according to Part IIF2 of the Permit. However, if the discharges of stormwater from construction activities are to surface waters identified as impaired, inspections shall be conducted according to Part IB4d.)

Stormwater Discharge Outfall Identification	**Date**	**Clarity**	**Floating Solids**	**Suspended Solids**	**Oil Sheen**	**Other obvious indicators of stormwater pollution** (list and describe)	**Visible sediment leaving the site?** (Y/N)	**If yes, describe actions taken to prevent future releases** (may need to attach additional information)	**Describe measures taken to clean up sediment outside of disturbed limits** (may need to attach additional information)

Clarity: Choose the number which best describes the clarity of the discharge where 1 is clear and 10 is very cloudy.
Floating Solids: Choose the number which best describes the amount of floating solids in the discharge where 1 is no solids and 10 the surface is covered in floating solids.
Suspended Solids: Choose the number which best describes the amount of suspended solids in the discharge where 1 is no solids and 10 is extremely muddy.
Oil Sheen: Is there an oil sheen in the stormwater discharge? Y or N.

STORMWATER INSPECTIONS FOR VSMP GENERAL PERMIT LAND DISTURBING ACTIVITIES

PROJECT: _____
MONITORING FOR THE WEEK BEGINNING: _____

RAINFALL:

Date of Rain	Amount (inches)	Initials

By this signature, I certify that this report is accurate and complete to the best of my knowledge:

_____
(Signature of Delegated Authority)

EROSION AND SEDIMENT CONTROL FACILITIES INSPECTED: (Inspections shall be conducted according to Part IIF2 of the Permit. However, if the discharges of stormwater from construction activities are to surface waters identified as impaired, inspections shall be conducted according to Part IB4d.)

Facility Identification	Date and Time of Inspection	Operating Properly (Y/N)	Description of inspection observations

OBSERVATION OF RUNOFF AT STORMWATER DISCHARGE OUTFALLS: (Inspections shall be conducted according to Part IIF2 of the Permit. However, if the discharges of stormwater from construction activities are to surface waters identified as impaired, inspections shall be conducted according to Part IB4d.)

Stormwater Discharge Outfall Identification	**Date**	**Clarity**	**Floating Solids**	**Suspended Solids**	**Oil Sheen**	**Other obvious indicators of stormwater pollution** (list and describe)	**Visible sediment leaving the site?** (Y/N)	**If yes, describe actions taken to prevent future releases** (may need to attach additional information)	**Describe measures taken to clean up sediment outside of disturbed limits** (may need to attach additional information)

Clarity: Choose the number which best describes the clarity of the discharge where 1 is clear and 10 is very cloudy.
Floating Solids: Choose the number which best describes the amount of floating solids in the discharge where 1 is no solids and 10 the surface is covered in floating solids.
Suspended Solids: Choose the number which best describes the amount of suspended solids in the discharge where 1 is no solids and 10 is extremely muddy.
Oil Sheen: Is there an oil sheen in the stormwater discharge? Y or N.

STORMWATER INSPECTIONS FOR VSMP GENERAL PERMIT LAND DISTURBING ACTIVITIES

PROJECT: _____
MONITORING FOR THE WEEK BEGINNING: _____

RAINFALL:

Date of Rain	Amount (inches)	Initials

By this signature, I certify that this report is accurate and complete to the best of my knowledge:

_____
(Signature of Delegated Authority)

EROSION AND SEDIMENT CONTROL FACILITIES INSPECTED: (Inspections shall be conducted according to Part IIF2 of the Permit. However, if the discharges of stormwater from construction activities are to surface waters identified as impaired, inspections shall be conducted according to Part IB4d.)

Facility Identification	Date and Time of Inspection	Operating Properly (Y/N)	Description of inspection observations

OBSERVATION OF RUNOFF AT STORMWATER DISCHARGE OUTFALLS: (Inspections shall be conducted according to Part IIF2 of the Permit. However, if the discharges of stormwater from construction activities are to surface waters identified as impaired, inspections shall be conducted according to Part IB4d.)

Stormwater Discharge Outfall Identification	**Date**	**Clarity**	**Floating Solids**	**Suspended Solids**	**Oil Sheen**	**Other obvious indicators of stormwater pollution** (list and describe)	**Visible sediment leaving the site?** (Y/N)	**If yes, describe actions taken to prevent future releases** (may need to attach additional information)	**Describe measures taken to clean up sediment outside of disturbed limits** (may need to attach additional information)

Clarity: Choose the number which best describes the clarity of the discharge where 1 is clear and 10 is very cloudy.
Floating Solids: Choose the number which best describes the amount of floating solids in the discharge where 1 is no solids and 10 the surface is covered in floating solids.
Suspended Solids: Choose the number which best describes the amount of suspended solids in the discharge where 1 is no solids and 10 is extremely muddy.
Oil Sheen: Is there an oil sheen in the stormwater discharge? Y or N.

STORMWATER INSPECTIONS FOR VSMP GENERAL PERMIT LAND DISTURBING ACTIVITIES

PROJECT: _____
MONITORING FOR THE WEEK BEGINNING: _____

RAINFALL:

Date of Rain	Amount (inches)	Initials

By this signature, I certify that this report is accurate and complete to the best of my knowledge:

_____
(Signature of Delegated Authority)

EROSION AND SEDIMENT CONTROL FACILITIES INSPECTED: (Inspections shall be conducted according to Part IIF2 of the Permit. However, if the discharges of stormwater from construction activities are to surface waters identified as impaired, inspections shall be conducted according to Part IB4d.)

Facility Identification	Date and Time of Inspection	Operating Properly (Y/N)	Description of inspection observations

OBSERVATION OF RUNOFF AT STORMWATER DISCHARGE OUTFALLS: (Inspections shall be conducted according to Part IIF2 of the Permit. However, if the discharges of stormwater from construction activities are to surface waters identified as impaired, inspections shall be conducted according to Part IB4d.)

Stormwater Discharge Outfall Identification	**Date**	**Clarity**	**Floating Solids**	**Suspended Solids**	**Oil Sheen**	**Other obvious indicators of stormwater pollution** (list and describe)	**Visible sediment leaving the site?** (Y/N)	**If yes, describe actions taken to prevent future releases** (may need to attach additional information)	**Describe measures taken to clean up sediment outside of disturbed limits** (may need to attach additional information)

Clarity: Choose the number which best describes the clarity of the discharge where 1 is clear and 10 is very cloudy.
Floating Solids: Choose the number which best describes the amount of floating solids in the discharge where 1 is no solids and 10 the surface is covered in floating solids.
Suspended Solids: Choose the number which best describes the amount of suspended solids in the discharge where 1 is no solids and 10 is extremely muddy.
Oil Sheen: Is there an oil sheen in the stormwater discharge? Y or N.

STORMWATER INSPECTIONS FOR VSMP GENERAL PERMIT LAND DISTURBING ACTIVITIES

PROJECT: _____
MONITORING FOR THE WEEK BEGINNING: _____

RAINFALL:

Date of Rain	Amount (inches)	Initials

By this signature, I certify that this report is accurate and complete to the best of my knowledge:

_____
(Signature of Delegated Authority)

EROSION AND SEDIMENT CONTROL FACILITIES INSPECTED: (Inspections shall be conducted according to Part IIF2 of the Permit. However, if the discharges of stormwater from construction activities are to surface waters identified as impaired, inspections shall be conducted according to Part IB4d.)

Facility Identification	Date and Time of Inspection	Operating Properly (Y/N)	Description of inspection observations

OBSERVATION OF RUNOFF AT STORMWATER DISCHARGE OUTFALLS: (Inspections shall be conducted according to Part IIF2 of the Permit. However, if the discharges of stormwater from construction activities are to surface waters identified as impaired, inspections shall be conducted according to Part IB4d.)

Stormwater Discharge Outfall Identification	**Date**	**Clarity**	**Floating Solids**	**Suspended Solids**	**Oil Sheen**	**Other obvious indicators of stormwater pollution** (list and describe)	**Visible sediment leaving the site?** (Y/N)	**If yes, describe actions taken to prevent future releases** (may need to attach additional information)	**Describe measures taken to clean up sediment outside of disturbed limits** (may need to attach additional information)

Clarity: Choose the number which best describes the clarity of the discharge where 1 is clear and 10 is very cloudy.
Floating Solids: Choose the number which best describes the amount of floating solids in the discharge where 1 is no solids and 10 the surface is covered in floating solids.
Suspended Solids: Choose the number which best describes the amount of suspended solids in the discharge where 1 is no solids and 10 is extremely muddy.
Oil Sheen: Is there an oil sheen in the stormwater discharge? Y or N.

CORRECTIVE ACTIONS

Documentation of any corrective actions taken must be noted and retained with the SWPPP as required by the General VPDES Permit for Discharges of Stormwater from Construction Activities. The operator shall implement corrective actions according to Part II G of the Permit.

CORRECTIVE ACTION LOG

Corrective Action Date	Description of Corrective Action
Responsible Party	
Responsible Party	
Responsible Party	
Responsible Party	

"I certify under penalty of law that I have read and understand this document in accordance with the General VPDES Permit for Discharges of Stormwater from Construction Activities. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."
Operator or Delegated Authority Signature

Appendix E

Delegation of Authority
Identification of Qualified Personnel

Revisions to Delegation of Authority

The individuals or positions with delegated authority must be identified to sign inspection forms and modify the SWPPP, in accordance with the General VPDES Permit for Discharges of Stormwater from Construction Activities. If the identified individual on the cover sheet of the SWPPP changes, it must be noted below.

Site: _____

Name:	
Title:	
Company:	
Telephone:	
I certify the individual or position named above has the delegated authority to sign inspection forms and amend/modify the SWPPP.	
Operator Signature:	
Date:	

Name:	
Title:	
Company:	
Telephone:	
I certify the individual or position named above has the delegated authority to sign inspection forms and amend/modify the SWPPP.	
Operator Signature:	
Date:	

Identification of Qualified Personnel

The individuals responsible for conducting inspections must be identified, in accordance with the General VPDES Permit for Discharges of Stormwater from Construction Activities. If the identified individual changes, it must be noted below.

Site: _____

Name:	
Title:	
Company:	
Address:	
Telephone:	
Qualifications:	

Name:	
Title:	
Company:	
Address:	
Telephone:	
Qualifications:	

Appendix F

Erosion and Sediment Control Plans
Stormwater Management Plan and Water Calculations

OLD STAGE ROAD BOOSTER PUMP STATION

STORMWATER MANAGEMENT NARRATIVE

MARCH 22, 2022

PREPARED FOR:

ISLE OF WIGHT

PREPARED BY:

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

2901 S Lynnhaven Road, Suite 200
Virginia Beach, Virginia 23452
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STORMWATER MANAGEMENT NARRATIVE

Pre-Development

The existing site is composed of almost entirely of wooded and grass cover. In total, there is approximately 0.27 acres of Forest area and 0.08 acres of Turf (grasses). Turf grasses cover approximately 22.9% of the site. The existing stormwater drainage from the site flows overland primarily to the southwest off site and eventually towards the Pagan River. According to the soil data, hydrologic soil groups (HSG) B and D soils existing with 63% B soils and 37% D soils. A full breakdown of HSG designations and land cover is provided in the VRRM spreadsheet calculations.

Post-Development

Pre-existing drainage patterns are being maintained through the project with only slight grading increases to provide a flat surface for the booster pump station. Proposed small slopes are graded at 3:1 or flatter for a height of less than 2 feet. The land cover is changing with the wooded area being cleared for the installation of the pump station and access road. The adjacent area is being grasses or mulched with plants, as shown on the Landscaping plan (analyzed as managed turf in the VRRM and stormwater analyses). The impervious on site will increase slightly by approximately 0.10 acres.

The 0.35 acres of Forest conversion to grass and impervious cover on this site is small and results in minimal stormwater impacts. Time of concentration and flow calculations were developed for this area to analyze any impact in increased sheet flow due to the land cover change. Time of concentration calculations are provided in Appendix A. A summary of the runoff Q values for this area is in the table below for the 10-yr storm event.

Table 1| 10yr Peak Flow Rates Pre and Post land clearing

Factors of Q / Drainage Basin	C Value	Intensity	Area	10 yr Q values
		in/hr	acres	cfs
Pre	0.22	5.39	0.35	0.42
Post	0.47	6.79	0.35	1.12
Increase				0.70

Both the Pre- and Post- Q values for the 10-yr storm are small enough to have almost negligible impact on the flow rate for the site, and the increase caused by the land cover change is only 0.70 cfs in a 10-yr storm, a negligible quantity over 0.35 acres. To further analyze the impact, a velocity of these flow rates was determined using the width of the total area (218') times an average depth of sheet flow

(0.1'). Using Q=VA, the velocity values associated with the Pre, Post, and increase flows are negligible and nonerosive for all soil and land cover conditions. These results are in the table below.

Table 2| 10yr Velocity Calculations for Flow Rates

	Q=VA		
	Q (cfs)	V (ft/s)	A (sf)
Pre	0.42	0.019	21.8
Post	1.12	0.051	21.8
Increase	0.70	0.032	21.8

With these results for the 10-yr storm events, no erosive change is anticipated for the 2-yr or other storms.

VRRM

The Virginia Runoff Reduction Method (VRRM) - Redevelopment Compliance Spreadsheet was used to calculate the Total Phosphorus Load (TP) and reduction required for this project. The project disturbed area (0.35 acres) was analyzed to calculate the required treatment volume and phosphorus load reduction. The drainage areas applied to VRRM are in Appendix A. Isle of Wight will purchase 0.20 lbs of phosphorus point source credits and the associated nitrogen and total suspended solids loading. The table below is a summary of the required TP Load reduction required and achieved for this project.

Table 3| Total Phosphorus Reduction and VRRM Requirements

Site	TP Reduction Required	TP Reduction Achieved
Old Stage Rd BPS	0.20 lb/yr	0.20 lb/yr

Refer to the VRRM calculations in Appendix B

Appendix A – Stormwater Management Calculations and Documents

DEQ Virginia Runoff Reduction Method Re-Development Compliance Spreadsheet - **Version 3.0**

☑ 2011 BMP Standards and Specifications ☐ 2013 Draft BMP Standards and Specifications

CLEAR ALL

data input cells | constant values | calculation cells | final results

Project Name:	**Old Stage Road Booster Pump Station**
Date:	**3/22/2022**
	Linear Development Project? No

Site Information

Post-Development Project (Treatment Volume and Loads)

Enter Total Disturbed Area *(acres)* → 0.35

Check:

BMP Design Specifications List: 2011 Stds & Specs

Maximum reduction required: 10%

Linear project? No

The site's net increase in impervious cover (acres) is: 0.1

Land cover areas entered correctly? ✔

Post-Development TP Load Reduction for Site (lb/yr): 0.20

Total disturbed area entered? ✔

Pre-ReDevelopment Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed forest/open space		0.22		0.05	0.27
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed				0.08	0.08
Impervious Cover (acres)					0.00
					0.35

Post-Development Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land					0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed		0.14		0.11	0.25
Impervious Cover (acres)		0.08		0.02	0.10
Area Check	OK.	OK.	OK.	OK.	0.35

Constants

Annual Rainfall (inches)	43
Target Rainfall Event (inches)	1.00
Total Phosphorus (TP) EMC (mg/L)	0.26
Total Nitrogen (TN) EMC (mg/L)	1.86
Target TP Load (lb/acre/yr)	0.41
Pj (unitless correction factor)	0.90

Runoff Coefficients (Rv)

	A Soils	B Soils	C Soils	D Soils
Forest/Open Space	0.02	0.03	0.04	0.05
Managed Turf	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

LAND COVER SUMMARY -- PRE-REDEVELOPMENT

Land Cover Summary-Pre

Pre-ReDevelopment	Listed	Adjusted[1]
Forest/Open Space Cover (acres)	0.27	0.17
Weighted Rv(forest)	0.03	0.03
% Forest	77%	68%
Managed Turf Cover (acres)	0.08	0.08
Weighted Rv(turf)	0.25	0.25
% Managed Turf	23%	32%
Impervious Cover (acres)	0.00	0.00
Rv(impervious)	0.95	0.95
% Impervious	0%	0%
Total Site Area (acres)	**0.35**	**0.25**
Site Rv	**0.08**	**0.10**

LAND COVER SUMMARY -- POST DEVELOPMENT

Land Cover Summary-Post (Final)

Post ReDev. & New Impervious	
Forest/Open Space Cover (acres)	0.00
Weighted Rv(forest)	0.00
% Forest	0%
Managed Turf Cover (acres)	0.25
Weighted Rv (turf)	0.22
% Managed Turf	71%
Impervious Cover (acres)	0.10
Rv(impervious)	0.95
% Impervious	29%
Final Site Area (acres)	**0.35**
Final Post Dev Site Rv	**0.43**

Land Cover Summary-Post

Post-ReDevelopment	
Forest/Open Space Cover (acres)	0.00
Weighted Rv(forest)	0.00
% Forest	0%
Managed Turf Cover (acres)	0.25
Weighted Rv (turf)	0.22
% Managed Turf	100%
ReDev. Impervious Cover (acres)	0.00
Rv(impervious)	0.95
% Impervious	0%
Total ReDev. Site Area (acres)	**0.25**
ReDev Site Rv	**0.22**

Land Cover Summary-Post

Post-Development New Impervious	
New Impervious Cover (acres)	0.10
Rv(impervious)	0.95

Treatment Volume and Nutrient Load

Pre-ReDevelopment Treatment Volume (acre-ft)	0.0024	0.0021
Pre-ReDevelopment Treatment Volume (cubic feet)	106	93
Pre-ReDevelopment TP Load (lb/yr)	**0.07**	**0.06**
Pre-ReDevelopment TP Load per acre (lb/acre/yr)	0.19	0.23
Baseline TP Load (lb/yr) (**0.41 lbs/acre/yr** applied to pre-redevelopment area excluding pervious land proposed for new impervious cover)		*0.10*

		*
Final Post-Development Treatment Volume (acre-ft)	0.0125	
Final Post-Development Treatment Volume (cubic feet)	546	
Final Post-Development TP Load (lb/yr)	**0.34**	*
Final Post-Development TP Load per acre **(lb/acre/yr)**	0.98	*

Treatment Volume and Nutrient Load

		*
Post-ReDevelopment Treatment Volume (acre-ft)	0.0046	
Post-ReDevelopment Treatment Volume (cubic feet)	201	
Post-ReDevelopment Load (TP) (lb/yr)*	**0.13**	*
Post-ReDevelopment TP Load per acre **(lb/acre/yr)**	0.51	
Max. Reduction Required (Below Pre-ReDevelopment Load)	**10%**	
TP Load Reduction Required for Redeveloped Area (lb/yr)	**0.02**	*

Post-Development Treatment Volume (acre-ft)	0.0079
Post-Development Treatment Volume (cubic feet)	345
Post-Development TP Load (lb/yr)	**0.22**
TP Load Reduction Required for New Impervious Area (lb/yr)	**0.18**

[1] *Adjusted Land Cover Summary:*
Pre ReDevelopment land cover minus pervious land cover (forest/open space or managed turf) acreage proposed for new impervious cover.

Adjusted total acreage is consistent with Post-ReDevelopment acreage (minus acreage of new impervious cover).

Column I shows load reduction requriement for new impervious cover (based on new development load limit, 0.41 lbs/acre/year).

* ***Reduction below new development load limitation not required***

Post-Development Requirement for Site Area

TP Load Reduction Required (lb/yr)	**0.20**

Nitrogen Loads (Informational Purposes Only)

Pre-ReDevelopment TN Load (lb/yr)	0.47		Final Post-Development TN Load (Post-ReDevelopment & New Impervious) (lb/yr)	2.46

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Drainage Area Runoff Coefficients for Rational Method

Project: Old Stage Rd BPS **Initials:** DD

Date: 03/22/22

Surface Type / Drainage Area (acres)	Runoff Coefficients															Total Area	Weighted Rational Factor
	0.90	**0.85**	**0.80**	**0.75**	**0.70**	**0.65**	**0.60**	**0.55**	**0.50**	**0.45**	**0.40**	**0.35**	**0.30**	**0.25**	**0.20**		
	90% Impervious			75% Impervious			50% Impervious			30% Impervious			15% Impervious				
	Roofs										Ditches						
	Concrete			Apartments						17k ft^2 Single-Family Lots							
	Asphalt			Townhomes			Schools				½ Acre Single-Family Lots						
	Business				Gravel				10k ft^2 Single-Family Lots			Lawns					
	Industrial				Lined Ditches					Pastures			Forests			**A**	**C**
	Commercial				Cultivated Areas							Parks / Cemeteries				**acres**	
Existing													0.08		0.27	**0.35**	**0.22**
Proposed	0.10												0.25			**0.35**	**0.47**

Time of Concentration Calculations for Rational Method

Project: Old Stage Rd BPS **Date:** 03/22/22 **Initials:** DD

	Overland/Sheet Flow (Seelye) 200' Maximum					Shallow Concentrated Flow (TR-55) Overland Flow >200' or Gutter Flow					Channelized Flow Ditches/Streams/Pipes			Total Time of Concentration	
Factors of Flow Time / Drainage Basin	Flow Length	Ground Slope	Weighted Rational Factor	Average Velocity	Time of Concentration	Flow Length	Ground Slope	Weighted Rational Factor	Average Velocity	Time of Concentration	Flow Length	Average Velocity (~ 2-5 ft/s)	Time of Concentration	Calculated	For Design
	L	S	C	V	Tc	L	S	C	V	Tc	L	V	Tc	Tc	Tc
	ft	ft/ft		ft/s	min	ft	ft/ft		ft/s	min	ft	ft/s	min	min	min
Pre	101	0.045	0.20	0.1	**14.1**									**14.1**	**14**
Post A	25	0.100	0.30	0.1	**4.5**										
Post B	76	0.026	0.90	0.4	**3.1**									**7.6**	**8**

Seelye Equation: $Tc = 0.225L^{0.42} S^{-0.19} C^{-1.0}$

TR-55 Equation: $S = 0.004V^{1.97}$ on unpaved surfaces (C = 0.30) and $S = 0.0025V^{1.97}$ on paved surfaces (C = 0.90)

Factors of Q / Drainage Basin	C Value	Intensity	Area	10 yr Q values
		in/hr	acres	cfs
Pre	0.22	5.39	0.35	0.42
Post	0.47	6.79	0.35	1.12
Increase				0.70

Pre Tc* 14 i= (in/hr) 5.394

Post Tc* 8 i= (in/hr) 6.79

** Interpolated from NOAA PDFS, 10-yr interval*

	Q=VA		
	Q (cfs)	**V (ft/s)**	**A (sf)****
Pre	**0.42**	**0.019**	**21.8**
Post	**1.12**	**0.051**	**21.8**
Increase	**0.70**	**0.032**	**21.8**

*** Area = length of edge of sheet where sheet flow leaves * 0.1' depth*

APPROVAL

APPROVED
DEPARTMENT OF PLANNING & ZONING ISLE OF WIGHT COUNTY, VIRGINIA — SIGNATURE — DATE

QUALITY ASSURANCE STATEMENT

A Quality Control and Assurance review has been performed on this document in accordance with the *TIMMONS* Quality Plan. The undersigned states that this document has been checked and reviewed in a manner commensurate with the level of detail for the type of submittal indicated below.

KENNETH TURNER, PE — *Project Manager* — 02/21/2022 — *Date*

PRELIMINARY SITE PLAN SUBMITTAL — *Type of Submittal*

PRELIMINARY NOT FOR CONSTRUCTION

OLD STAGE ROAD BOOSTER PUMP STATION

ISLE OF WIGHT COUNTY, VIRGINIA

FEBRUARY 2022

CONTACTS

1. EASEMENT HOLDERS
   ISLE OF WIGHT COUNTY
   DEPARTMENT OF UTILITY SERVICES
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   PHONE: (757) 365-1655
   EMAIL: DJENNINGS@ISLEOFWIGHTUS.NET

2. ENGINEERS
   TIMMONS GROUP
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   FAX: (757) 340-1415
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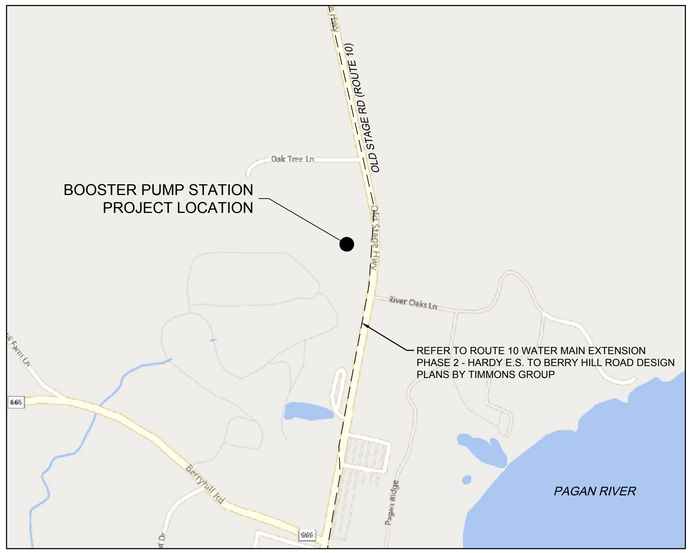

VICINITY MAP
SCALE: 1" = 600'

SHEET INDEX

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C-2	GRADING AND ESC PLAN
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C-4	EROSION & SEDIMENT CONTROL DETAILS
C-5	SITE UTILITY DETAILS
C-6	SITE UTILITY DETAILS

CALL BEFORE YOU DIG
ALWAYS CALL 811 BEFORE YOU DIG IN VIRGINIA
CALL 1-800-552-7001
SECTION 56-265.17 REQUIRES THREE WORKING DAYS
NOTICE TO UTILITIES BEFORE YOU EXCAVATE, DRILL OR BLAST.
VIRGINIA UTILITY PROTECTION SERVICE, INC.

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Local Roots, Global Reach
ISLE OF WIGHT COUNTY, VIRGINIA

THIS DRAWING PREPARED AT THE
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REVISION DESCRIPTION

DATE

DATE: 02/21/2022
DRAWN BY: L. KIM
DESIGNED BY: K. TURNER
CHECKED BY: K. TURNER
SCALE: AS SHOWN

TIMMONS GROUP

OLD STAGE ROAD BOOSTER PUMP STATION
ISLE OF WIGHT COUNTY - VIRGINIA
COVER

JOB NO. 48527
SHEET NO. COVER

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GENERAL NOTES:

1. THE CONTRACTOR SHALL CONTACT VIRGINIA 811 PRIOR TO BEGINNING WORK IN ORDER TO DETERMINE THE EXTENT AND LOCATION OF ALL UNDERGROUND UTILITIES WITHIN THE PROJECT LIMITS. UTILITY COMPANIES WILL BE NOTIFIED THROUGH VIRGINIA 811 48 HOURS PRIOR TO ANY EXCAVATION WITHIN THE PROXIMITY OF THEIR UTILITIES. THE CONTRACTOR WILL BE RESPONSIBLE FOR REPAIRING OR REPLACING AT HIS/HER OWN EXPENSE, ANY EXISTING UTILITIES, PAVEMENT, CONCRETE ITEMS, PIPES, ETC. THAT ARE DAMAGED DURING CONSTRUCTION.

   ISLE OF WIGHT COUNTY EMERGENCY CONTACT:
   DONALD JENNINGS
   DIRECTOR OF UTILITY SERVICES
   P.O. BOX 80
   ISLE OF WIGHT, VIRGINIA 23397
   OFFICE: (757) 365-1655

2. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND IDENTIFYING ALL EXISTING UTILITIES PRIOR TO STARTING CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY THE ENGINEER TO ANY DISCREPANCIES BETWEEN ACTUAL FIELD CONDITIONS AND THOSE NOTED ON CONSTRUCTION PLAN SET. ADJUSTMENTS TO THE PROPOSED DESIGN DUE TO DIFFERING FIELD CONDITIONS MUST BE APPROVED BY THE OWNER PRIOR TO PROCEEDING WITH THE ADJUSTMENT. DEVIATION FROM PLANS WITHOUT PRIOR WRITTEN APPROVAL FROM THE OWNER MAY BE REJECTED AND REQUIRE REMOVAL AND REINSTALLATION AT NO ADDITIONAL COST TO THE PROJECT.

3. THE CONTRACTOR SHALL PAY FOR AND OBTAIN ALL REQUIRED PERMITS AND DELIVER COPIES TO THE OWNER AT THE PRE-CONSTRUCTION MEETING.

4. 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.

5. HORIZONTAL DATUM: NAD 83
   VERTICAL DATUM: NAVD 88

6. WHEN IT IS NECESSARY TO DISTURB EXISTING DRIVEWAYS BEYOND THE PROPOSED CONSTRUCTION LIMITS, CONCRETE DRIVEWAYS WILL BE REPLACED TO THE NEXT JOINT PAST THE DISTURBANCE, AS APPROVED BY THE OWNER. ASPHALT DRIVEWAYS WILL BE REPLACED FOR THE FULL WIDTH OF THE DRIVEWAY TO A POINT PAST THE DISTURBANCE, AS APPROVED BY THE OWNER. THE CONTRACTOR WILL MATCH THE EXISTING DRIVEWAY DESIGN WHEN CONSTRUCTING THE TIE-IN.

7. THE CONTRACTOR WILL PLACE A MINIMUM OF TWO INCHES OF TOPSOIL ON ALL DISTURBED AREAS, OUTSIDE OF PAVEMENT.

8. THE CONTRACTOR WILL FINE GRADE, FERTILIZE, MULCH AND SEED ALL DISTURBED AREAS UNLESS OTHERWISE DIRECTED BY THE OWNER OR NOTED BY THE PLANS. USE THE SEEDING SCHEDULE SHOWN IN THE PLANS.

9. THE CONTRACTOR WILL REPLACE ANY VALVE BOXES, RISERS, OR LIDS LOST OR DAMAGED DURING CONSTRUCTION AT HIS/HER EXPENSE.

10. ALL VALVES, WATER METERS, AND CLEANOUTS SHALL BE ADJUSTED TO GRADE.

11. PRIOR TO INSTALLATION OF PIPING FOR CONNECTIONS TO EXISTING WATER MAINS, THE CONTRACTOR SHALL EXCAVATE TO DETERMINE PIPE MATERIAL, PIPE DIAMETER, PIPE ROUNDNESS, PIPE LOCATION AND ELEVATION, PIPE ALIGNMENT, AND LOCATION OF EXISTING JOINTS AT THE CONNECTION POINTS. THE TIE-IN LOCATIONS ARE TO BE APPROVED BY THE ENGINEER IN THE FIELD. THE CONTRACTOR SHALL ADJUST THE INSTALLATION OF THE PROPOSED REPLACEMENT PIPING AS REQUIRED TO PROVIDE FOR PROPER ALIGNMENT AND CONNECTION WITH THE EXISTING WATER MAIN.

12. THE OPERATIONS OF ALL EXISTING TOWN OF SMITHFIELD MAINLINE VALVES SHALL BE PERFORMED BY TOWN OF SMITHFIELD OPERATIONS.

13. THE CONTRACTOR SHALL COORDINATE CONSTRUCTION ADJACENT TO ALL STREETS LIGHTS AND POLES WITH DOMINION VIRGINIA POWER.

14. THE CONTRACTOR SHALL WORK WITHIN THE COUNTY PROPERTY, RIGHT-OF-WAY AND IDENTIFIED EASEMENTS.

15. THE CONTRACTOR SHALL INSPECT TEMPORARY PAVEMENT PATCHES AT THE END OS EACH DAY AND AFTER RAINFALL FOR DAMAGE. THE CONTRACTOR SHALL MAKE THE REPAIRS REQUIRED TO PROVIDE A SMOOTH, STABLE RIDING SURFACE.

16. THE CONTRACTOR SHALL ADVISE THE OWNER OF ANY ILLICIT DISCHARGE CONNECTIONS (STORM OR SANITARY SEWER) DISCOVERED DURING CONSTRUCTION.

17. ALL PIPING MATERIALS BEING REPLACED OR REMOVED AS PART OF THIS CONTRACT SHALL BE DISPOSED OF AT THE CONTRACTOR'S EXPENSE.

18. THE CONTRACTOR SHALL BE REQUIRED AND AGREES TO COMPLY WITH ALL THE PROVISIONS OF THE "VIRGINIA UNDERGROUND UTILITY DAMAGE PREVENTION ACT" (SECTION 56-265.14 ET SEQ., CODE OF VIRGINIA, 1950, AS AMENDED) AND HEREBY AGREES TO HOLD ISLE OF WIGHT COUNTY AND TOWN OF SMITHFIELD HARMLESS AGAINST ANY LOSS, DAMAGES OR CLAIMS OF ANY NATURE WHATSOEVER ARISING OUT OF THE CONTRACTOR'S FAILURE TO COMPLY WITH THE REQUIREMENT OF SAID ACT.

19. THE CONTRACTOR IS RESPONSIBLE FOR CONSTRUCTION STAKEOUT. THE STRUCTURES, WATER MAIN, OTHER UTILITIES, AND ALL APPURTENANCES SHALL BE LOCATED.

20. CONTRACTOR SHALL HAVE A SET OF SPECIFICATIONS & CONTRACT DOCUMENTS AND A COMPLETE SET OF DRAWINGS ON SITE AT ALL TIMES.

21. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PAVEMENT PATCHING, PER THE PAVEMENT PATCH DETAILS AND AS SPECIFIED IN THE PROJECT MANUAL.

22. WHERE WATER LINES PASS OVER OR UNDER SEWER, THERE MUST BE 18 INCHES VERTICAL SEPARATION.

23. THE CONTRACTOR SHALL REPLACE ALL DAMAGED OR REMOVED SIDEWALKS DAILY. THE TEMPORARY SIDEWALK SHALL BE 1 INCH COLD MIX OVER COMPACTED SUBGRADE AND SLOPED TO PROVIDE POSITIVE DRAINAGE, THE PERMANENT SIDEWALK REPLACEMENT SHALL BE IN ACCORDANCE WITH THE DETAILS ON THE PLANS.

24. LOCATION OF WATER, GAS, CABLE AND ELECTRIC UTILITIES ARE BASED ON BEST AVAILABLE INFORMATION. VERTICAL ELEVATIONS OF UTILITIES ARE ASSUMED UNLESS NOTED OTHERWISE.

25. CONTRACTOR SHALL MAINTAIN ACCESS THROUGH PROJECT AREA FOR MAIL DELIVERY, SCHOOL BUSES, EMERGENCY VEHICLES, ETC.

26. AT NIGHT OR DURING NON-CONSTRUCTION HOURS, ALL EXCAVATED AREAS ARE TO BE BACKFILLED OR SECURED AND PROTECTED BY USING APPROVED SAFETY DEVICES OR MATERIALS.

27. PRIOR TO ANY CLEARING, GRADING OR CONSTRUCTION, PROTECTIVE BARRIERS SHALL BE PLACED AROUND ALL TREES TO BE RETAINED ON THE SITE TO PREVENT THE DESTRUCTION OR DAMAGE OF TREES. THESE WILL BE LOCATED IN A CIRCULAR PATTERN WITH A RADIUS EQUAL TO THE LENGTH OF THE WIDEST OR LONGEST BRANCH. MATERIAL WILL NOT BE STOCKPILED WITHIN THIS DEFINED AREA AND OTHER EQUIPMENT ARE TO BE EXCLUDED TO AVOID SOIL COMPACTION. THE ONLY EXCEPTION TO THIS REQUIREMENT WILL BE THOSE SPECIFICALLY ALLOWED BY THESE STANDARDS AND SPECIFICATIONS.

32. BOARDS OR WIRES OF NON PROTECTIVE NATURE WILL NOT BE NAILED OR ATTACHED TO TREES DURING BUILDING OPERATIONS.

33. HEAVY EQUIPMENT OPERATIONS WILL BE CAUTIONED TO AVOID DAMAGE TO EXISTING TREE TRUNKS, AND ROOTS DURING LAND LEVELING OPERATIONS. FEEDER ROOTS SHOULD NOT BE CUT IN AN AREA EQUAL TO TWICE THE TREE CIRCUMFERENCE (MEASURED 4-1/2" ABOVE GROUND IN INCHES). EXPRESSED IN FEET. (EXAMPLE - CIRCUMFERENCE OF TEN INCHES WOULD HAVE A "NO CUT" ZONE OF TWENTY FEET IN ALL DIRECTIONS FROM THE TREE). THIS SHOULD APPLY TO DITCHING FOR ALL UTILITIES SERVICES, IF FEASIBLE.

34. ALL TREE LIMBS DAMAGED DURING BUILDING OR LEVELING, OR REMOVED FOR ANY OTHER REASON, WILL BE SAWED FLUSH TO TREE TRUNK.

35. ALL ROOTS SERVED OR SEVERELY DAMAGED DURING BUILDING OR LAND LEVELING SHALL BE TRIMMED TO REMOVE DAMAGED OR SPLINTERED AREA. EXPOSED ROOTS SHOULD BE COVERED AND MOISTENED IMMEDIATELY AFTER EXPOSURE.

36. ALL POWER POLES, MAILBOXES AND FENCES ARE TO BE RELOCATED AS REQUIRED.

37. ADJACENT PROPERTY OWNERS SHALL BE NOTIFIED 30 DAYS PRIOR TO CONSTRUCTION.

38. STAKING FOR CONSTRUCTION, TO ASSURE PROPER LOCATION OF PROJECT COMPONENTS SHALL BE PERFORMED BY A CERTIFIED LAND SURVEYOR.

39. ALL EXISTING PROPERTY MARKERS ARE TO REMAIN UNDISTURBED. IF DISTURBANCE OCCURS, REPLACEMENT MUST BE PERFORMED BY A CERTIFIED LAND SURVEYOR AT THE CONTRACTOR'S EXPENSE.

40. 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.

41. WORK AREAS SHALL BE KEPT AT ALL TIMES FREE OF DEBRIS AND HAZARDOUS MATERIAL TO THE SATISFACTION OF THE INSPECTOR.

42. THE CONTRACTOR SHALL COORDINATE STORAGE OF MATERIALS, PARKING OF VEHICLES, AND RESTRICTIONS OF WORK WITH THE INSPECTOR.

43. CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF ALL EXISTING FEATURES, 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.

44. 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, LOCATE ALL EXISTING UNDERGROUND LINES, FACILITIES, AND STRUCTURES. THE CONTRACTOR IS RESPONSIBLE FOR REPAIRING ANY UNDERGROUND LINES, FACILITIES, AND STRUCTURES DAMAGED.

45. 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.

46. ALL WORK SHALL BE SUBJECT TO INSPECTION BY LOCAL INSPECTORS.

47. A VIRGINIA DEPARTMENT OF TRANSPORTATION LAND USE PERMIT FROM THE FRANKLIN VDOT RESIDENCY IS REQUIRED.

48. FINAL ACCEPTANCE BY THE OWNER AND STATE WILL NOT BE MADE UNTIL ALL WORK SHOWN ON THE APPROVED CONTRACT DOCUMENTS IS COMPLETED, INCLUDING PAVING, GRADING AND ALL ADJUSTMENTS.

49. CONTRACTOR SHALL RESTORE EXISTING DITCHES TO ORIGINAL CONDITION AND ENSURE THAT POSITIVE DRAINAGE IS MAINTAINED WITHIN THE DITCH. PAVEMENT AND SHOULDERS MUST ALSO BE RESTORED TO THEIR ORIGINAL CONDITION.

50. CONTRACTOR SHALL ENSURE THAT PUBLIC AND PRIVATE ENTRANCE CULVERTS ARE FREE OF ANY CONSTRUCTION DEBRIS.

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. WATER MAIN SHALL HAVE A MINIMUM OF 3.0 FEET OF COVER, UNLESS NOTED OTHERWISE.

4. ALL TIE-IN CONNECTIONS SHALL BE APPROVED BY THE INSPECTOR PRIOR TO BACKFILLING.

5. AFTER BACKFILLING, FINISHED GRADE ABOVE TRENCH SHALL BE RESTORED TO ORIGINAL CONDITION.

6. TRACING WIRE SHALL BE INSTALLED ALONG WITH THE PIPE DURING THE INSTALLATION PROCESS. WATER MAIN TRACING WIRE SHALL HAVE A BLUE EXTERIOR COATING.

7. ALL WATER MAIN BENDS, VALVES, AND OTHER APPURTENANCES SHALL BE DESIGNATED WITH A HIGHLY VISIBLE MARKER/LOCATOR.

SUGGESTED SEQUENCE OF CONSTRUCTION:

1. CONSTRUCTION OF THE ISLE OF WIGHT WATER MAIN AND BOOSTER PUMP STATION CAN OCCUR SIMULTANEOUSLY AND DO NOT HAVE TO OCCUR IN THE ORDER DISCUSSED IN THE FOLLOWING SEQUENCE.

2. OBTAIN ALL PERMITS RELATED TO EACH PHASE OF THE PROJECT PRIOR TO COMMENCING WORK.

3. INSTALL EROSION & SEDIMENT CONTROL MEASURES AND TRAFFIC CONTROL MEASURES RELATED TO EACH ACTIVE WORK AREA OF THE PROJECT PRIOR TO COMMENCING WORK.

4. ISLE OF WIGHT WATER MAIN FROM SMITHFIELD CONNECTION TO BOOSTER PUMP STATION:
   a. COMPLETE INSTALLATION OF ISLE OF WIGHT WATER MAIN TO PUMP STATION SITE.
   b. CONSTRUCT HORIZONTAL DIRECTIONAL DRILL (HDD) WITH WATER MAIN.
   c. TEST WATER MAIN.
   d. COMPLETE RESTORATION.

5. ISLE OF WIGHT WATER MAIN FROM BOOSTER PUMP STATION TO ELEVATED STORAGE TANK:
   a. COMPLETE INSTALLATION OF ISLE OF WIGHT WATER MAIN TO ELEVATED TANK SITE.
   b. TEST WATER MAIN.
   c. COMPLETE RESTORATION.

6. ISLE OF WIGHT BOOSTER PUMP STATION:
   a. CONSTRUCT NEW BOOSTER PUMP STATION.
   b. CONSTRUCT ONSITE UTILITIES.
   c. TIE-IN TO NEW ISLE OF WIGHT WATER MAIN.
   d. PERFORM PUMP STATION START-UP AND TESTING IN ACCORDANCE WITH SPECIFICATIONS. ACCEPTANCE OF START-UP TESTING IS REQUIRED PRIOR TO PROCEEDING.
   e. PERFORM SITE IMPROVEMENTS, ACCESS DRIVEWAY AND RESTORATION.

7. ONCE THE PUMP STATION AND WATER MAINS ARE CONSTRUCTED AND TESTED, COMPLETE TIE-INS AND TOWN OF SMITHFIELD WATER MAIN CONNECTION.

8. COMPLETE ALL FINAL SITE RESTORATION.
   a. REMOVE EROSION AND SEDIMENTATION CONTROL MEASURES ONLY AFTER VEGETATIVE COVER IS ESTABLISHED.

9. CLOSE OUT PERMITS.

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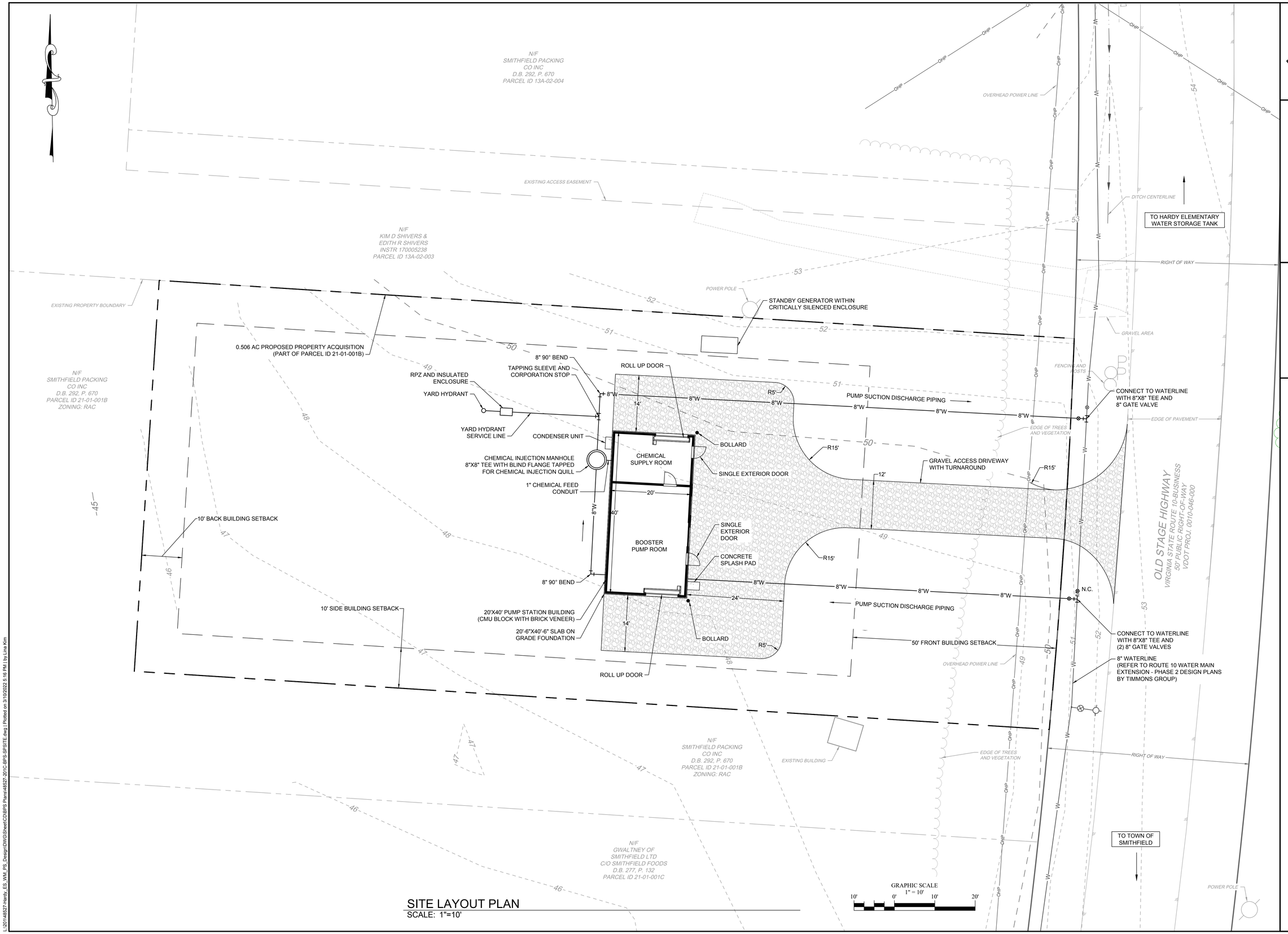
TIMMONS GROUP

REVISION DESCRIPTION	DATE

DATE: 02/21/2022
DRAWN BY: L. KIM
DESIGNED BY: K. TURNER
CHECKED BY: K. TURNER
SCALE: NONE

OLD STAGE ROAD BOOSTER PUMP STATION
ISLE OF WIGHT COUNTY - VIRGINIA
GENERAL NOTES

JOB NO. 48527
SHEET NO. GENERAL NOTES



SITE LAYOUT PLAN
SCALE: 1"=10'

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TIMMONS GROUP

OLD STAGE ROAD BOOSTER PUMP STATION
ISLE OF WIGHT COUNTY - VIRGINIA
BOOSTER PUMP STATION SITE PLAN

JOB NO. 48527
SHEET NO. C-1

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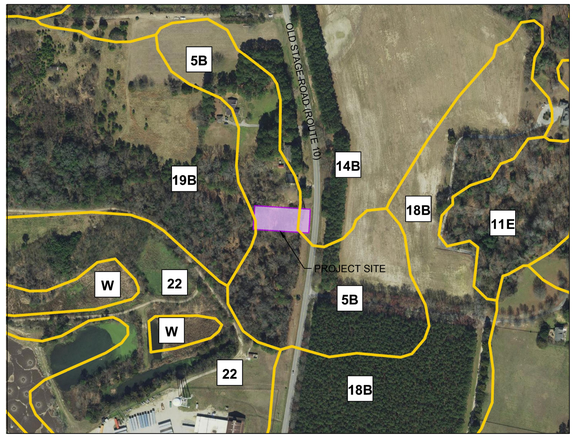
SOILS LEGEND -OLD STAGE ROAD BPS - ISLE OF WIGHT COUNTY

MAP UNIT SYMBOL	MAP UNIT NAME
5B	Emporia fine sandy loam, 2 to 6 percent slopes
11E	Nevarc and Remlik soils, 15 to 35 percent slopes
12B	Peawick silt loam, 2 to 6 percent slopes
14B	Peawick-Slagle complex, 2 to 6 percent slopes
18B	Slagle fine sandy loam, 2 to 6 percent slopes
19B	Uchee loamy sand, 2 to 6 percent slopes
22	Urban land
W	Water



OLD STAGE ROAD (ROUTE 10)
BOOSTER PUMP STATION
SOILS MAP

GENERAL EROSION AND SEDIMENT CONTROL NOTES

ES-1: 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-2: A COPY OF THE APPROVED EROSION AND SEDIMENT CONTROL PLAN SHALL BE MAINTAINED ON THE SITE AT ALL TIMES.

ES-3: 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-4: 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-5: ALL DISTURBED AREAS ARE TO DRAIN TO APPROVED SEDIMENT CONTROL MEASURES AT ALL TIMES DURING LAND DISTURBING ACTIVITIES AND DURING SITE DEVELOPMENT UNTIL FINAL STABILIZATION IS ACHIEVED.

STRUCTURAL PRACTICES

3.01 SAFETY FENCE:
A PROTECTIVE BARRIER INSTALLED TO PROHIBIT UNDESIRABLE USE OF AN EROSION CONTROL MEASURE

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.

3.02 TEMPORARY STONE CONSTRUCTION ENTRANCE:

A STONE PAD, LOCATED AT POINTS OF VEHICULAR INGRESS AND EGRESS TO REDUCE THE SOIL TRANSPORTED ONTO PUBLIC ROADS AND OTHER PAVED ARES. - IN THE EVENT FIELD CONDITIONS ARE SUCH THAT THE STONE PAD DOES NOT SIGNIFICANTLY REDUCE THE TRANSPORT OF SOIL ONTO THE ROADWAY, A WASH STATION SHALL BE INSTALLED AT EACH ENTRANCE AND AN ADEQUATE DEWATERING STRUCTURE OR WASH RACK SHALL BE INSTALLED.

3.20 ROCK CHECK DAM

SMALL TEMPORARY STONE DAM CONSTRUCTED ACROSS A SWALE OR DRAINAGE DITCH TO REDUCE THE VELOCITY OF CONCENTRATED FLOWS, REDUCING EROSION IN THE SWALE OR DITCH.

VEGETATIVE PRACTICES

3.31 TEMPORARY SEEDING

ALL DENUDED AREAS WHICH WILL BE LEFT DORMANT FOR MORE THAN 30 DAYS SHALL BE SEEDED WITH FAST GERMINATING TEMPORARY VEGETATION IMMEDIATELY FOLLOWING GRADING OF THOSE AREAS. SELECTION OF THE SEED MIXTURE SHALL DEPEND ON THE TIME OF YEAR IT IS APPLIED.

3.32 PERMANENT SEEDING

FOLLOWING GRADING ACTIVITIES, ESTABLISH PERENNIAL VEGETATIVE COVER BY PLANTING SEED TO REDUCE EROSION, STABILIZE DISTURBED AREAS, AND ENHANCE NATURAL BEAUTY.

3.35 MULCHING: APPLICATION OF PLANT RESIDUES OR OTHER SUITABLE MATERIALS TO DISTURBED SURFACES TO PREVENT EROSION AND REDUCE OVERLAND FLOW VELOCITIES. FOSTERS PLANT GROWTH BY INCREASING AVAILABLE MOISTURE AND PROVIDING INSULATION AGAINST EXTREME HEAT OR COLD. SHOULD BE APPLIED TO ALL SEEDING OPERATIONS, OTHER PLANT MATERIALS WHICH DO NOT PROVIDE ADEQUATE SOIL PROTECTION BY THEMSELVES AND BARE AREAS WHICH CANNOT BE SEEDED DUE TO THE SEASON BUT WHICH STILL NEED PROTECTION TO PREVENT SOIL LOSS.

PERMANENT STABILIZATION

ALL NON-PAVED AREAS DISTURBED BY CONSTRUCTION SHALL BE STABILIZED WITH PERMANENT SEEDING AND MULCHED 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 CONTROL NARRATIVE

PROJECT DESCRIPTION:

THE PURPOSE OF THIS PROJECT IS TO CONSTRUCT A WATER BOOSTER PUMP STATION IN ISLE OF WIGHT COUNTY, WEST OF OLD STAGE ROAD (ROUTE 10) AND JUST NORTH OF THE TOWN OF SMITHFIELD. THE BOOSTER PUMP STATION WILL ALLOW THE NEW HARDY ELEMENTARY SCHOOL PHASE 2 WATER MAIN TO FILL THE NEW ELEVATED WATER STORAGE TANK AT THE ELEMENTARY SCHOOL.

THE PUMP STATION BUILDING CONSISTS OF TWO ROOMS: A PUMP ROOM WHICH HOUSES THE BOOSTER PUMPS, MECHANICAL, AND ELECTRICAL EQUIPMENT, AND A CHEMICAL SUPPLY ROOM WHICH HOUSES DISINFECTION CHEMICAL PUMPS, STORAGE, ELECTRICAL, AND MECHANICAL PIPING.

EXISTING SITE CONDITIONS:

THE SITE FOR THE BOOSTER PUMP STATION CONSISTS OF PROPERTY PURCHASED FROM SMITHFIELD FOODS WHICH CONSISTS OF A MOSTLY FORESTED AREA.

ADJACENT AREAS:

THE BOOSTER PUMP STATION SITE IS LOCATED ADJACENT TO OLD STAGE ROAD (ROUTE 10) AND PRIVATE PROPERTY OWNERS.

OFF-SITE AREAS:

THERE WILL BE NO OFF-SITE LAND DISTURBANCE ASSOCIATED WITH THIS PROJECT. SPOILS WILL BE DISPOSED OF IN STRICT ACCORDANCE WITH COUNTY AND STATE REQUIREMENTS.

SOILS:

SEE SOILS LEGEND ON THIS SHEET FOR A DESCRIPTION OF THE SOILS LOCATED AT AND NEAR THE BOOSTER PUMP STATION SITE.

CRITICAL AREAS:

CRITICAL AREAS OF EROSION AND SEDIMENT CONTROL WILL BE THE SILT FENCING, ROCK CHECK DAMS, AND CONSTRUCTION ENTRANCES. CONTRACTOR MUST REGULARLY MAINTAIN / INSPECT THE ROCK CHECK DAM AND PERIMETER SILT FENCING IN ORDER TO PREVENT SEDIMENT FROM WASHING DOWNSTREAM DURING LAND DISTURBANCE. CONTRACTOR MUST ALSO MONITOR CONSTRUCTION TRAFFIC ON THE EXISTING ROAD SYSTEM TO PREVENT SEDIMENT BUILD UP ON EXISTING ROADS.

MAINTENANCE:

IN GENERAL, ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE CHECKED AFTER EACH RAINFALL OR WEEKLY, WHICHEVER IS MORE FREQUENT, AND SHOULD BE CLEANED AND REPAIRED ACCORDING TO THE FOLLOWING SCHEDULE AND GUIDELINES:

A. EROSION AND SEDIMENT CONTROL DEVICES WILL BE CHECKED REGULARLY FOR UNDERMINING OR DETERIORATION AND BUILDUP OR CLOTTING WITH SEDIMENT. CORRECTIVE ACTION WILL BE TAKEN IMMEDIATELY.

B. ALL SEEDED AREAS WILL BE CHECKED REGULARLY TO SEE THAT A GOOD STAND IS MAINTAINED. AREAS SHOULD BE FERTILIZED, RE-SEEDED, WATERED AND MOWED AS NEEDED OR AS DIRECTED.

C. ALL TEMPORARY EROSION AND SEDIMENT MEASURES SHALL BE DISPOSED OF WITHIN THIRTY (30) DAYS AFTER FINAL SITE STABILIZATION IS ACHIEVED AND VEGETATION IS ESTABLISHED.

D. IF SEDIMENT-LADEN WATER IS REMOVED FROM A CONSTRUCTION SITE BY MEANS OF PUMPING, A TEMPORARY SETTLING AND FILTERING DEVICE SHALL BE USED TO FILTER THE SEDIMENT-LADEN WATER PRIOR TO THE WATER BEING DISCHARGED OFFSITE.

PUMP STATION EROSION AND SEDIMENT CONTROL SEQUENCING:

1. ACQUIRE ALL NECESSARY PERMITS.
2. INSTALL SILT FENCING AROUND PROJECT SITES AND AROUND EXISTING DRAINAGE STRUCTURES AND MAINTAIN THROUGHOUT CONSTRUCTION.
3. INSTALL TEMPORARY CONSTRUCTION ENTRANCE AND ESTABLISH PERIMETER PROTECTION AND MAINTAIN THROUGHOUT CONSTRUCTION. ANY AND ALL MATERIAL OR DEBRIS TRACKED ONTO A PUBLIC OR PRIVATE ROAD WILL BE CLEANED THROUGHLY AT THE END OF EACH DAY. SEDIMENT SHALL BE REMOVED FROM ROADS BY SHOVELING OR SWEEPING AND BE TRANSPORTED TO A SEDIMENT CONTROLLED DISPOSAL AREA.
4. WHERE REQUIRED CLEAR AND GRUB SITE AND STOCK PILE STRIPPED MATERIAL AND INSTALL ADDITIONAL EROSION CONTROL MEASURES AS NEEDED.
5. INSTALL UNDERGROUND UTILITIES, STRUCTURES, PUMP STATION AND STORM DRAINAGE AND PROVIDE SEDIMENT TRAPS OR OTHER APPROVED PROTECTION AT NEW DRAINAGE STRUCTURES.
6. GRADE ALL DISTURBED AREAS.
7. DRESS AND OVERSEED ALL DISTURBED AREAS, MAINTAIN VEGETATIVE COVER THROUGHOUT THE DURATION OF PROJECT.
8. MAINTAIN PROTECTION AT DRAINAGE STRUCTURES.
9. COMPLETE PAVEMENT RESTORATION.
10. REPAIR ANY INADVERTENT EROSION AND REMOVE ACCUMULATED SEDIMENTATION.
11. FINE GRADE & TOPSOIL DISTURBED AREAS, ESTABLISH PERMANENT VEGETATION.
12. REMOVE REMAINING TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES WITHIN THIRTY DAYS AFTER FINAL SITE IS STABILIZED WITH VEGETATIVE CROPS.

MINIMUM STANDARDS:

AN EROSION AND SEDIMENT CONTROL PROGRAM ADOPTED BY A DISTRICT OR LOCALITY MUST BE CONSISTENT WITH THE FOLLOWING CRITERIA, TECHNIQUES AND METHODS PER THE VESCH HANDBOOK, LATEST EDITION:

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 14 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 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.

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 WORKING 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 THIS PROVISION SHALL APPLY TO INDIVIDUAL DEVELOPMENT LOTS AS WELL AS TO LARGER LAND-DISTURBING ACTIVITIES.

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 STANDARDS AND CRITERIA LISTED IN THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK, CHAPTER 8 PAGES 20-24.

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REVISION DESCRIPTION

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DESIGNED BY K. TURNER
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SCALE NTS

TIMMONS GROUP

OLD STAGE ROAD BOOSTER PUMP STATION
ISLE OF WIGHT COUNTY - VIRGINIA
EROSION & SEDIMENT CONTROL NARRATIVE

JOB NO. 48527
SHEET NO. C-3

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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 ORGANIC MULCH MATERIALS AND APPLICATION RATES

No Scale

SEED[1]		
LAND USE	SPECIES	APPLICATION PER ACRE
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[1] (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. 20LBS. 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 LIST IS AVAILABLE AT THE LOCAL COUNTY EXTENSION OFFICE OR THROUGH VCIA AT 804-746-4884 OR AT HTTP://SUDAN.CSES.VT.EDU/HTML/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 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

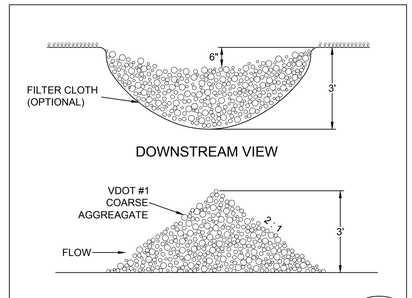
- APPLY 10-20-10 FERTILIZER AT A RATE OF 500 LBS. / ACRE (OR 12 LBS. / 1,000 SQ. FT.)
- APPLY PULVERIZED AGRICULTURAL LIMESTONE AT A RATE OF 2 TONS/ACRE (90 LBS. / 1,000 SQ. FT.)

NOTE:
- A SOIL TEST IS NECESSARY TO DETERMINE THE ACTUAL AMOUNT OF LIME REQUIRED TO ADJUST THE SOIL pH OF SITE.
- INCORPORATE THE LIME AND FERTILIZER INTO THE TOP 4 - 6 INCHES OF THE SOIL BY DISKING OR BY OTHER MEANS.
- WHEN APPLYING SLOWLY AVAILABLE NITROGEN, USE RATES AVAILABLE IN EROSION & SEDIMENT CONTROL TECHNICAL BULLETIN #4, 2003 NUTRIENT MANAGEMENT FOR DEVELOPMENT SITES AT HTTP://WWW.DCR.STATE.VA.US/SW/E&S.HTM#PUBS

PLATE 3.05-1

WSF PERMANENT SEEDING SPECIFICATIONS FOR COASTAL PLAIN AREA

No Scale



CD ROCK CHECK DAM

No 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

No Scale

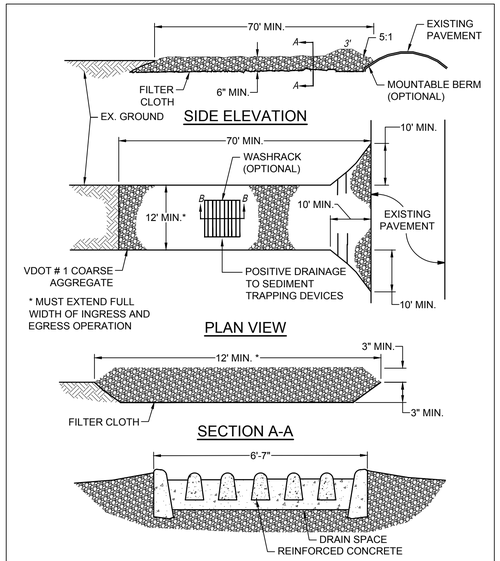
TABL 3.30-A

CUBIC YARDS OF TOPSOIL REQUIRED OR APPLICATION TO VARIOUS DEPTHS

DEPTH (INCHES)	PER 1,000 SQUARE FEET	PER ACRE
1	3.1	134
2	6.2	268
3	9.3	403
4	12.4	537
5	15.5	672
6	18.6	806

TS TOPSOILING

No Scale



CE CONSTRUCTION ENTRANCE

No Scale

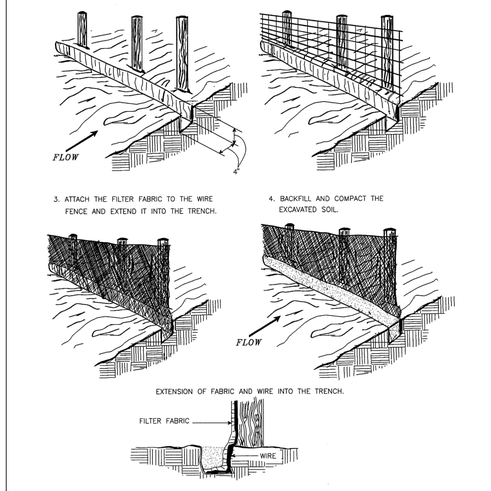


PLATE 3.05-1

WSF CONSTRUCTION OF A SILT FENCE (WITH WIRE SUPPORT)

No Scale

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REVISION DESCRIPTION

DATE

DATE 02/21/2022

DRAWN BY L. KIM

DESIGNED BY K. TURNER

CHECKED BY K. TURNER

SCALE NTS

TIMMONS GROUP

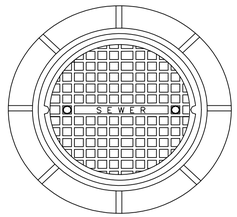
OLD STAGE ROAD BOOSTER PUMP STATION

ISLE OF WIGHT COUNTY - VIRGINIA

EROSION & SEDIMENT CONTROL DETAILS

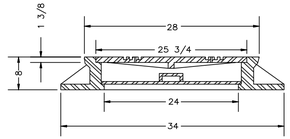
JOB NO. 48527

SHEET NO. C-4



NOTE:

DESIGN NO. B-1800 BLOCK TYPE COVER

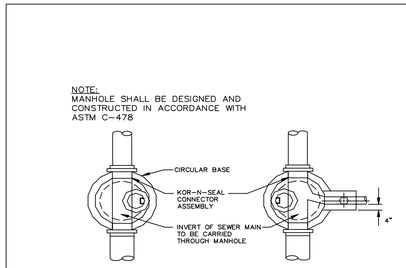


STANDARD & WATERTIGHT MANHOLE FRAME & COVER

PLATE S VI

ISLE OF WIGHT COUNTY STANDARD DETAIL

NOTE:
MANHOLE SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH ASTM C-478



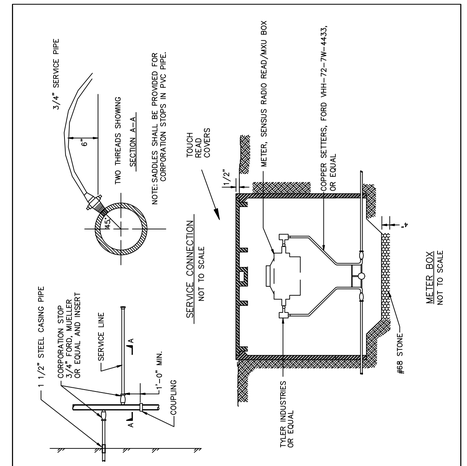
* 8" FOR MONOLITHIC SLAB & BASE UNIT

STANDARD MANHOLES

NOT TO SCALE

PLATE S VII

ISLE OF WIGHT COUNTY STANDARD DETAIL

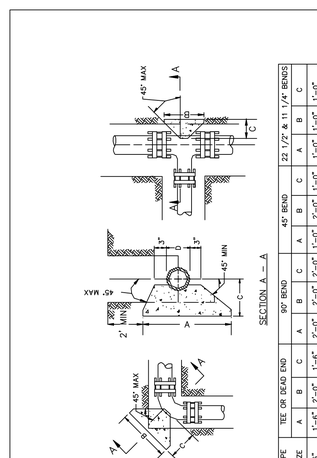


SERVICE CONNECTION

NOT TO SCALE

PLATE W VIII

ISLE OF WIGHT COUNTY STANDARD DETAIL



PIPE SIZE	TEE OR DEAD END			90° BEND			45° BEND			22 1/2° & 11 1/4° BENDS		
	A	B	C	A	B	C	A	B	C	A	B	C
6"	1'-6"	2'-0"	1'-6"	2'-0"	2'-0"	2'-0"	1'-0"	2'-0"	1'-0"	1'-0"	1'-0"	1'-0"
8"	2'-0"	2'-6"	1'-6"	2'-6"	3'-0"	2'-0"	2'-0"	2'-0"	2'-0"	1'-0"	2'-0"	1'-0"
10"	2'-0"	4'-0"	2'-0"	3'-0"	4'-0"	2'-0"	2'-0"	3'-0"	2'-0"	1'-6"	2'-0"	1'-6"
12"	3'-0"	4'-0"	2'-0"	3'-0"	5'-0"	2'-0"	2'-6"	3'-6"	2'-0"	2'-0"	2'-6"	1'-6"

NOTE:
VERTICAL BENDS WILL REQUIRE BLOCKS TO BE TIED TO FITTINGS USE OF ANY METHOD TO BE APPROVED BY DIRECTOR OF PUBLIC UTILITIES
DIMENSIONS SHOWN ARE MINIMUM

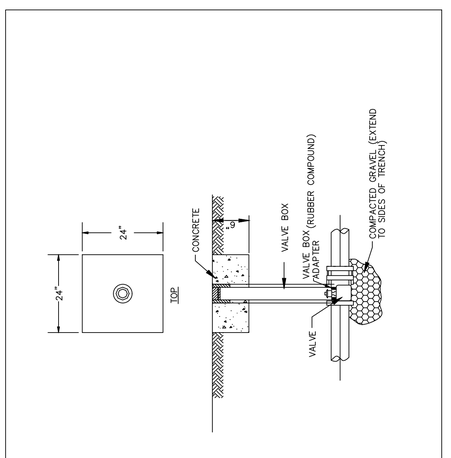
NOTE:
CONCRETE SHALL NOT BE PLACED ON JOINTS, LIMITING FLEXIBILITY.
CONCRETE SHALL NOT ENGAGE M.J. PIPE FASTENINGS OR GLANDS AT JOINTS

THRUST BLOCKS

NOT TO SCALE

PLATE W IX

ISLE OF WIGHT COUNTY STANDARD DETAIL



VALVE BOX INSTALLATION AND VALVE SETTING

PLATE W X

ISLE OF WIGHT COUNTY STANDARD DETAIL

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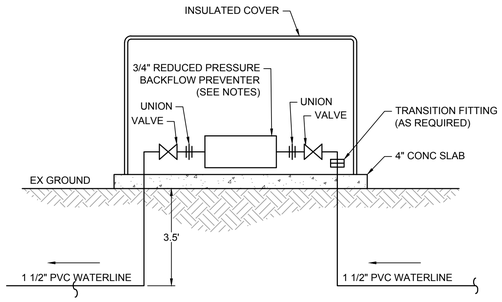
DRAWN BY: L. KIM
DESIGNED BY: K. TURNER
CHECKED BY: K. TURNER
SCALE: AS SHOWN

OLD STAGE ROAD BOOSTER PUMP STATION

ISLE OF WIGHT COUNTY - VIRGINIA

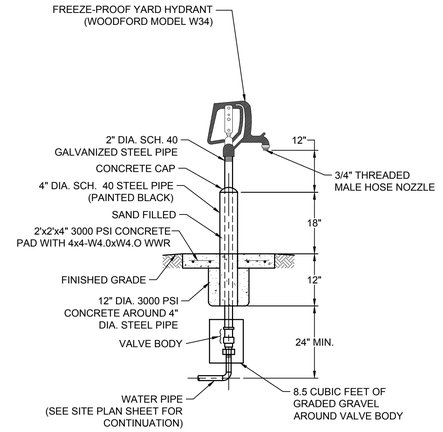
JOB NO. 48527

SHEET NO. D-1

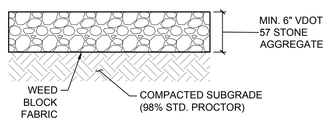


NOTES:
1. PROVIDE HEAT TRACING AND INSULATION ON ALL PIPING AND VALVES LOCATED ABOVE GRADE.
2. RPZ SHALL BE WATTS REGULATOR MODEL 009QT OR APPROVED EQUAL W/BRONZE STRAINER & QUARTER TURN BALL SHUTOFF VALVES.
3. ENCLOSURE SHALL BE A WATTBOX MODEL WB-75 OR APPROVED EQUAL. ENCLOSURE SHALL BE FIBERGLASS W/ A HINGED AND LOCKABLE HASP.

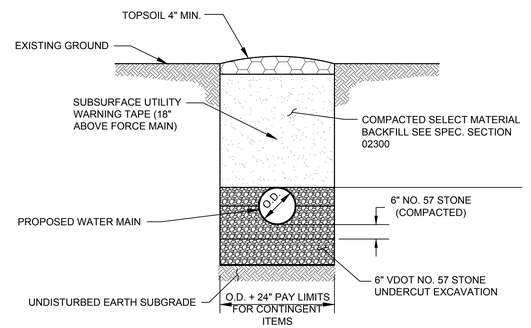
REDUCED PRESSURE ZONE BACKFLOW PREVENTER
SCALE: NOT TO SCALE



YARD HYDRANT ASSEMBLY
SCALE: NOT TO SCALE



GRAVEL SITE DETAIL
SCALE: NOT TO SCALE



TRENCH DETAIL NOTES:
1. THE TRENCH WIDTH SHOWN IS STRICTLY FOR MEASUREMENT AND PAYMENT OF CONTINGENT ITEMS. THE CONTRACTOR SHALL ADJUST THE UNIT BID PRICE(S) BASED ON THE METHOD OF CONSTRUCTION EMPLOYED FOR THE PIPELINE INSTALLATION.

TYPICAL PIPE TRENCH DETAIL (NON-PAVED AREAS)
SCALE: NOT TO SCALE

PRELIMINARY NOT FOR CONSTRUCTION

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DESIGNED BY: K. TURNER
CHECKED BY: K. TURNER
SCALE: AS SHOWN

OLD STAGE ROAD BOOSTER PUMP STATION
ISLE OF WIGHT COUNTY - VIRGINIA

JOB NO. 48527
SHEET NO. D-1

PRE-CONSTRUCTION

- CONTRACTOR IS RESPONSIBLE FOR CONTACTING "MISS UTILITY" AT 1.800.552.7001 FOR LOCATION OF ALL UTILITY LINES.TREES SHALL BE LOCATED A MINIMUM OF 5 FEET FROM SEWER/WATER CONNECTIONS. NOTIFY LANDSCAPE ARCHITECT OF CONFLICTS.
- VERIFY ALL PLANT MATERIAL QUANTITIES ON THE PLAN PRIOR TO BIDDING, PLANT LIST TOTALS ARE FOR CONVENIENCE ONLY AND SHALL BE VERIFIED PRIOR TO BIDDING.
- PROVIDE PLANT MATERIALS OF QUANTITY, SIZE, GENUS, SPECIES, AND VARIETY INDICATED ON PLANS. ALL PLANT MATERIALS AND INSTALLATION SHALL COMPLY WITH RECOMMENDATIONS AND REQUIREMENTS OF ANSI Z60.1 "AMERICAN STANDARD FOR NURSERY STOCK". IF SPECIFIED PLANT MATERIAL IS NOT OBTAINABLE, SUBMIT PROOF OF NON AVAILABILITY TO THE ARCHITECTS, TOGETHER WITH PROPOSAL FOR USE OF EQUIVALENT MATERIAL.
- PROVIDE AND INSTALL ALL PLANTS AS IN ACCORDANCE WITH DETAILS AND CONTRACT SPECIFICATIONS
- SOIL TESTS SHALL BE PERFORMED TO DETERMINE SOIL CHARACTER AND QUALITY. NECESSARY SOIL AMENDMENTS SHALL BE PERFORMED PER TEST RESULTS TO ENSURE PLANT HEALTH.

CONSTRUCTION/INSTALLATION

- LANDSCAPE ARCHITECT RESERVES THE RIGHT TO REJECT ANY PLANTS AND MATERIALS THAT ARE IN AN UNHEALTHY OR UNSIGHTLY CONDITION, AS WELL AS PLANTS AND MATERIALS THAT DO NOT CONFORM TO ANSI Z60.1 "AMERICAN STANDARD FOR NURSERY STOCK"
- LABEL AT LEAST ONE TREE AND ONE SHRUB OF EACH VARIETY AND CALIPER WITH A SECURELY ATTACHED, WATERPROOF TAG BEARING THE DESIGNATION OF BOTANICAL AND COMMON NAME.
- INSTALL LANDSCAPE PLANTINGS AT ENTRANCES/EXITS AND PARKING AREAS ACCORDING TO PLANS SO THAT MATERIALS WILL NOT INTERFERE WITH SIGHT DISTANCES.
- CONTRACTOR IS RESPONSIBLE FOR WATERING ALL PLANT MATERIAL DURING INSTALLATION AND UNTIL FINAL INSPECTION AND ACCEPTANCE BY OWNER. CONTRACTOR SHALL NOTIFY OWNER OF CONDITIONS WHICH AFFECTS THE GUARANTEE.

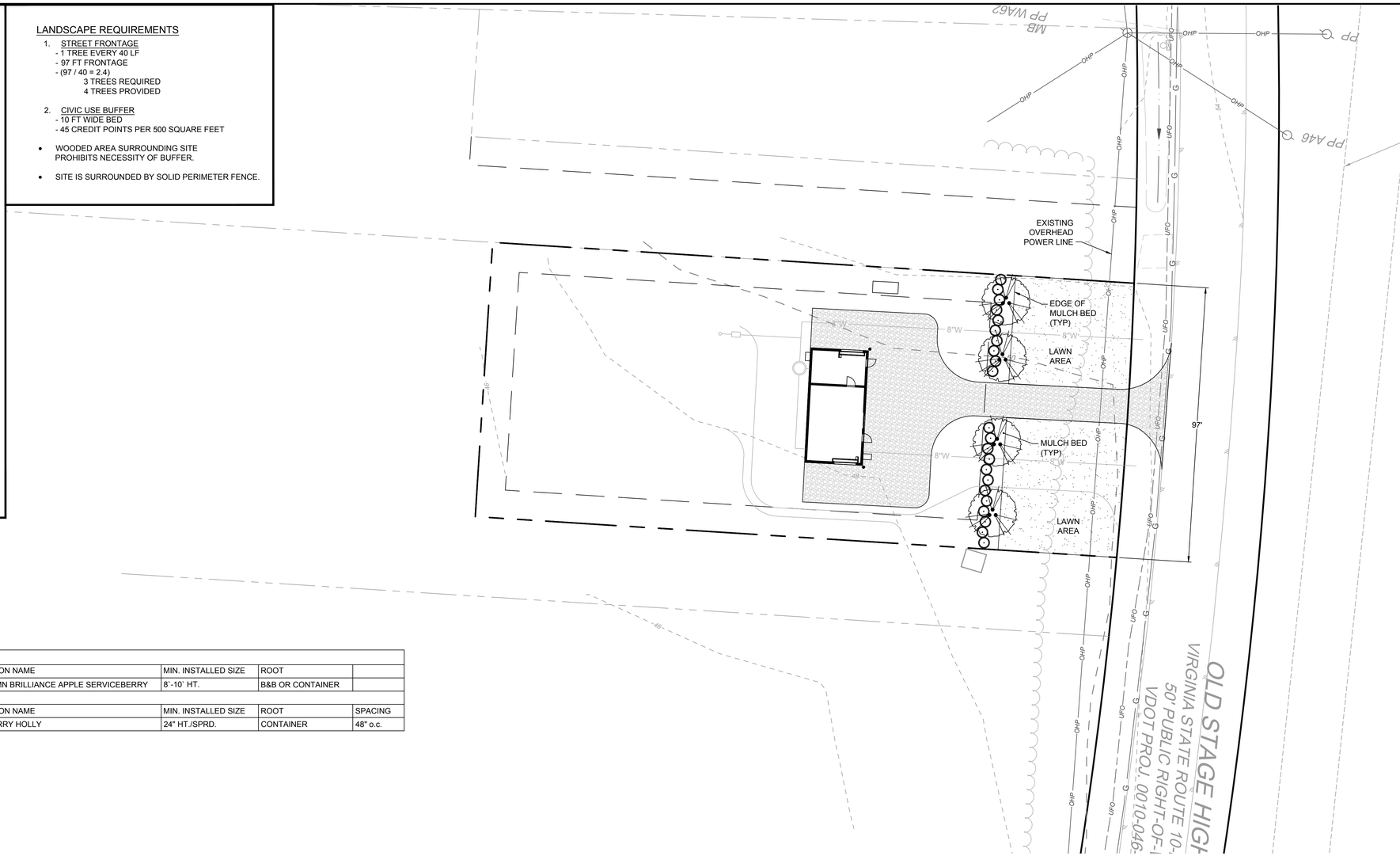
INSPECTIONS/GUARANTEE

- UPON COMPLETION OF LANDSCAPE INSTALLATION, THE LANDSCAPE CONTRACTOR SHALL NOTIFY THE GENERAL CONTRACTOR WHO WILL VERIFY COMPLETENESS, INCLUDING THE REPLACEMENT OF ALL DEAD PLANT MATERIAL. CONTRACTOR IS RESPONSIBLE FOR SCHEDULING A FINAL INSPECTION BY THE LANDSCAPE ARCHITECT.
- ALL EXTERIOR PLANT MATERIALS SHALL BE GUARANTEED FOR ONE FULL YEAR AFTER DATE OF FINAL INSPECTION AGAINST DEFECTS INCLUDING DEATH AND UNSATISFACTORY GROWTH. DEFECTS RESULTING FROM NEGLECT BY THE OWNER, ABUSE OR DAMAGE BY OTHERS, OR UNUSUAL PHENOMENA OR INCIDENTS WHICH ARE BEYOND THE CONTRACTORS CONTROL ARE NOT THE RESPONSIBILITY OF THE CONTRACTOR
- PLANT MATERIAL QUANTITIES AND SIZES WILL BE INSPECTED FOR COMPLIANCE WITH APPROVED PLANS BY A SITE PLAN REVIEW AGENT OF THE PLANNING DEPARTMENT PRIOR TO THE RELEASE OF THE CERTIFICATE OF OCCUPANCY.
- REMOVE ALL GUY WIRES AND STAKES 12 MONTHS AFTER INSTALLATION.

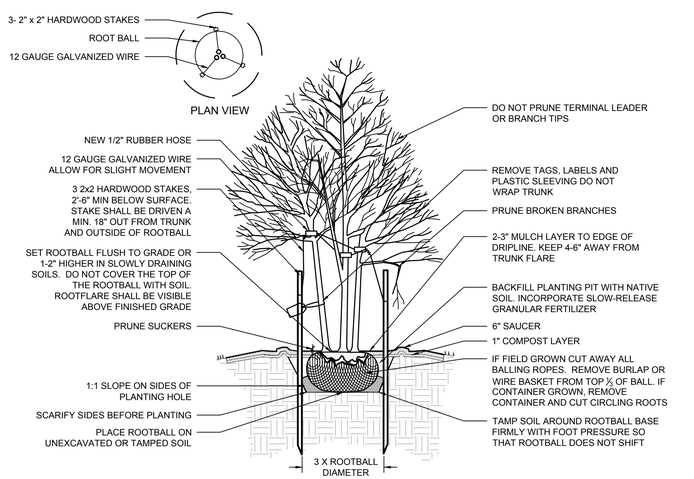
LANDSCAPE REQUIREMENTS

1. STREET FRONTAGE
   - 1 TREE EVERY 40 LF
   - 97 FT FRONTAGE
   - (97 / 40 = 2.4)
   - 3 TREES REQUIRED
   - 4 TREES PROVIDED
2. CIVIC USE BUFFER
   - 10 FT WIDE BED
   - 45 CREDIT POINTS PER 500 SQUARE FEET

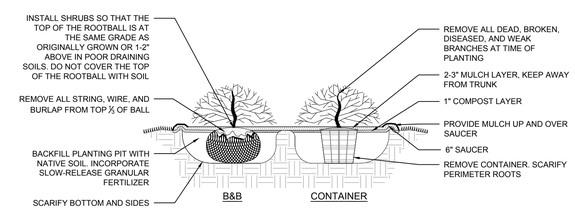
- WOODED AREA SURROUNDING SITE PROHIBITS NECESSITY OF BUFFER.
- SITE IS SURROUNDED BY SOLID PERIMETER FENCE.



PLANT SCHEDULE						
TREES	QTY	BOTANICAL NAME	COMMON NAME	MIN. INSTALLED SIZE	ROOT	
AG	4	AMELANCHIER X GRANDIFLORA 'AUTUMN BRILLIANCE'	AUTUMN BRILLIANCE APPLE SERVICEBERRY	8`-10` HT.	B&B OR CONTAINER	
SHRUBS	QTY	BOTANICAL NAME	COMMON NAME	MIN. INSTALLED SIZE	ROOT	SPACING
ID	22	ILEX GLABRA 'DENSA'	INKBERRY HOLLY	24" HT./SPRD.	CONTAINER	48" o.c.



1 **MULTI-STEM TREE - STAKING SPECIFIED**
NOT TO SCALE



2 **SHRUB PLANTING**
NOT TO SCALE

GRAPHIC SCALE
20' 0' 1" = 20' 20' 40'

KENNETH TURNER
Lic. No. 021260
1/12/2022
PROFESSIONAL ENGINEER
COMMONWEALTH OF VIRGINIA

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DESIGNED BY DC
CHECKED BY DJ
SCALE 1" = 20'

ROUTE 10 WATER MAIN EXTENSION & P.S. - PH. 2
ISLE OF WIGHT COUNTY - VIRGINIA
ROUTE 10 BOOSTER PUMP STATION - PROPOSED PLANTING PLAN

JOB NO. 48527
SHEET NO. L-1.0

NOAA Atlas 14, Volume 2, Version 3
Location name: Smithfield, Virginia, USA*
Latitude: 36.9977°, Longitude: -76.6289°
Elevation: 43.31 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**5.02** (4.55-5.58)	**5.93** (5.36-6.59)	**6.79** (6.14-7.54)	**7.72** (6.94-8.56)	**8.68** (7.79-9.62)	**9.50** (8.50-10.5)	**10.3** (9.13-11.4)	**11.0** (9.74-12.2)	**11.9** (10.5-13.3)	**12.8** (11.1-14.3)
10-min	**4.01** (3.63-4.45)	**4.74** (4.29-5.27)	**5.44** (4.91-6.04)	**6.17** (5.55-6.84)	**6.92** (6.20-7.67)	**7.57** (6.76-8.39)	**8.17** (7.25-9.06)	**8.73** (7.72-9.70)	**9.44** (8.27-10.5)	**10.1** (8.75-11.2)
15-min	**3.34** (3.02-3.71)	**3.98** (3.60-4.41)	**4.59** (4.15-5.09)	**5.20** (4.68-5.77)	**5.84** (5.24-6.48)	**6.38** (5.71-7.08)	**6.88** (6.12-7.63)	**7.34** (6.50-8.16)	**7.93** (6.94-8.82)	**8.43** (7.32-9.40)
30-min	**2.29** (2.07-2.54)	**2.74** (2.48-3.05)	**3.26** (2.95-3.62)	**3.77** (3.39-4.18)	**4.33** (3.88-4.80)	**4.81** (4.30-5.33)	**5.27** (4.68-5.85)	**5.72** (5.06-6.35)	**6.31** (5.53-7.02)	**6.83** (5.93-7.61)
60-min	**1.43** (1.29-1.59)	**1.72** (1.56-1.91)	**2.09** (1.89-2.32)	**2.45** (2.21-2.72)	**2.88** (2.59-3.20)	**3.26** (2.91-3.61)	**3.63** (3.23-4.03)	**4.01** (3.55-4.45)	**4.52** (3.96-5.03)	**4.98** (4.33-5.55)
2-hr	**0.840** (0.756-0.935)	**1.01** (0.912-1.13)	**1.25** (1.12-1.39)	**1.49** (1.34-1.65)	**1.79** (1.59-1.98)	**2.05** (1.82-2.27)	**2.32** (2.05-2.57)	**2.61** (2.29-2.88)	**3.00** (2.60-3.32)	**3.35** (2.89-3.72)
3-hr	**0.599** (0.537-0.672)	**0.720** (0.646-0.808)	**0.892** (0.799-1.00)	**1.07** (0.956-1.20)	**1.30** (1.15-1.45)	**1.50** (1.32-1.67)	**1.71** (1.50-1.91)	**1.94** (1.69-2.16)	**2.26** (1.95-2.52)	**2.56** (2.18-2.85)
6-hr	**0.360** (0.323-0.406)	**0.432** (0.387-0.487)	**0.536** (0.478-0.603)	**0.644** (0.572-0.724)	**0.783** (0.692-0.878)	**0.912** (0.801-1.02)	**1.05** (0.911-1.17)	**1.19** (1.03-1.33)	**1.40** (1.19-1.56)	**1.59** (1.34-1.78)
12-hr	**0.211** (0.188-0.241)	**0.253** (0.224-0.288)	**0.315** (0.279-0.358)	**0.381** (0.336-0.432)	**0.467** (0.409-0.529)	**0.549** (0.477-0.620)	**0.635** (0.546-0.715)	**0.730** (0.622-0.822)	**0.866** (0.727-0.975)	**0.995** (0.823-1.12)
24-hr	**0.123** (0.113-0.135)	**0.149** (0.137-0.164)	**0.193** (0.177-0.212)	**0.230** (0.210-0.253)	**0.285** (0.258-0.312)	**0.333** (0.299-0.364)	**0.385** (0.343-0.421)	**0.443** (0.391-0.484)	**0.529** (0.459-0.579)	**0.603** (0.516-0.662)
2-day	**0.071** (0.065-0.079)	**0.086** (0.079-0.095)	**0.111** (0.102-0.122)	**0.132** (0.121-0.146)	**0.164** (0.149-0.180)	**0.192** (0.172-0.210)	**0.222** (0.198-0.244)	**0.257** (0.226-0.283)	**0.308** (0.266-0.340)	**0.353** (0.300-0.391)
3-day	**0.050** (0.046-0.055)	**0.061** (0.056-0.067)	**0.078** (0.072-0.086)	**0.093** (0.085-0.102)	**0.114** (0.104-0.125)	**0.132** (0.119-0.145)	**0.153** (0.136-0.167)	**0.175** (0.154-0.192)	**0.209** (0.181-0.230)	**0.238** (0.204-0.263)
4-day	**0.040** (0.037-0.044)	**0.048** (0.045-0.053)	**0.062** (0.057-0.068)	**0.073** (0.067-0.080)	**0.089** (0.081-0.097)	**0.103** (0.093-0.112)	**0.118** (0.105-0.129)	**0.134** (0.119-0.147)	**0.159** (0.139-0.174)	**0.181** (0.156-0.200)
7-day	**0.027** (0.025-0.029)	**0.032** (0.030-0.035)	**0.041** (0.037-0.044)	**0.047** (0.044-0.051)	**0.057** (0.053-0.062)	**0.066** (0.060-0.071)	**0.075** (0.067-0.081)	**0.085** (0.075-0.092)	**0.099** (0.087-0.107)	**0.110** (0.096-0.121)
10-day	**0.021** (0.020-0.023)	**0.026** (0.024-0.028)	**0.032** (0.029-0.034)	**0.037** (0.034-0.040)	**0.044** (0.041-0.047)	**0.050** (0.046-0.054)	**0.056** (0.051-0.061)	**0.063** (0.057-0.068)	**0.073** (0.065-0.079)	**0.081** (0.072-0.089)
20-day	**0.014** (0.014-0.016)	**0.017** (0.016-0.018)	**0.021** (0.020-0.022)	**0.024** (0.022-0.026)	**0.028** (0.026-0.030)	**0.032** (0.029-0.034)	**0.035** (0.032-0.038)	**0.039** (0.035-0.042)	**0.044** (0.040-0.048)	**0.049** (0.043-0.053)
30-day	**0.012** (0.011-0.013)	**0.014** (0.013-0.015)	**0.017** (0.016-0.018)	**0.019** (0.018-0.021)	**0.022** (0.021-0.024)	**0.025** (0.023-0.026)	**0.027** (0.025-0.029)	**0.030** (0.027-0.032)	**0.033** (0.030-0.036)	**0.036** (0.033-0.039)
45-day	**0.010** (0.009-0.011)	**0.012** (0.011-0.012)	**0.014** (0.013-0.015)	**0.016** (0.015-0.017)	**0.018** (0.017-0.019)	**0.020** (0.019-0.021)	**0.022** (0.020-0.024)	**0.024** (0.022-0.026)	**0.027** (0.025-0.029)	**0.029** (0.026-0.032)
60-day	**0.009** (0.008-0.009)	**0.010** (0.010-0.011)	**0.012** (0.012-0.013)	**0.014** (0.013-0.015)	**0.016** (0.015-0.017)	**0.017** (0.016-0.018)	**0.019** (0.017-0.020)	**0.020** (0.019-0.021)	**0.022** (0.020-0.024)	**0.024** (0.022-0.025)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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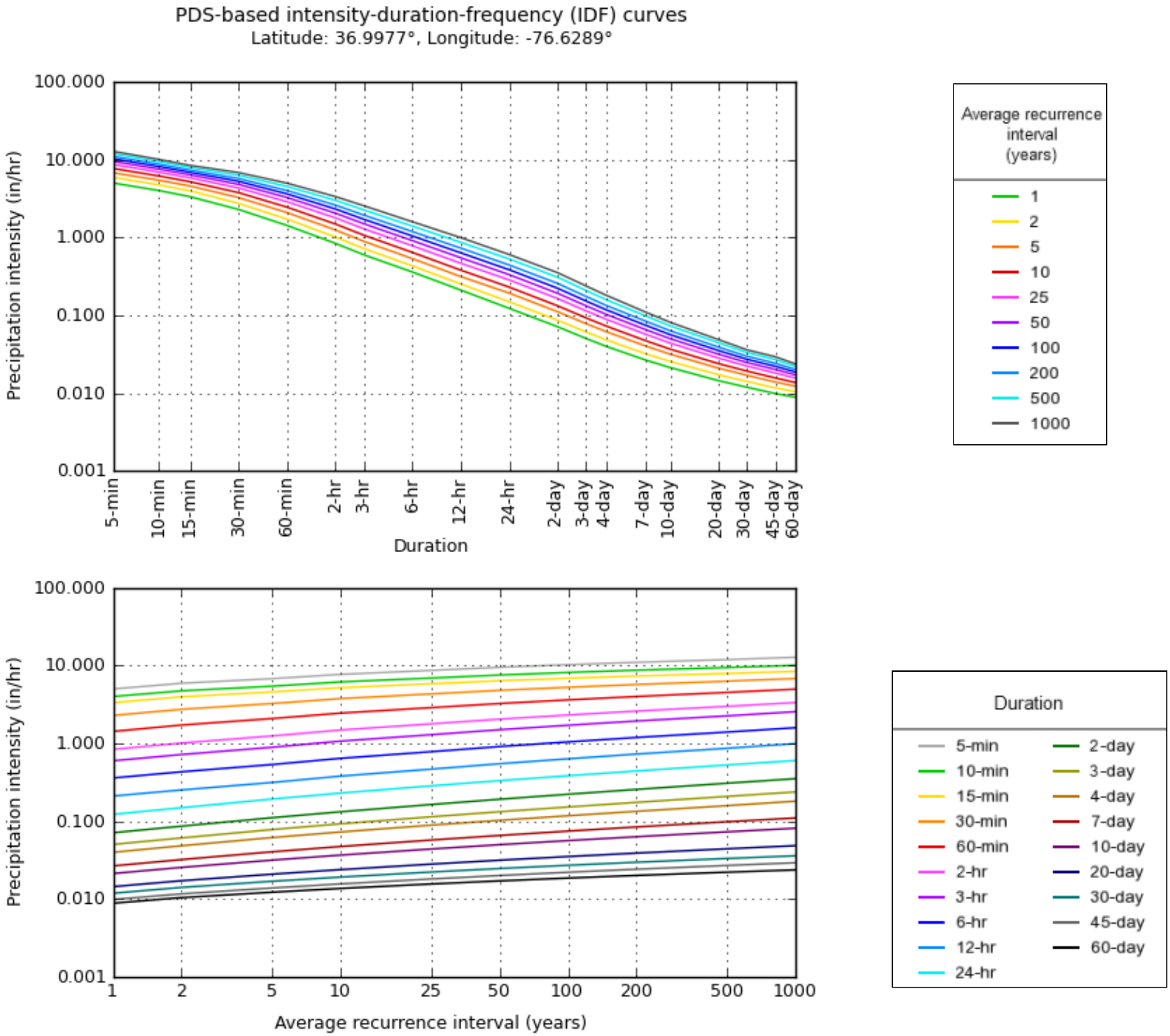
PF graphical



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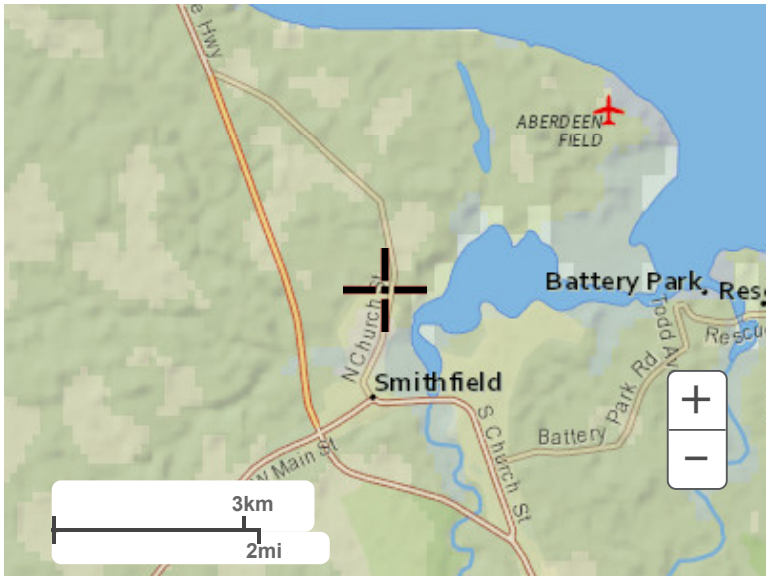
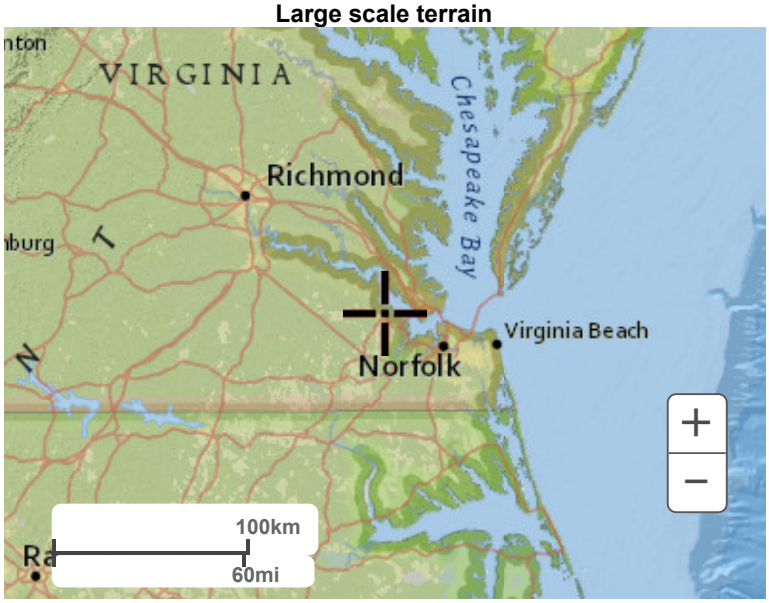
Maps & aerials

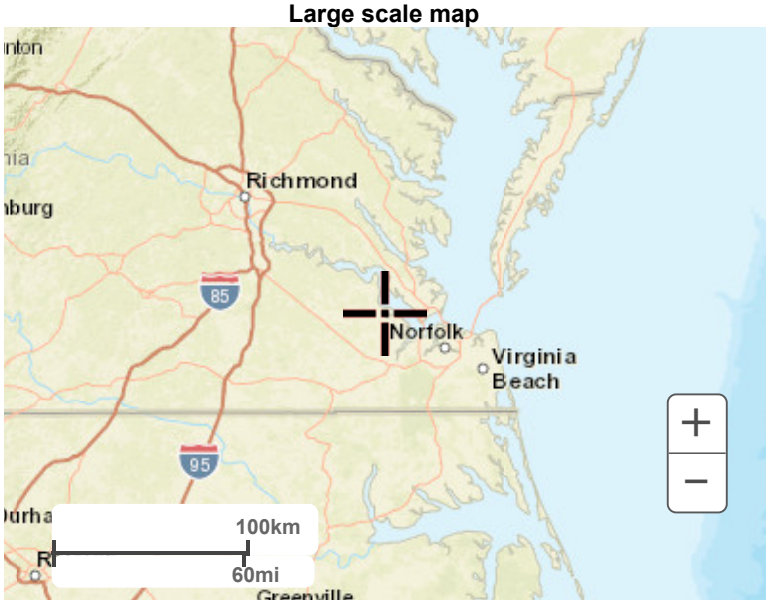
Small scale terrain



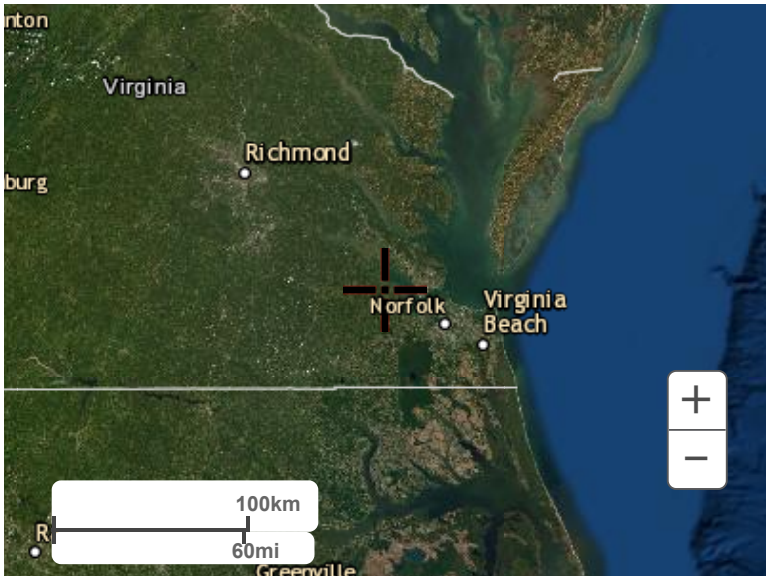
Large scale terrain



Large scale map



Large scale aerial



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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

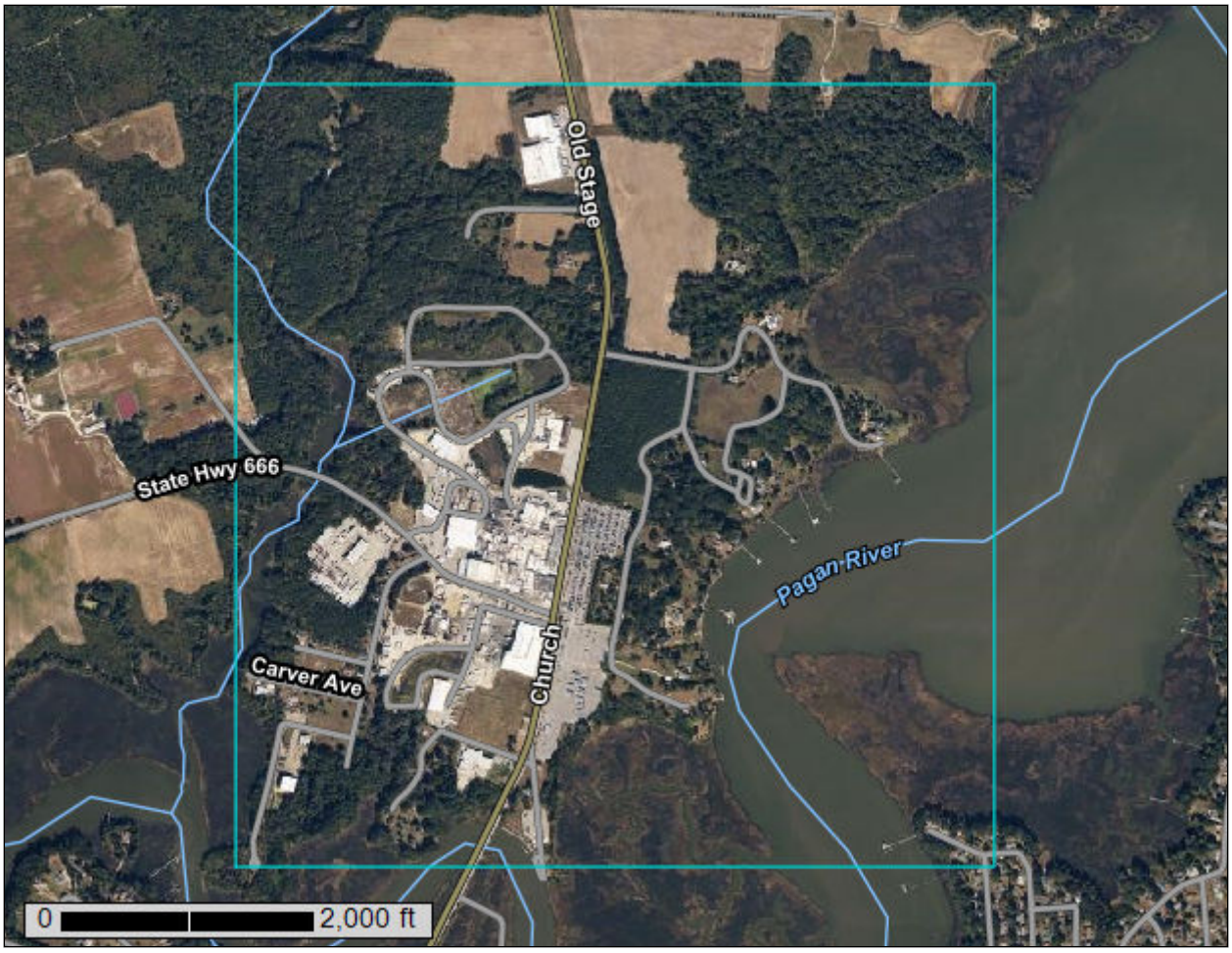
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Isle of Wight County, Virginia



March 22, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:14,100 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Isle of Wight County, Virginia
Survey Area Data: Version 17, Sep 14, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 11, 2019—Oct 15, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2	Bohicket silty clay loam	165.8	19.6%
5A	Emporia fine sandy loam, 0 to 2 percent slopes	8.8	1.0%
5B	Emporia fine sandy loam, 2 to 6 percent slopes	17.7	2.1%
11E	Nevarc and Remlik soils, 15 to 35 percent slopes	163.0	19.3%
12A	Peawick silt loam, 0 to 2 percent slopes	25.2	3.0%
12B	Peawick silt loam, 2 to 6 percent slopes	10.5	1.2%
13B3	Peawick clay loam, 2 to 6 percent slopes, severely eroded	10.9	1.3%
14B	Peawick-Slagle complex, 2 to 6 percent slopes	80.2	9.5%
16	Rumford loamy sand	2.2	0.3%
17B3	Slagle sandy loam, 2 to 6 percent slopes, severely eroded	27.3	3.2%
18A	Slagle fine sandy loam, 0 to 2 percent slopes	15.4	1.8%
18B	Slagle fine sandy loam, 2 to 6 percent slopes	50.3	5.9%
18C	Slagle fine sandy loam, 6 to 10 percent slopes	1.3	0.2%
19A	Uchee loamy sand, 0 to 2 percent slopes	12.7	1.5%
19B	Uchee loamy sand, 2 to 6 percent slopes	23.1	2.7%
21	Udorthents, loamy	17.3	2.0%
22	Urban land	89.4	10.6%
W	Water	124.5	14.7%
Totals for Area of Interest		**845.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps.

The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Isle of Wight County, Virginia

2—Bohicket silty clay loam

Map Unit Setting

National map unit symbol: 4051
Elevation: 0 feet
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Bohicket and similar soils: 85 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bohicket

Setting

Landform: Salt marshes
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 11 inches: silty clay loam
H2 - 11 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Very frequent
Frequency of ponding: Frequent
Maximum salinity: Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 25.0
Available water supply, 0 to 60 inches: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: D
Hydric soil rating: Yes

Minor Components

Rappahannock

Percent of map unit: 7 percent
Landform: Salt marshes
Landform position (three-dimensional): Tread

Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

5A—Emporia fine sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 4059
Elevation: 20 to 150 feet
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Emporia and similar soils: 85 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emporia

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 15 inches: fine sandy loam
H2 - 15 to 33 inches: sandy clay loam
H3 - 33 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 36 to 54 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Nawney

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

5B—Emporia fine sandy loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 405b
Elevation: 20 to 150 feet
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Emporia and similar soils: 85 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emporia

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 15 inches: fine sandy loam
H2 - 15 to 33 inches: sandy clay loam
H3 - 33 to 60 inches: sandy loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 36 to 54 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Nawney

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

11E—Nevarc and Remlik soils, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 404k
Elevation: 10 to 300 feet
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Nevarc and similar soils: 45 percent
Remlik and similar soils: 35 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nevarc

Setting

Landform: Marine terraces
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 4 inches: silt loam
H2 - 4 to 57 inches: clay loam
H3 - 57 to 64 inches: sandy clay loam

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained

Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Remlik

Setting

Landform: Marine terraces
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 28 inches: loamy sand
H2 - 28 to 52 inches: sandy clay loam
H3 - 52 to 60 inches: loamy sand

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Nawney

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

12A—Peawick silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 404l
Elevation: 20 to 350 feet
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Peawick and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peawick

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 4 inches: silt loam
H2 - 4 to 70 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Chickahominy

Percent of map unit: 5 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Kinston

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

12B—Peawick silt loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 404m
Elevation: 20 to 350 feet
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Peawick and similar soils: 85 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peawick

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 4 inches: silt loam
H2 - 4 to 70 inches: clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained

Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.4 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Kinston
Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Nawney
Percent of map unit: 3 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

13B3—Peawick clay loam, 2 to 6 percent slopes, severely eroded

Map Unit Setting
National map unit symbol: 404p
Elevation: 20 to 350 feet
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition
Peawick and similar soils: 80 percent
Minor components: 12 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peawick

Setting
Landform: Marine terraces

Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 2 inches: clay loam
H2 - 2 to 70 inches: clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Kinston

Percent of map unit: 8 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Nawney

Percent of map unit: 4 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

14B—Peawick-Slagle complex, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 404q
Elevation: 20 to 350 feet
Mean annual precipitation: 43 to 53 inches

Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Peawick and similar soils: 45 percent
Slagle and similar soils: 40 percent
Minor components: 9 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peawick

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 4 inches: silt loam
H2 - 4 to 70 inches: clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Slagle

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 13 inches: fine sandy loam
H2 - 13 to 25 inches: sandy clay loam
H3 - 25 to 60 inches: sandy clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Kinston

Percent of map unit: 9 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

16—Rumford loamy sand

Map Unit Setting

National map unit symbol: 404s
Elevation: 50 to 300 feet
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Rumford and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rumford

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 16 inches: loamy sand
H2 - 16 to 36 inches: sandy loam
H3 - 36 to 60 inches: sand

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Kinston

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

17B3—Slagle sandy loam, 2 to 6 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 404t
Elevation: 50 to 350 feet
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Slagle and similar soils: 85 percent
Minor components: 9 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Slagle

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 4 inches: sandy loam
H2 - 4 to 25 inches: sandy clay loam
H3 - 25 to 60 inches: sandy clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Kinston

Percent of map unit: 7 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Nawney

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

18A—Slagle fine sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 404v
Elevation: 50 to 350 feet
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Slagle and similar soils: 85 percent
Minor components: 9 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Slagle

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 13 inches: fine sandy loam
H2 - 13 to 25 inches: sandy clay loam
H3 - 25 to 60 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Kinston

Percent of map unit: 7 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Nawney

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

18B—Slagle fine sandy loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2sgy1
Elevation: 70 to 330 feet
Mean annual precipitation: 32 to 51 inches
Mean annual air temperature: 47 to 70 degrees F
Frost-free period: 158 to 206 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Slagle and similar soils: 83 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Slagle

Setting

Landform: Marine terraces
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread, riser, rise
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bt - 8 to 51 inches: sandy clay loam
C - 51 to 70 inches: sandy loam

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Myatt

Percent of map unit: 3 percent
Landform: Depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

18C—Slagle fine sandy loam, 6 to 10 percent slopes

Map Unit Setting

National map unit symbol: 404x
Elevation: 50 to 350 feet
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Slagle and similar soils: 85 percent
Minor components: 9 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Slagle

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 13 inches: fine sandy loam
H2 - 13 to 25 inches: sandy clay loam
H3 - 25 to 60 inches: sandy clay loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Kinston

Percent of map unit: 7 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Nawney

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

19A—Uchee loamy sand, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 404y
Elevation: 50 to 700 feet
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Uchee and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Uchee

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 28 inches: loamy sand
H2 - 28 to 52 inches: sandy clay loam
H3 - 52 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 42 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Kinston

Percent of map unit: 7 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Nawney

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

19B—Uchee loamy sand, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 404z
Elevation: 50 to 700 feet
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Uchee and similar soils: 85 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Uchee

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 28 inches: loamy sand
H2 - 28 to 52 inches: sandy clay loam
H3 - 52 to 60 inches: sandy loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 42 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Nawney

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Kinston

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

21—Udorthents, loamy

Map Unit Setting

National map unit symbol: 4054
Elevation: 0 to 80 feet
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Properties and qualities

Slope: 0 to 10 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydric soil rating: No

22—Urban land

Map Unit Setting

National map unit symbol: 4055
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Down-slope shape: Convex
Across-slope shape: Convex

Typical profile

H1 - 0 to 6 inches: material

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: 10 inches to
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

W—Water

Map Unit Setting

National map unit symbol: 405h
Mean annual precipitation: 43 to 53 inches
Mean annual air temperature: 66 to 73 degrees F
Frost-free period: 165 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

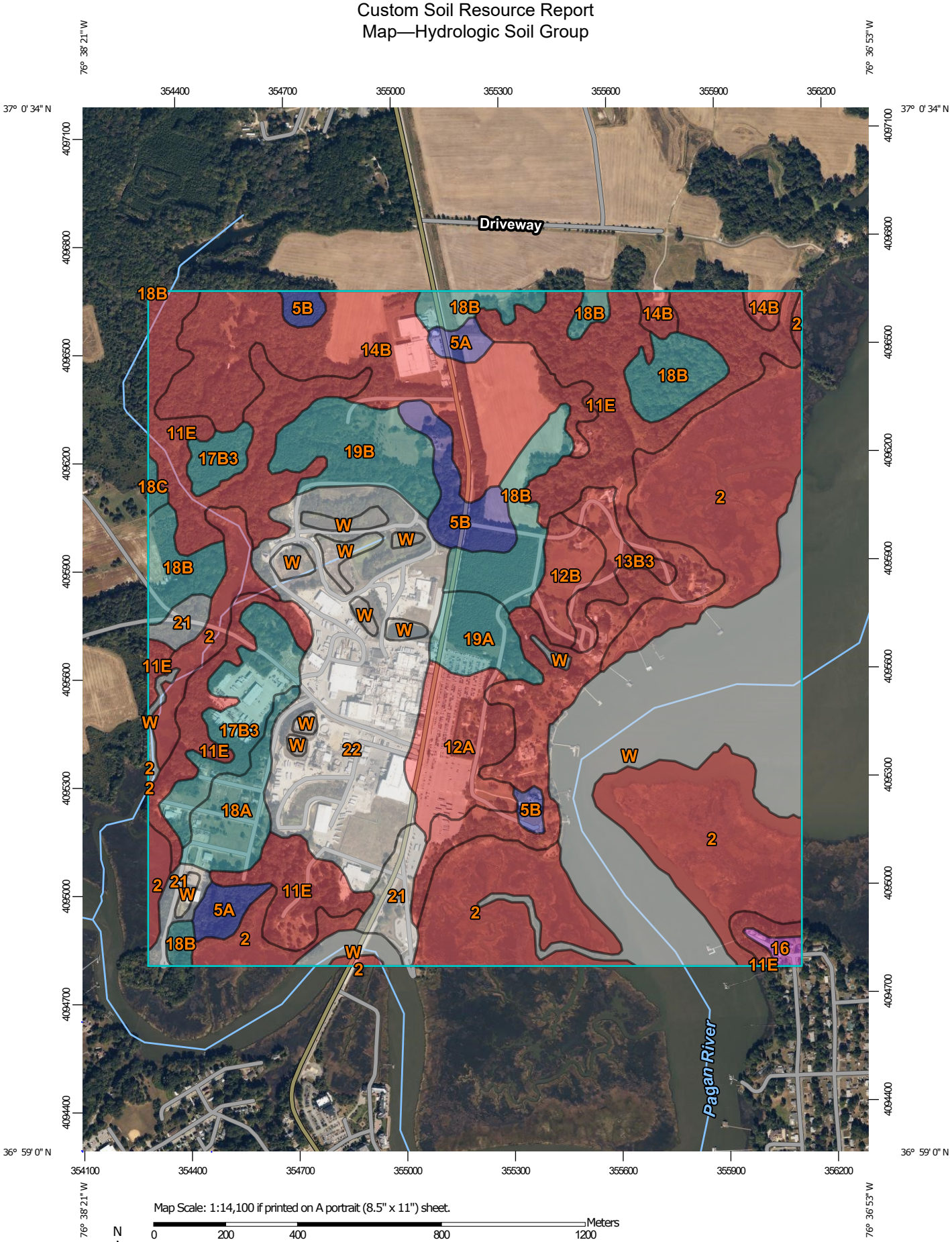
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.



Map Scale: 1:14,100 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 200 400 800 1200

Feet
0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Isle of Wight County, Virginia
Survey Area Data: Version 17, Sep 14, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 11, 2019—Oct 15, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
2	Bohicket silty clay loam	D	165.8	19.6%
5A	Emporia fine sandy loam, 0 to 2 percent slopes	B	8.8	1.0%
5B	Emporia fine sandy loam, 2 to 6 percent slopes	B	17.7	2.1%
11E	Nevarc and Remlik soils, 15 to 35 percent slopes	D	163.0	19.3%
12A	Peawick silt loam, 0 to 2 percent slopes	D	25.2	3.0%
12B	Peawick silt loam, 2 to 6 percent slopes	D	10.5	1.2%
13B3	Peawick clay loam, 2 to 6 percent slopes, severely eroded	D	10.9	1.3%
14B	Peawick-Slagle complex, 2 to 6 percent slopes	D	80.2	9.5%
16	Rumford loamy sand	A	2.2	0.3%
17B3	Slagle sandy loam, 2 to 6 percent slopes, severely eroded	C	27.3	3.2%
18A	Slagle fine sandy loam, 0 to 2 percent slopes	C	15.4	1.8%
18B	Slagle fine sandy loam, 2 to 6 percent slopes	C	50.3	5.9%
18C	Slagle fine sandy loam, 6 to 10 percent slopes	C	1.3	0.2%
19A	Uchee loamy sand, 0 to 2 percent slopes	C	12.7	1.5%
19B	Uchee loamy sand, 2 to 6 percent slopes	C	23.1	2.7%
21	Udorthents, loamy		17.3	2.0%
22	Urban land		89.4	10.6%
W	Water		124.5	14.7%
Totals for Area of Interest			**845.6**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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Appendix G

Pollution Prevention Plan

Pollution Prevention Plan

A Pollution Prevention Plan must address potential pollutant-generating activities that reasonably be expected to affect the quality of stormwater discharges from the construction activity, including support activities, according to Part IIA4 of the Permit.

Potential Pollutant Sources

Leaks, Spills, and other Releases	Pollution Prevention Practices and Procedures (Part IIA4e1)
Spill Containment Kit Location: _____ Revised Location: _____ Operator Initials: _____	Oil, chemical or other hazardous substance spills in excess of reportable quantities, in accordance with the Permit (Appendix 1), will be reported to the Department in accordance with Part III G. of the Permit as soon as the discharge is discovered, but no later than 24 hours. A reportable quantity of oil is defined as a discharge to a surface water that causes a sheen, discoloration, and/or an emulsion. Reports will be made to the following: **Virginia Department of Emergency Management** **Emergency Operations Center (EOC)** **Phone: (800) 468-8892** Materials and equipment necessary for oil or chemical spill cleanup will be kept in the temporary material storage trailer onsite. Equipment will include, but not be limited to, brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, saw dust, and plastic and metal trash containers. All oil or other chemical spills will be cleaned up immediately upon discovery. Spills large enough to reach the storm sewers will be reported to the National Response Center at 1-800-424-8802.

Equipment/Vehicle Washing	Pollution Prevention Practices and Procedures (Part IIA4e4)
Location of Dedicated Area: _____ Revised Location: _____ Operator Initials: _____	Washing must be conducted in a dedicated area that is to be located greater than 50 feet from storm drain inlets, ditches, waterbodies or wetlands. All wash water used for vehicle wheel washing must be directed to a sediment basin/trap. All vehicle washing activities other than wheel washing must have secondary containment. Appropriate signage must inform users of location of dedicated areas.
	Water Source:

Vehicle Fueling and Maintenance	Pollution Prevention Practices and Procedures (Part IIA4e2)
Location of Dedicated Area: _____ Revised Location: _____ Operator Initials: _____	(i) On-site vehicle refueling will be conducted in a dedicated location away from access to surface waters. Since the location of fueling activities will periodically move during construction, the design plans do not contain a specific location. For each phase of work a location will be determined in the field and noted in the Site Inspection Log (Appendix 4). Containment berms will be located adjacent to the refueling area that will contain any inadvertent spills until they can be cleaned up. Any on-site storage tanks will have a means of secondary containment. In the event of a spill, it will be cleaned up immediately and the material, including any contaminated soil, will be disposed of according to all federal, state, and local regulations. (ii) All vehicles on site will be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage. (iii) Petroleum products will be stored in tightly sealed containers which are clearly labeled. (iv) Spill kits will be included with all fueling sources and maintenance activities. (v) Any asphalt substances used onsite will be applied according to the manufacturer's recommendation.

Discharge from Storage, Handling, and Disposal of Construction Materials	Pollution Prevention Practices and Procedures (Part IIA4e6)
Location of Dedicated Area: _____ Revised Location: _____ Operator Initials: _____	Storage of construction products, materials, and waste is to be conducted in dedicated areas. The dedicated area is to be located greater than 50 feet from storm drain inlets, ditches, waterbodies or wetlands. The dedicated areas must be designed to minimize the discharge of pollutants from storage, handling, and disposal of construction products, materials and wastes including i) building products such as asphalt sealants, copper flashings, roofing materials, adhesives, and concrete mixtures; ii) pesticides, herbicides, insecticides, fertilizers, and landscape materials; and iii) construction and domestic wastes such as packaging materials, scrap construction materials, masonry products, timber, pipes and electrical cuttings, plastics, Styrofoam, concrete and other trash or building products. Appropriate signage must inform users of location of dedicated areas.

Discharges from other Potential Pollutant Sources	Pollution Prevention Practices and Procedures (Part IIA4e8)
Location of Dedicated Area: _____ Revised Location: _____ Operator Initials: _____	Discharges from other pollutant sources not mentioned elsewhere must be addressed.

Discharges from Concrete Related Wash Activities	Pollution Prevention Practices and Procedures (Part IIA4e5)
Location of Dedicated Area: _____ Revised Location: _____ Operator Initials: _____	(i) Concrete trucks will not be allowed to wash out or discharge surplus concrete or drum wash water on the site, except in a specially designated concrete disposal area. (ii) Form release oil used for decorative stone work will be applied over a pallet covered with an absorbent material to collect excess fluid. The absorbent material will be replaced and disposed of properly when saturated.

Discharges of Soaps, Detergents, Solvents, and Wash Water from Construction Activities	Pollution Prevention Practices and Procedures (Part IIA4e3)
Location of Dedicated Area: _____ Revised Location: _____ Operator Initials: _____	Environmentally friendly washing, flushing and dust controlling procedures shall be practiced during construction to prevent contamination of surface and ground water. These practices will consist of the use of using off-site facilities; washing in designated, contained areas only; eliminating discharges to storm drains by infiltrating the water or routing to the sanitary sewer; and training employees and subcontractors in proper cleaning procedures.

Discharges of Hazardous, Toxic, and Sanitary Waste	Pollution Prevention Practices and Procedures (Part IIA4e7)
Location of Dedicated Area: _____ Revised Location: _____ Operator Initials: _____	Portable lavatories are located on-site and are serviced on a regular basis by a contractor. They will be located in upland areas away from direct contact with surface waters. Any spills occurring during servicing will be cleaned up immediately, including any contaminated soils, and disposed of according to all federal, state, and local regulations.

"I certify under penalty of law that I have read and understand this document in accordance with the General VPDES Permit for Discharges of Stormwater from Construction Activities. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."
Operator or Delegated Authority Signature

Appendix H

TMDL Information

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

James River Basin

***Cause Group Code:* G01E-03-PCB** **James River and Various Tributaries**

Cause Location: Estuarine James River from the fall line to the Hampton Roads Bridge Tunnel, including several tributaries listed below.

City / County:					
	Charles City Co.	Chesapeake City	Chesterfield Co.	Colonial Heights City	Dinwiddie Co.
	Hampton City	Henrico Co.	Hopewell City	Isle Of Wight Co.	James City Co.
	New Kent Co.	Newport News City	Norfolk City	Petersburg City	Portsmouth City
	Prince George Co.	Richmond City	Suffolk City	Surry Co.	Williamsburg City

Use(s): Fish Consumption

Cause(s) / VA Category: PCB in Fish Tissue / 5A

During the 2002 cycle, the James River from the fall line to Queens Creek was considered not supporting of the Fish Consumption Use due to PCBs in several fish species at multiple DEQ monitoring locations.

During the 2004 cycle, a VDH Fish Consumption Restriction was issued from the fall line to Flowerdew Hundred and the segment was adjusted slightly to match the restriction. In addition, in the 2004 cycle, the Chickahominy River from Walkers Dam to Diascund Creek was assessed as not supporting of the Fish Consumption Use because the DEQ screening value for PCBs was exceeded in 3 species during sampling in 2001.

The VDH restriction was extended on 12/13/2004 to stretch from the I-95 bridge downstream to the Hampton Roads Bridge Tunnel and include the tidal portions of the following tributaries:

Appomattox River up to Lake Chesdin Dam
Bailey Creek up to Route 630
Bailey Bay
Chickahominy River up to Walkers Dam
Skiffes Creek up to Skiffes Creek Dam
Pagan River and its tributary Jones Creek
Chuckatuck Creek
Nansemond River and its tributaries Bennett Creek and Star Creek
Hampton River
Willoughby Bay and the Elizabeth R. system (Western, Eastern, and Southern Branches and Lafayette R.) and tributaries St. Julian Creek, Deep Creek, and Broad Creek

The advisory was modified again on 10/10/2006 to add Poythress Run.

The impairments were combined. The TMDL for the lower extended portion is due in 2018.

PCB sampling in 2012 showed exceedances in 4 species at 2-JMS087.01, 3 species at 2-JMS097.77, 4 species at 2-JMS110.00, 2 species at 2-PTH000.23, 2 species at 2-BLY000.65, 3 species at 2-JMS074.44, 2 species at 2-JMS066.88, 2 species at 2-JMS057.69, 3 species at 2-JMS052.67, among others.

Additional sampling occurred in 2016. The results are as follows:
2-JMS110.00 - 7 sp

Assessment Unit / Water Name / Location Desc.	Cause Category	Cause Name	Cycle First Listed	TMDL Dev. Priority	Water Size
VAP-G01E_JMS01A02 / James River / The James River from the fall line near Mayos Bridge to river mile 108.76.	5A	PCB in Fish Tissue	2002	H, 2yr	0.239
State Scenic River					
JMSTFu					
VAP-G01E_JMS02A02 / James River / The James River from river mile 108.76 to river mile 108.63.	5A	PCB in Fish Tissue	2002	H, 2yr	0.016

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

James River Basin

JMSTFu VAP-G01E_JMS03A02 / James River / The James River from river mile 108.63 to the confluence with Proctors Creek at river mile 2-JMS097.94.	5A	PCB in Fish Tissue	2002	H, 2yr	1.229
JMSTFu VAP-G02E_APP01A12 / Appomattox River / Portion of the Appomattox River within CB segment JMSTFl	5A	PCB in Fish Tissue	2002	H, 2yr	0.113
State Scenic River VAP-G02E_JMS01A00 / James River / The James River from Proctors Creek to 5 miles above the old American Tobacco raw water intake.	5A	PCB in Fish Tissue	2002	H, 2yr	0.078
JMSTFu VAP-G02E_JMS02A00 / James River / The James River from 5 miles above the old American Tobacco intake to 5 miles above City Point at Hopewell.	5A	PCB in Fish Tissue	2002	H, 2yr	2.790
JMSTFu VAP-G02E_JMS02B18 / James River / The James River from 5 miles above City Point at Hopewell to the downstream extent of JMSTFu.	5A	PCB in Fish Tissue	2002	H, 2yr	1.182
JMSTFu VAP-G02E_JMS03A06 / James River / The James River from the upstream extent of JMSTFl to the downstream extent of PWS.	5A	PCB in Fish Tissue	2002	H, 2yr	0.633
JMSTFl VAP-G03E_BLY01A98 / Bailey Creek/Cattail Creek / The tidal portions of Bailey Creek and Cattail Creek.	5A	PCB in Fish Tissue	2002	H, 2yr	0.114
JMSTFl VAP-G03E_JMS01A00 / James River / The mainstem of the James River from the confluence with the Appomattox River downstream to Powell Creek.	5A	PCB in Fish Tissue	2002	H, 2yr	10.194
JMSTFl VAP-G03E_JMS01B10 / James River / The mainstem of the James River from the confluence with Powell Creek downstream to Queen Creek.	5A	PCB in Fish Tissue	2002	H, 2yr	3.485
JMSTFl VAP-G03E_PTH01A00 / Poythress Run / The tidal portion of Poythress Run.	5A	PCB in Fish Tissue	2008	H, 2yr	0.002
JMSTFl VAP-G04E_JMS01A02 / James River / The James River from the confluence with Queens Creek downstream to Buoy 74 at Brandon Point	5A	PCB in Fish Tissue	2006	H, 2yr	7.756
JMSTFl VAP-G04E_JMS02A02 / James River / The James River from the	5A	PCB in Fish Tissue	2006	H, 2yr	20.409

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

James River Basin

tidal freshwater/oligohaline boundary at approx. river mile 51.94 to the limit of the PRO watershed (approx. rm 42.7).

JMSOH

VAP-G04E_JMS03A04 / James River / Buoy 74 at Brandon Point (rivermile 55.94) to the tidal freshwater/oligohaline boundary at approximately river mile 52.08.	5A	PCB in Fish Tissue	2006	H, 2yr	3.756

JMSTFl

VAP-G08E_CHK01A00 / Chickahominy River / The Chickahominy River from Walkers Dam to the confluence with Diascund Creek.	5A	PCB in Fish Tissue	2004	H, 2yr	1.373

CHKOH

VAP-G08E_CHK02A00 / Chickahominy River / The Chickahominy River from the confluence with Diascund Creek downstream to the James River, excluding 0.5 mile upstream and downstream of station 2CCHK002.40.	5A	PCB in Fish Tissue	2006	H, 2yr	5.468

CHKOH

VAP-G08E_CHK02B18 / Chickahominy River / Approximately 0.5 mile upstream and downstream of station 2CCHK002.40	5A	PCB in Fish Tissue	2006	H, 2yr	0.452

CHKOH

VAP-J15E_APP01A98 / Lower Appomattox River/Ashton Creek / The estuarine Appomattox River from the fall line to river mile 6.49.	5A	PCB in Fish Tissue	2002	H, 2yr	0.507

APPTF.
Virginia Scenic River

VAP-J15E_APP02A98 / Appomattox River / The estuarine portion of the Appomattox River from The confluence of Walthall Channel to the end of APPTF.	5A	PCB in Fish Tissue	2002	H, 2yr	1.361

Virginia Scenic River

VAP-J15E_APP02B12 / Appomattox River / The estuarine portion of the Appomattox River from the start of PWS at river mile 6.49 to the confluence of Walthall Channel	5A	PCB in Fish Tissue	2002	H, 2yr	0.703

APPTF.

Virginia Scenic River

VAP-J15R_APP01A12 / Appomattox River / The Appomattox River from the Rohoic Creek to the fall line at the Route 1/301 bridge.	5A	PCB in Fish Tissue	2006	H, 2yr	1.94

Virginia Scenic River

VAP-J15R_APP01A98 / Appomattox River / The Appomattox River from the Lake Chesdin dam to the confluence of Rohoic Creek	5A	PCB in Fish Tissue	2006	H, 2yr	5.57

VAT-G10E_JMS01A06 / James River Mainstem - Chickahominy R. to Hog Point / From confluence with Chickahominy R. coincident with watershed line (RM 48.40) downstream to line between Hog Pt. and mouth College Cr. N shore James R. CBP segment JMSOH. DSS (ADMIN) shellfish condemn # 059-069 A (effective 20141219).	5A	PCB in Fish Tissue	2006	H, 2yr	17.843
VAT-G10E_JMS01B08 / James River - Carters Grove Area (G10) / Mainstem along north shore, Camp Wallace to Carters Grove. Area	5A	PCB in Fish Tissue	2006	H, 2yr	0.985

shoreline upstream of Skiffes Creek. Portion of CBP segment JMSOH. DSS (ADMIN PROHIB) shellfish direct harvesting condemnation # 059-067 A&B (effective 20100901).					
VAT-G10E_JMS02A06 / James River - Hog Point Area (Open Shellfish Area) / Triangular area in mainstem around Walnut Point, from Hog Pt. to G11 watershed line. CBP segment JMSOH. DSS (OPEN) shellfish direct harvesting condemnation # 057-069 (effective 20141219).	5A	PCB in Fish Tissue	2006	H, 2yr	2.240
VAT-G11E_CKT01A04 / Chuckatuck & Brewers Creeks / South shore trib to James R., confluence upstream of Nansemond R. From headwaters to end of SF condemnation at Johnson near tidal flat. Portion of CBP segment JMSMH. DSS shellfish harvesting condemnation # 062-080 A (effective 20161005).	5A	PCB in Fish Tissue	2006	H, 2yr	0.731
VAT-G11E_CKT02A12 / Chuckatuck Creek and Mouth in James / South shore trib to James R., after confluence with Brewers Creek to mouth. Portion of CBP segment JMSMH. DSS OPEN shellfish direct harvesting condemnation # 062-080 (effective 20161005).	5A	PCB in Fish Tissue	2006	H, 2yr	0.714
VAT-G11E_JMS01A06 / James River - Gravel Neck to Pagan River / From start of JMSMH salinity boundary (Hog Isl. Cr.) downstream to line between Jail Pt (Mulberry Isl) to Days Pt (mouth Pagan R). CBP segment JMSMH. DSS (OPEN) shellfish condemnation # 059-069 (effective 20141219).	5A	PCB in Fish Tissue	2002	H, 2yr	40.260
VAT-G11E_JMS01B08 / James River - Hog Island Area [JMSOH area] / From area of Homewood (G11 watershed line) downstream to start of JMSMH salinity boundary (Hog Isl. Cr.). CBP segment JMSOH. DSS (OPEN) shellfish direct harvesting condemnation # 059-069 (effective 20141219).	5A	PCB in Fish Tissue	2006	H, 2yr	3.846
VAT-G11E_JMS01C08 / James River - Carter Grove Area / Mainstem along north shore, from near Carter Grove. CBP segment JMSMH. Portion of DSS (ADMIN) shellfish condemnation # 059-067 A (effective 20100901).	5A	PCB in Fish Tissue	2006	H, 2yr	0.404
VAT-G11E_JMS01D14 / James River - Carters Grove Area (G11) / Mainstem along north shore, Camp Wallace to Carters Grove. Area shoreline upstream of Skiffes Creek. Portion of CBP segment JMSOH. DSS (ADMIN PROHIB) shellfish direct harvesting condemnation # 059-067 A&B (effective 20100901.	5A	PCB in Fish Tissue	2006	H, 2yr	1.218
VAT-G11E_JMS02A06 / James River - Jail Point to Hilton Village / Mainstem from line between Jail Pt (Mulberry Isl) to Days Pt (Mouth Pagan R) downstream to line Hilton Village (Newport News)/Kings Creek (Isle of Wight). CBP segment JMSMH. DSS (OPEN) shellfish harvesting condemnation # 059-069 (effective 20141219).	5A	PCB in Fish Tissue	2006	H, 2yr	24.697
VAT-G11E_JMS03A06 / James River - Along Lower North Shore / Mainstem along north shore, from Jail Point (Mulberry Isl) downstream to line following Rt. 664. CBP segment JMSMH. Portions of DSS (ADMIN) shellfish condemnation # 058-034 A (effective 20080518) & 057-007 A (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	3.943
VAT-G11E_JMS03B06 / James River - Hilton Beach Area / North shore James R. NW of James R. Bridge. Mainstem along north shoreline beach in Hilton Village area. CBP segment JMSMH. Portion of DSS (ADMIN) shellfish condemnation # 058-034 A (effective 20080518).	5A	PCB in Fish Tissue	2006	H, 2yr	0.110
VAT-G11E_JMS03C06 / James River - Huntington Beach Area / North shore James R. near foot of James R. Bridge. Mainstem along north shoreline beach in Hilton Village area. CBP segment JMSMH.	5A	PCB in Fish Tissue	2006	H, 2yr	0.008

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

James River Basin

Portion of DSS (ADMIN) shellfish condemnation # 058-034 A (effective 20080508).

VAT-G11E_JMS04A06 / James River - Hilton Village to Craney Island / Mainstem from a line between Hilton Village (Newport News)/Kings Creek (Isle of Wight) downstream to the end of DSS (OPEN) shellfish harvesting condemnation # 059-069 F (effective 20141219). CBP segment JMSMH.	5A	PCB in Fish Tissue	2006	H, 2yr	24.879
VAT-G11E_JMS06A10 / James River - Outside Mouth Streeter & Hoffler Creeks / Mainstem area at Mouth of Streeter & Hoffler Creeks @ SW corner Craney Island. CBP segment JMSMH. DSS (ADMIN) shellfish condemnation # 064-018 A (effective 20080530).	5A	PCB in Fish Tissue	2006	H, 2yr	0.156
VAT-G11E_JOG01A08 / Jones Creek - Tributary to Pagan River / South shore trib. to Pagan R. near confluence with James R. From headwaters to SR 669, including tidal tributaries. CBP segment JMSMH. Portion of DSS shellfish harvesting (Admin-PROHIBITED) # 061-064 B (effective 20160502).	5A	PCB in Fish Tissue	2006	H, 2yr	0.229
VAT-G11E_JOG02A08 / Jones Creek - Tributary to Pagan River / South shore trib. to Pagan R. near confluence with James R. From SR 669 to mouth, including tidal tributaries. CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 B & M2 (effective 20160502).	5A	PCB in Fish Tissue	2006	H, 2yr	0.102
VAT-G11E_PGN01A08 / Pagan River - Upper / Located in Smithfield area. South shore tributary to James R. From end of tidal water downstream to approx RM 7.00. Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 A (effective 201460502).	5A	PCB in Fish Tissue	2006	H, 2yr	0.062
VAT-G11E_PGN01B18 / Pagan River - Upper Middle / Located in Smithfield area. South shore tributary to James R. From downstream of Crook Ln to UT N Trib.Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 A (effective 20160502).	5A	PCB in Fish Tissue	2006	H, 2yr	0.065
VAT-G11E_PGN01C18 / Pagan River - Middle / Located in Smithfield area. South shore tributary to James R.N of Rt 10 downstrm N of Cupress Cr .Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 A (effective 20160502).	5A	PCB in Fish Tissue	2006	H, 2yr	0.058
VAT-G11E_PGN02A08 / Pagan River - Middle Lower / Located in Smithfield area. South shore tributary to James R. North of Town of Smithfield downstream Azalea Dr. Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 A (effective 20160502).	5A	PCB in Fish Tissue	2006	H, 2yr	1.030
VAT-G11E_PGN02B14 / Pagan River - Lower / Located in Smithfield area. South shore tributary to James R. Lower portion from Moonefield Dr to Morris Cr. Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 A (effective 20160502).	5A	PCB in Fish Tissue	2006	H, 2yr	0.162
VAT-G11E_PGN02C18 / Pagan River - Lower SF Open / Located in Smithfield area. South shore tributary to James R. From Morris Creeek downstream to River Ave. Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 A (effective 20160502).	5A	PCB in Fish Tissue	2006	H, 2yr	0.084
VAT-G11E_PGN02D16 / Pagan River - Jones Cr / Located in Smithfield area. South shore tributary on the East shore to James R. Portion near Battery Park. Portion of CBP segment JMSMH. Portion of	5A	PCB in Fish Tissue	2006	H, 2yr	0.020

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

James River Basin

DSS shellfish direct harvesting condemnation # 061-064 M2 (effective 20160502).					
VAT-G11E_PGN03A10 / Pagan River - Mouth / Located in Smithfield area. South shore tributary to James R. From the edge of shellfish condemnation #061-064A to. downstream to mouth. Portion of CBP segment JMSMH. DSS OPEN shellfish direct harvesting condemnation # 061-064 (effective 20160502).	5A	PCB in Fish Tissue	2006	H, 2yr	0.889
VAT-G11E_SFF02A08 / Skiffes Creek System [Admin Cond] / Located west of Lee Hall area, flows along the James City Co./NN City boundary. From dam downstream to mouth, including tidal tribs. Portion of CBP segment JMSMH. DSS (ADMIN) shellfish direct harvesting condemnation # 059-023 A (effective 20081215).	5A	PCB in Fish Tissue	2006	H, 2yr	0.452
VAT-G11E_SFF03A10 / Skiffes Creek - Mouth / Located west of Lee Hall area, flows across the James City Co./NN City boundary. From Goose Island to point on opposite shore. Portion of CBP segment JMSMH. DSS (OPEN) shellfish direct harvesting condemnation # 059-069 (effective 20141219).	5A	PCB in Fish Tissue	2006	H, 2yr	0.060
VAT-G11E_WIL01A18 / Williams Creek / Located off of North shore tributary to Pagan River. Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting ADMIN condemnation # 061-064 C (effective 20160502).	5A	PCB in Fish Tissue	2006	H, 2yr	0.060
VAT-G13E_BEN01A04 / Bennett Creek - Tributary to Nansemond R. / Eastern shore trib. to Nansemond R., near confluence with James R. Bennett Harbor area. From headwaters to mouth, including tidal tributaries. Portion of CBP segment JMSMH. DSS shellfish direct harvesting condemnation # 063-046 A (20140826).	5A	PCB in Fish Tissue	2004	H, 2yr	0.542
VAT-G13E_NAN01A00 / Nansemond River - Upper / Upper Nansemond River, within city of Suffolk. Extends from most upstream point in river at Lake Meade Dam (RM 19.8) downstream to Rt. 58/460 crossing (RM 15.2). CBP segment JMSMH. Portion of DSS shellfish condemnation # 063-008 A (effective 20160926).	5A	PCB in Fish Tissue	2006	H, 2yr	0.269
VAT-G13E_NAN02A06 / Nansemond River - Upper Middle / Downstream of Suffolk. From Rt 58/460 (RM 15.1) crossing downstream to confluence with the Western Branch Reservoir (RM 11.9). CBP segment JMSMH. Portion of DSS shellfish condemnation # 063-008 A (20160926).TMDL (32045)	5A	PCB in Fish Tissue	2006	H, 2yr	0.209
VAT-G13E_NAN03A06 / Nansemond River - Lower Middle / In area of Western Branch Reservoir. From confluence with Western Br. (RM 11.8) downstream to Holidays Pt. CBP segment JMSMH. Portion of DSS shellfish condemnation # 063-008 A & C1 (2016096). TMDL (32045)	5A	PCB in Fish Tissue	2006	H, 2yr	2.833
VAT-G13E_NAN04A00 / Nansemond River - Lower [No TMDL] / Nansemond R mouth. From Olds Cove downstream to mouth. CBP segment JMSMH. DSS (OPEN) condemnation 063-046 (effective 20140826) & 063-008 (effective 20140826).	5A	PCB in Fish Tissue	2006	H, 2yr	6.303
VAT-G13E_NAN04C10 / Nansemond River - Lower DSS Condemned at Knotts Cr / Nansemond R at confluence Knotts Cr. CBP segment JMSMH. DSS condemnation # 063-046 B (effective 20120801).	5A	PCB in Fish Tissue	2006	H, 2yr	0.467
VAT-G13E_STR01A04 / Star & Oyster House Creeks - Tributary to Nansemond R. / Eastern shore tributary to Nansemond R. Adjacent to the Naval Communication station at Driver. From headwaters to confluence with Nansemond R. CBP segment JMSMH. DSS shellfish condemnation # 063-008 A (effective 20140826).	5A	PCB in Fish Tissue	2006	H, 2yr	0.046

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

James River Basin

VAT-G15E_BRO01A02 / Broad Creek, Eastern Br. Elizabeth R. / Located between Ingleside and Thomas Corner areas. North shore tributary to Eastern Br. Elizabeth R. Entirety of Broad Creek. CBP segment EBEMH. BIBI segment EBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 065-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.371
VAT-G15E_DEC01A06 / Deep Creek, Southern Br. Elizabeth R. / South of I-64 crossing of Southern Br. E shore trib to Southern Br. CBP segment SBEMH. BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.209
VAT-G15E_DEC02A18 / Deep Creek, Southern Br. Elizabeth R.-Mouth / South of I-64 crossing of Southern Br. E shore trib to Southern Br. Mouth of Creek North of Interstate 64. CBP segment SBEMH. BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.075
VAT-G15E_EBE01A00 / Eastern Branch, Elizabeth R. - Upper / Located between Carolanne Farms and Tanglewood areas. Upper Eastern Br., from headwaters to confluence of Broad Creek (RM 4.0). CBP segment EBEMH. BIBI segment EBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.377
VAT-G15E_EBE02A06 / Eastern Branch, Elizabeth R. - Lower Middle / From Broad Creek (RM 4.0) downstream to the Campestella Bridge. CBP segment EBEMH. BIBI segment EBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.625
VAT-G15E_EBE03A18 / Eastern Branch, Elizabeth R. - Lower / From Campastella Bridge to mouth of Elizabeth River mainstem. CBP segment EBEMH. BIBI segment EBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.390
VAT-G15E_ELI01A06 / Elizabeth River Mainstem - Upper / From start of mainstem downstream to line between Hospital Pt and Smiths Cr. (Incl. Hague). BIBI segment ELIMHa (downstream Lamberts Pt.). CBP segment ELIPH. DSS (ADMIN) cond # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.468
VAT-G15E_ELI02A06 / Elizabeth River Mainstem - Middle / From a line between Hospital Pt and Smiths Cr down stream to the end of CBP-BIBI segment ELIMHa (downstream of Lamberts Pt.). BIBI segment ELIMHa. CBP segment ELIPH. DSS (ADMIN) condemnation # 056-007 E and A (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	4.005
VAT-G15E_ELI03A08 / Elizabeth River Mainstem - Mouth / From start BIBI segment ELIPHa (SE corner Craney Isl. line to east) downstream to mouth (NE corner Craney Isl. east to S Glenwood Pk). BIBI segment ELIPHa. CBP segment ELIPH. DSS (ADMIN) condemnation # 056-007 A (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	3.445
VAT-G15E_GIL01A10 / Gilligan Cr - Upper, trib to SB Eliz R / Trib to E shore SB Eliz R, adjacent to Jones Cr. Opposite Paradise Cr. Upper portion no Deep Water Use. CBP & BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.012
VAT-G15E_GIL02A10 / Gilligan Cr - Lower, trib to SB Eliz R / Trib to E shore SB Eliz R, adjacent to Jones Cr. Opposite Paradise Cr. Lower portion with Deep Water Use. CBP & BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.011

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

James River Basin

VAT-G15E_HAI01A06 / Hampton River / Located between Cherry Acres & East Hampton areas of Hampton, north shore tributary to Hampton Roads Harbor. CBP segment JMSPH. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 A (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.547
VAT-G15E_JMS01A00 / James River at Hampton Roads Harbor / Mainstem from a line between Lincoln Park and the NW corner of Craney Isl. downstream to mouth at Hampton Roads Tunnel. CBP segment JMSPH. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 A (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	25.540
VAT-G15E_JMS01B06 / James River - King/Lincoln Park Beach Area / Located NE of Newport News Point, along the northern shore of Hampton Roads Harbor. CBP segment JMSPH. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 A (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.009
VAT-G15E_JMS01C06 / James River - Anderson Park Beach Area / Located NE of Newport News Point, along the northern shore of Hampton Roads Harbor. CBP segment JMSPH. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 A (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.011
VAT-G15E_JMS05A06 / James River - Newport News Point to NW Corner Craney Isl. / Line following the Rt. 664 crossing mid-river, SW to mid-mouth Nansemond R. to SW tip Craney Isl. Line. The NW line from NW tip Craney Isl. to Lincoln Pk. CBP segment JMSMH. DSS (ADMIN) cond # 056-007 A, B, C (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	3.611
VAT-G15E_JON01A10 / Jones Cr - Upper, trib to SB Eliz R / Trib to E shore SB Eliz R, adjacent to Jones Cr. Opposite Paradise Cr. Upper portion no Deep Water Use. CBP & BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.027
VAT-G15E_JON02A10 / Jones Cr - Lower, trib to SB Eliz R / Trib to E shore SB Eliz R, adjacent to Jones Cr. Opposite Paradise Cr. Lower portion with Deep Water Use. CBP & BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.017
VAT-G15E_LAF01A06 / Lafayette River - Upper / Located east of Craney Isl. From headwaters (approx. RM 7.5) downstream to past Rt 337 (Hampton Blvd bridge, RM 1.75) near Edgewater Haven. CBP segment LAFMHa. DSS (ADMIN) condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	1.743
VAT-G15E_LAF02A06 / Lafayette River - Lower / Located east of Craney Isl. From Rt. 337 (Hampton Blvd bridge, RM 1.75) downstream to the mouth. CBP segment LAFMHa. DSS (ADMIN) condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.404
VAT-G15E_MAI01A10 / Mains Cr. - SB Eliz R. E shore Tributary / SB Eliz R. E shore upstream tributary, SE of Deep Cr. CBP & BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.013
VAT-G15E_MCE01A10 / Mill Creek - SB Elizabeth R. S. shore tributary / SB Elizabeth R S shore tributary SW of Great Bridge Locks. CBP & BIBI segment SBEMHa. Portion of DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.023
VAT-G15E_MDM01A10 / Milldam Cr trib S. Br. Elizabeth R. /	5A	PCB in Fish Tissue	2006	H, 2yr	0.071

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

James River Basin

Tributary to E shore SB Elizabeth R. N of Gilmerton Br. CBP & BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).					
VAT-G15E_MIG01A10 / Mill Creek, Trib to Hampton Roads Harbor / Mill Creek, north shore tributary to Hampton Roads Harbor. CBP segment JMSPH. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 A (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.915
VAT-G15E_NMC01A00 / New Mill Creek - Southern Br. Elizabeth R. / Located south of I-64 crossing of Southern Br. Eastern shore trib to Southern Br, downstream of locks. Entirety of Creek. CBP segment SBEMH. BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.082
VAT-G15E_NTN01A10 / Newton Cr trib to SB Eliz R / Tributary to E shore SB Eliz R. NE of Deep Cr. CBP & BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.038
VAT-G15E_PAR01A06 / Paradise Creek - Upper, trib. to S. Br. Elizabeth R. / South of Norfolk Naval Shipyard. Eastern shore trib to Southern Br. Entirety of Creek. No Deep Water Use. CBP segment SBEMH. BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.025
VAT-G15E_PAR02A10 / Paradise Creek - Lower, trib. to S. Br. Elizabeth R. / South of Norfolk Naval Shipyard. Eastern shore trib to Southern Br. Entirety of Creek. With Deep Water Use. CBP segment SBEMH. BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.028
VAT-G15E_SBE01A00 / Southern Branch, Elizabeth R. - Upper / South of I-64 crossing. From headwaters @ Great Br Locks downstream to I-64 crossing @ Deep Cr. (RM 6.86). CBP segment SBEMH. BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.636
VAT-G15E_SBE02A06 / Southern Branch, Elizabeth R. - Middle / From I-64 crossing @ Deep Cr. confluence (RM 6.86) downstream to the Jordan Bridge (RM 2.30). CBP segment SBEMH. BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	1.074
VAT-G15E_SBE03A06 / Southern Branch, Elizabeth R. - Lower / North of the Jordan Bridge. From the Jordan Bridge, Rt. 337 (RM 2.30) downstream to the mouth, confluence with the mainstem Elizabeth R. CBP segment SBEMH. BIBI segment SBEMHa. DSS (ADMIN) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.545
VAT-G15E_STJ01A04 / Saint Julian Creek / Northwest of Gilmerton Bridge. Eastern shore tributary to Southern Br. Entirety of Creek. CBP segment SBEMH. BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.133
VAT-G15E_WBE01A02 / Western Branch, Elizabeth R. - Upper / Located between Stewart Manor and Point Elizabeth areas. From headwaters (RM 8.5) downstream to Sterns Creek (RM 3.5). BIBI segment WBEMHa. DSS (ADMIN) condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.561
VAT-G15E_WBE02A00 / Western Branch, Elizabeth R. - Lower / Located between the Point Elizabeth and Lovett Point areas. From Sterns Creek confluence (RM 3.5) downstream to the mouth. CBP segment WBEMH. BIBI segment WBEMHa. DSS (ADMIN)	5A	PCB in Fish Tissue	2006	H, 2yr	1.457

James River Basin

condemnation # 056-007 E (effective 20120529).

VAT-G15E_WLY01A06 / Willoughby Bay [Less Beach Area] / Located adjacent to mouth of James River at Hampton Roads, southeast of Hampton Roads Bridge Tunnel. CBP segment JMSPH. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 A (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	2.476
VAT-G15E_WLY03A06 / Willoughby Bay - Beach Area / Located along the northern shore portion of Willoughby Bay along Willoughby Spit. CBP segment JMSPH. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 A (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.142
VAT-G15E_XFR01A10 / UT to SB Elizabeth R. S shore estuary SE of Mill Cr. / SB Eliz S shore estuary SE of Mill Cr. CBP & BIBI segment SBEMH. DSS (ADMIN-COND) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.008
VAT-G15E_XQT01A10 / UT to SB Elizabeth R. N shore creek near Great Bridge Locks / SB Elizabeth R. upstream N shore creek north of Great Bridge Locks. CBP & BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.045
VAT-G15E_XQU01A10 / SB Eliz N shore creek SW of Mains Cr. / SB Elizabeth R. upstream N shore creek SW of Mains Cr. CBP & BIBI segment SBEMHa. DSS (ADMIN-COND) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.020
VAT-G15E_ZZZ02A08 / Unsegmented estuaries in SBEMH / CBP segment SBEMH. BIBI segment SBEMHa. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 E (effective 20120529).	5A	PCB in Fish Tissue	2006	H, 2yr	0.058

James River and Various Tributaries **Fish Consumption**	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
PCB in Fish Tissue - Total Impaired Size by Water Type:	**248.078**		**7.51**

Sources:

Contaminated Sediments

Source Unknown

Sources Outside State Jurisdiction or Borders

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

James River Basin

***Cause Group Code:* G11E-05-EBEN** **Chesapeake Bay segment JMSMHa**

Cause Location: This cause encompasses the complete CBP segment JMSMHa.

City / County: Isle Of Wight Co. James City Co. Newport News City Portsmouth City Suffolk City
Surry Co.

Use(s): Aquatic Life

Cause(s) / VA Category: Estuarine Bioassessments / 5A

The Aquatic Life Use is impaired based on not meeting the Chesapeake Bay benthics associated with JMSMHa Chesapeake Bay segment.

Assessment Unit / Water Name / Location Desc.	Cause Category	Cause Name	Cycle First Listed	TMDL Dev. Priority	Water Size
VAT-G11E_JMS01A06 / James River - Gravel Neck to Pagan River / From start of JMSMH salinity boundary (Hog Isl. Cr.) downstream to line between Jail Pt (Mulberry Isl) to Days Pt (mouth Pagan R). CBP segment JMSMH. DSS (OPEN) shellfish condemnation # 059-069 (effective 20141219).	5A	Estuarine Bioassessments	2006	L	40.260
VAT-G11E_JMS01C08 / James River - Carter Grove Area / Mainstem along north shore, from near Carter Grove. CBP segment JMSMH. Portion of DSS (ADMIN) shellfish condemnation # 059-067 A (effective 20100901).	5A	Estuarine Bioassessments	2010	L	0.404
VAT-G11E_JMS02A06 / James River - Jail Point to Hilton Village / Mainstem from line between Jail Pt (Mulberry Isl) to Days Pt (Mouth Pagan R) downstream to line Hilton Village (Newport News)/Kings Creek (Isle of Wight). CBP segment JMSMH. DSS (OPEN) shellfish harvesting condemnation # 059-069 (effective 20141219).	5A	Estuarine Bioassessments	2006	L	24.697
VAT-G11E_JMS03A06 / James River - Along Lower North Shore / Mainstem along north shore, from Jail Point (Mulberry Isl) downstream to line following Rt. 664. CBP segment JMSMH. Portions of DSS (ADMIN) shellfish condemnation # 058-034 A (effective 20080518) & 057-007 A (effective 20120529).	5A	Estuarine Bioassessments	2006	L	3.943
VAT-G11E_JMS03B06 / James River - Hilton Beach Area / North shore James R. NW of James R. Bridge. Mainstem along north shoreline beach in Hilton Village area. CBP segment JMSMH. Portion of DSS (ADMIN) shellfish condemnation # 058-034 A (effective 20080518).	5A	Estuarine Bioassessments	2006	L	0.110
VAT-G11E_JMS03C06 / James River - Huntington Beach Area / North shore James R. near foot of James R. Bridge. Mainstem along north shoreline beach in Hilton Village area. CBP segment JMSMH. Portion of DSS (ADMIN) shellfish condemnation # 058-034 A (effective 20080508).	5A	Estuarine Bioassessments	2006	L	0.008
VAT-G11E_JMS04A06 / James River - Hilton Village to Craney Island / Mainstem from a line between Hilton Village (Newport News)/Kings Creek (Isle of Wight) downstream to the end of DSS (OPEN) shellfish harvesting condemnation # 059-069 F (effective 20141219). CBP segment JMSMH.	5A	Estuarine Bioassessments	2006	L	24.879
VAT-G11E_JMS06A10 / James River - Outside Mouth Streeter & Hoffler Creeks / Mainstem area at Mouth of Streeter & Hoffler Creeks @ SW corner Craney Island. CBP segment JMSMH. DSS (ADMIN) shellfish condemnation # 064-018 A (effective 20080530).	5A	Estuarine Bioassessments	2010	L	0.156
VAT-G11E_SFF03A10 / Skiffes Creek - Mouth / Located west of	5A	Estuarine Bioassessments	2018	L	0.060

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

James River Basin

Lee Hall area, flows across the James City Co./NN City boundary. From Goose Island to point on opposite shore. Portion of CBP segment JMSMH. DSS (OPEN) shellfish direct harvesting condemnation # 059-069 (effective 20141219).					
VAT-G11E_TYB01A00 / Tylers Beach Boat Basin / Located in the Bailey Beach area. Adjacent to the James River. Opposite Mulberry Island. NW corner of Burwell Bay. From end of tidal waters downstream to mouth. CBP segment JMSMH. DSS shellfish direct harvesting condemnation # 060-206 B (20141231).	5A	Estuarine Bioassessments	2018	L	0.011
VAT-G15E_JMS05A06 / James River - Newport News Point to NW Corner Craney Isl. / Line following the Rt. 664 crossing mid-river, SW to mid-mouth Nansemond R. to SW tip Craney Isl. Line. The NW line from NW tip Craney Isl. to Lincoln Pk. CBP segment JMSMH. DSS (ADMIN) cond # 056-007 A, B, C (effective 20120529).	5A	Estuarine Bioassessments	2010	L	3.611

Chesapeake Bay segment JMSMHa	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
Aquatic Life			
Estuarine Bioassessments - Total Impaired Size by Water Type:	**98.137**		

Sources:

Source Unknown

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

James River Basin

***Cause Group Code:* G11E-10-SF** **Pagan River - Middle Lower & Lower**

Cause Location: Described in VDH Notice and Description of Shellfish Condemnation Number 061-064 A effective 5/2/2016.

City / County: Isle Of Wight Co.

Use(s): Shellfishing

Cause(s) / VA Category: Fecal Coliform / 4A

The Shellfishing Use is impaired based on the DSS shellfish direct harvesting condemnation # 061-064 A (20160502). Bacteria impairment covered under TMDL (35579) VAT-G11E-10-SF, 'Pagan River & Jones Creek', EPA approved 2/12/2008.

Assessment Unit / Water Name / Location Desc.	Cause Category	Cause Name	Cycle First Listed	TMDL Dev. Priority	Water Size
VAT-G11E_PGN02A08 / Pagan River - Middle Lower / Located in Smithfield area. South shore tributary to James R. North of Town of Smithfield downstream Azalea Dr. Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 A (effective 20160502).	4A	Fecal Coliform	2008	L	1.030
VAT-G11E_PGN02B14 / Pagan River - Lower / Located in Smithfield area. South shore tributary to James R. Lower portion from Moonefield Dr to Morris Cr. Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 A (effective 20160502).	4A	Fecal Coliform	2008	L	0.162

Pagan River - Middle Lower & Lower	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
Shellfishing			
Fecal Coliform - Total Impaired Size by Water Type:	**1.192**		

Sources:

Source Unknown

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

James River Basin

***Cause Group Code:* JMSMH-SAV-BAY Chesapeake Bay segment JMSMH**

Cause Location: This cause encompasses the complete CBP segment JMSMH.

City / County: Isle Of Wight Co. James City Co. Newport News City Portsmouth City Suffolk City
Surry Co.

Use(s): Aquatic Life Shallow-Water Submerged Aquatic Vegetation

Cause(s) / VA Category: Aquatic Plants (Macrophytes) / 4A

The Aquatic Life Use Aquatic Plants [Macrophytes] use is impaired based on not meeting the SAV criteria. EPA approved Chesapeake Bay TMDL 12/29/2010.

Assessment Unit / Water Name / Location Desc.	Cause Category	Cause Name	Cycle First Listed	TMDL Dev. Priority	Water Size
VAT-G11E_BAL01A06 / Ballard Creek & Bay- James R. South Shore Tributary / South shore tributary to James R., upstream of James R. Bridge. North of Ragged Island area. From end of tidal water downstream almost to confluence with James R. CBP segment JMSMH. Portion of DSS shellfish condemnation # 062-164 A (effective 20161005).	4A	Aquatic Plants (Macrophytes)	2006	L	0.019
VAT-G11E_CKT01A04 / Chuckatuck & Brewers Creeks / South shore trib to James R., confluence upstream of Nansemond R. From headwaters to end of SF condemnation at Johnson near tidal flat. Portion of CBP segment JMSMH. DSS shellfish harvesting condemnation # 062-080 A (effective 20161005).	4A	Aquatic Plants (Macrophytes)	2006	L	0.731
VAT-G11E_CKT02A12 / Chuckatuck Creek and Mouth in James / South shore trib to James R., after confluence with Brewers Creek to mouth. Portion of CBP segment JMSMH. DSS OPEN shellfish direct harvesting condemnation # 062-080 (effective 20161005).	4A	Aquatic Plants (Macrophytes)	2014	L	0.714
VAT-G11E_CYP01A06 / Cypress Creek / South shore tributary to Pagan R, confluence near Smithfield. From end of tidal waters downstream to mouth. Portion of CBP segment JMSMH. DSS shellfish direct harvesting condemnation # 061-064 A (effective 20160502).	4A	Aquatic Plants (Macrophytes)	2006	L	0.263
VAT-G11E_DEP01A02 / Deep Creek - Lower / Located in Menchville area. Tributary to Warwick R. From Warwick Yacht Club downstream to mouth. CBP segment JMSMH. DSS (ADMIN) shellfish direct harvesting condemnation # 058-034 A (effective 20080518).	4A	Aquatic Plants (Macrophytes)	2006	L	0.100
VAT-G11E_JMS01A06 / James River - Gravel Neck to Pagan River / From start of JMSMH salinity boundary (Hog Isl. Cr.) downstream to line between Jail Pt (Mulberry Isl) to Days Pt (mouth Pagan R). CBP segment JMSMH. DSS (OPEN) shellfish condemnation # 059-069 (effective 20141219).	4A	Aquatic Plants (Macrophytes)	2006	L	40.260
VAT-G11E_JMS01C08 / James River - Carter Grove Area / Mainstem along north shore, from near Carter Grove. CBP segment JMSMH. Portion of DSS (ADMIN) shellfish condemnation # 059-067 A (effective 20100901).	4A	Aquatic Plants (Macrophytes)	2014	L	0.404
VAT-G11E_JMS02A06 / James River - Jail Point to Hilton Village / Mainstem from line between Jail Pt (Mulberry Isl) to Days Pt (Mouth Pagan R) downstream to line Hilton Village (Newport News)/Kings Creek (Isle of Wight). CBP segment JMSMH. DSS (OPEN) shellfish harvesting condemnation # 059-069 (effective 20141219).	4A	Aquatic Plants (Macrophytes)	2006	L	24.697
VAT-G11E_JMS03A06 / James River - Along Lower North Shore /	4A	Aquatic Plants (Macrophytes)	2006	L	3.943

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

James River Basin

Mainstem along north shore, from Jail Point (Mulberry Isl) downstream to line following Rt. 664. CBP segment JMSMH. Portions of DSS (ADMIN) shellfish condemnation # 058-034 A (effective 20080518) & 057-007 A (effective 20120529).					
VAT-G11E_JMS03B06 / James River - Hilton Beach Area / North shore James R. NW of James R. Bridge. Mainstem along north shoreline beach in Hilton Village area. CBP segment JMSMH. Portion of DSS (ADMIN) shellfish condemnation # 058-034 A (effective 20080518).	4A	Aquatic Plants (Macrophytes)	2006	L	0.110
VAT-G11E_JMS03C06 / James River - Huntington Beach Area / North shore James R. near foot of James R. Bridge. Mainstem along north shoreline beach in Hilton Village area. CBP segment JMSMH. Portion of DSS (ADMIN) shellfish condemnation # 058-034 A (effective 20080508).	4A	Aquatic Plants (Macrophytes)	2006	L	0.008
VAT-G11E_JMS04A06 / James River - Hilton Village to Craney Island / Mainstem from a line between Hilton Village (Newport News)/Kings Creek (Isle of Wight) downstream to the end of DSS (OPEN) shellfish harvesting condemnation # 059-069 F (effective 20141219). CBP segment JMSMH.	4A	Aquatic Plants (Macrophytes)	2006	L	24.879
VAT-G11E_JMS06A10 / James River - Outside Mouth Streeter & Hoffler Creeks / Mainstem area at Mouth of Streeter & Hoffler Creeks @ SW corner Craney Island. CBP segment JMSMH. DSS (ADMIN) shellfish condemnation # 064-018 A (effective 20080530).	4A	Aquatic Plants (Macrophytes)	2014	L	0.156
VAT-G11E_JOG01A08 / Jones Creek - Tributary to Pagan River / South shore trib. to Pagan R. near confluence with James R. From headwaters to SR 669, including tidal tributaries. CBP segment JMSMH. Portion of DSS shellfish harvesting (Admin-PROHIBITED) # 061-064 B (effective 20160502).	4A	Aquatic Plants (Macrophytes)	2014	L	0.229
VAT-G11E_JOG02A08 / Jones Creek - Tributary to Pagan River / South shore trib. to Pagan R. near confluence with James R. From SR 669 to mouth, including tidal tributaries. CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 B & M2 (effective 20160502).	4A	Aquatic Plants (Macrophytes)	2014	L	0.102
VAT-G11E_KIN01A06 / Kings Creek & Bay - James R. South Shore Tributary / South shore tributary to James R., upstream of James R. Bridge. North of Ragged Island area. CBP segment JMSMH. From end of tidal waters downstream to end of DSS shellfish direct harvesting condemnation # 062-164 B (effective 20161005).	4A	Aquatic Plants (Macrophytes)	2006	L	0.031
VAT-G11E_KIN02A18 / Kings Creek & Bay Mouth- James R. South Shore Tributary / South shore tributary to James R., upstream of James R. Bridge. North of Ragged Island area. CBP segment JMSMH. From end of SF Condem to mouth # 062-164 (effective 20161005).	4A	Aquatic Plants (Macrophytes)	2006	L	0.005
VAT-G11E_LAW01A00 / Lawnes Creek (Tributary to James River) / South shore tributary to James R. near Hog Island WMA. Hog Isl. area, opposite Mulberry Point. From end of tidal waters downstream to mouth. Portion of CBP segment JMSMH. DSS shellfish direct harvesting condemnation # 060-206 A (effective 20141231).	4A	Aquatic Plants (Macrophytes)	2006	L	0.291
VAT-G11E_MRS01A06 / Morrisons Creek - Mulberry Island / North shore tributary to James R. on Mulberry Island. Downstream of Mulberry Point. From end of tidal waters downstream to mouth. Portion of CBP segment JMSMH. DSS (OPEN) shellfish direct harvesting condemnation # 058-183 (effective 20161010).	4A	Aquatic Plants (Macrophytes)	2006	L	0.127
VAT-G11E_PGN01A08 / Pagan River - Upper / Located in Smithfield area. South shore tributary to James R. From end of tidal	4A	Aquatic Plants (Macrophytes)	2014	L	0.062

James River Basin

water downstream to approx RM 7.00. Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 A (effective 201460502).					
VAT-G11E_PGN01B18 / Pagan River - Upper Middle / Located in Smithfield area. South shore tributary to James R. From downstream of Crook Ln to UT N Trib.Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 A (effective 20160502).	4A	Aquatic Plants (Macrophytes)	2014	L	0.065
VAT-G11E_PGN01C18 / Pagan River - Middle / Located in Smithfield area. South shore tributary to James R.N of Rt 10 downstrm N of Cupress Cr .Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 A (effective 20160502).	4A	Aquatic Plants (Macrophytes)	2014	L	0.058
VAT-G11E_PGN02A08 / Pagan River - Middle Lower / Located in Smithfield area. South shore tributary to James R. North of Town of Smithfield downstream Azalea Dr. Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 A (effective 20160502).	4A	Aquatic Plants (Macrophytes)	2014	L	1.030
VAT-G11E_PGN02B14 / Pagan River - Lower / Located in Smithfield area. South shore tributary to James R. Lower portion from Moonefield Dr to Morris Cr. Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 A (effective 20160502).	4A	Aquatic Plants (Macrophytes)	2014	L	0.162
VAT-G11E_PGN02C18 / Pagan River - Lower SF Open / Located in Smithfield area. South shore tributary to James R. From Morris Creeek downstream to River Ave. Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 A (effective 20160502).	4A	Aquatic Plants (Macrophytes)	2014	L	0.084
VAT-G11E_PGN02D16 / Pagan River - Jones Cr / Located in Smithfield area. South shore tributary on the East shore to James R. Portion near Battery Park. Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting condemnation # 061-064 M2 (effective 20160502).	4A	Aquatic Plants (Macrophytes)	2014	L	0.020
VAT-G11E_PGN03A10 / Pagan River - Mouth / Located in Smithfield area. South shore tributary to James R. From the edge of shellfish condemnation #061-064A to. downstream to mouth. Portion of CBP segment JMSMH. DSS OPEN shellfish direct harvesting condemnation # 061-064 (effective 20160502).	4A	Aquatic Plants (Macrophytes)	2014	L	0.889
VAT-G11E_RIC01A06 / Ragged Island Creek / North shore tributary to James R. on Mulberry Island. Downstream of Mulberry Point. From end of tidal waters downstream to mouth. Portion of CBP segment JMSMH. DSS (OPEN) shellfish direct harvesting condemnation # 062-080 (effective 20161005).	4A	Aquatic Plants (Macrophytes)	2006	L	0.295
VAT-G11E_SFF02A08 / Skiffes Creek System [Admin Cond] / Located west of Lee Hall area, flows along the James City Co./NN City boundary. From dam downstream to mouth, including tidal tribs. Portion of CBP segment JMSMH. DSS (ADMIN) shellfish direct harvesting condemnation # 059-023 A (effective 20081215).	4A	Aquatic Plants (Macrophytes)	2014	L	0.452
VAT-G11E_SFF03A10 / Skiffes Creek - Mouth / Located west of Lee Hall area, flows across the James City Co./NN City boundary. From Goose Island to point on opposite shore. Portion of CBP segment JMSMH. DSS (OPEN) shellfish direct harvesting condemnation # 059-069 (effective 20141219).	4A	Aquatic Plants (Macrophytes)	2014	L	0.060
VAT-G11E_TTS01A16 / Titus Creek / Located in Isle of Wight	4A	Aquatic Plants (Macrophytes)	2006	L	0.017

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James River Basin

County. Tributary of Jones Creek, which flows into the Pagan River. Shellfish Cond # 061-064C (20140416).					
VAT-G11E_TYB01A00 / Tylers Beach Boat Basin / Located in the Bailey Beach area. Adjacent to the James River. Opposite Mulberry Island. NW corner of Burwell Bay. From end of tidal waters downstream to mouth. CBP segment JMSMH. DSS shellfish direct harvesting condemnation # 060-206 B (20141231).	4A	Aquatic Plants (Macrophytes)	2006	L	0.011
VAT-G11E_WIL01A18 / Williams Creek / Located off of North shore tributary to Pagan River. Portion of CBP segment JMSMH. Portion of DSS shellfish direct harvesting ADMIN condemnation # 061-064 C (effective 20160502).	4A	Aquatic Plants (Macrophytes)	2014	L	0.060
VAT-G11E_WWK01A08 / Warwick River - Upper Tidal Portion / Located in Menchville area. Tributary to James R. From end of tidal waters downstream approx. to Denbigh Landing. Portion of CBP segment JMSMH. Portion of DSS (ADMINISTRATIVE) shellfish direct harvesting condemnation # 058-034 A (20080518).	4A	Aquatic Plants (Macrophytes)	2014	L	0.283
VAT-G11E_WWK02A08 / Warwick River - Middle Tidal Portion / Located in Menchville area. From approx. Denbigh Landing area downstream to Denbigh Park area. CBP segment JMSMH. DSS (ADMINISTRATIVE) shellfish direct harvesting condemnation # 058-034 A (20080518).	4A	Aquatic Plants (Macrophytes)	2014	L	0.075
VAT-G11E_WWK03A08 / Warwick River - Lower Tidal Portion / Located in Menchville area. Tributary to James R. From Lucas Cr to downstream to mouth. Portion of CBP segment JMSMH. DSS (ADMINISTRATIVE) shellfish direct harvesting condemnation # 058-034 A, B (20080518).	4A	Aquatic Plants (Macrophytes)	2014	L	2.434
VAT-G11E_WWK03B18 / Warwick River - Middle-Lower Tidal Portion / Located in Menchville area. Tributary to James R. From Denbigh Park to Approx Lucas Cr. Portion of CBP segment JMSMH. DSS (ADMINISTRATIVE) shellfish direct harvesting condemnation # 058-034 A, B (20080518).	4A	Aquatic Plants (Macrophytes)	2014	L	0.077
VAT-G11E_ZZZ01A00 / Unsegmented estuaries - James R. Tribs / Tributaries to James R., Mulberry Island area & NW Ragged Isl. From end of tidal water downstream to confluence. CBP segment JMSMH. DSS (OPEN) shellfish direct harvesting condemnation # 059-069 (20041008).	4A	Aquatic Plants (Macrophytes)	2006	L	0.358
VAT-G11E_ZZZ02A00 / Unsegmented estuaries - Warwick R. Tribs / Tributaries to Warwick R., NE of Mulberry Island area. From end of tidal water downstream to confluence with Warwick R. CBP segment JMSMH. DSS (Admin Cond) shellfish direct harvesting condemnation # 058-034 A (20080518).	4A	Aquatic Plants (Macrophytes)	2006	L	0.119
VAT-G13E_BEN01A04 / Bennett Creek - Tributary to Nansemond R. / Eastern shore trib. to Nansemond R., near confluence with James R. Bennett Harbor area. From headwaters to mouth, including tidal tributaries. Portion of CBP segment JMSMH. DSS shellfish direct harvesting condemnation # 063-046 A (20140826).	4A	Aquatic Plants (Macrophytes)	2006	L	0.542
VAT-G13E_BHN01A00 / Bleakhorn Creek - Tributary to Nansemond R. Mouth / Western shore trib. to Nansemond R., near confluence with James R. Eclipse area near Crittenden. From headwaters to mouth, including tidal tributaries. CBP segment JMSMH. DSS shellfish direct harvesting condemnation # 063-046 B (20140826). TMDL.	4A	Aquatic Plants (Macrophytes)	2006	L	0.014
VAT-G13E_BML01A06 / Burnetts Mill Creek - Tributary to Upper Nansemond R. / Eastern shore trib. to upper Nansemond R., south of the Nansemond area. Drains the Beamon area. From headwaters to	4A	Aquatic Plants (Macrophytes)	2006	L	0.028

James River Basin

mouth. CBP segment JMSMH. DSS shellfish condemnation # 063-008 A (20160926). TMDL (32045)					
VAT-G13E_KNC01A00 / Knotts Creek - Tributary to E. shore Nansemond R. / Eastern shore trib. to Nansemond R., near confluence with James R. Belleville and Huntersville areas. From headwaters to mouth, including tidal tributaries. CBP segment JMSMH. DSS shellfish direct harvesting condemnation # 063-046 A (20140826).	4A	Aquatic Plants (Macrophytes)	2006	L	0.122
VAT-G13E_NAN01A00 / Nansemond River - Upper / Upper Nansemond River, within city of Suffolk. Extends from most upstream point in river at Lake Meade Dam (RM 19.8) downstream to Rt. 58/460 crossing (RM 15.2). CBP segment JMSMH. Portion of DSS shellfish condemnation # 063-008 A (effective 20160926).	4A	Aquatic Plants (Macrophytes)	2006	L	0.269
VAT-G13E_NAN02A06 / Nansemond River - Upper Middle / Downstream of Suffolk. From Rt 58/460 (RM 15.1) crossing downstream to confluence with the Western Branch Reservoir (RM 11.9). CBP segment JMSMH. Portion of DSS shellfish condemnation # 063-008 A (20160926).TMDL (32045)	4A	Aquatic Plants (Macrophytes)	2006	L	0.209
VAT-G13E_NAN03A06 / Nansemond River - Lower Middle / In area of Western Branch Reservoir. From confluence with Western Br. (RM 11.8) downstream to Holidays Pt. CBP segment JMSMH. Portion of DSS shellfish condemnation # 063-008 A & C1 (2016096). TMDL (32045)	4A	Aquatic Plants (Macrophytes)	2006	L	2.833
VAT-G13E_NAN04A00 / Nansemond River - Lower [No TMDL] / Nansemond R mouth. From Olds Cove downstream to mouth. CBP segment JMSMH. DSS (OPEN) condemnation 063-046 (effective 20140826) & 063-008 (effective 20140826).	4A	Aquatic Plants (Macrophytes)	2006	L	6.303
VAT-G13E_NAN04C10 / Nansemond River - Lower DSS Condemned at Knotts Cr / Nansemond R at confluence Knotts Cr. CBP segment JMSMH. DSS condemnation # 063-046 B (effective 20120801).	4A	Aquatic Plants (Macrophytes)	2014	L	0.467
VAT-G13E_SGL01A00 / Shingle Creek - Tributary to Nansemond R. / NE of Suffolk, near Rt 642. From end of tidal waters (0.2 mi upstream of Portsmouth Blvd) downstream to confluence with Nansemond River. CBP segment JMSMH. DSS shellfish condemnation # 063-008 A (effective 20160926).	4A	Aquatic Plants (Macrophytes)	2006	L	0.040
VAT-G13E_STR01A04 / Star & Oyster House Creeks - Tributary to Nansemond R. / Eastern shore tributary to Nansemond R. Adjacent to the Naval Communication station at Driver. From headwaters to confluence with Nansemond R. CBP segment JMSMH. DSS shellfish condemnation # 063-008 A (effective 20140826).	4A	Aquatic Plants (Macrophytes)	2006	L	0.046
VAT-G13E_WBN01A06 / Western Branch - Tributary to Nansemond R. / Western shore branch off the Nansemond River south of the Reids Ferry area. Downstream of the Western Branch Reservoir, prior to reaching the Nansemond River. CBP segment JMSMH. DSS shellfish condemnation # 063-008 A (effective 20160926).	4A	Aquatic Plants (Macrophytes)	2006	L	0.106
VAT-G13E_ZZZ01A00 / Unsegmented Estuaries - Upper Nansemond R. / Upper Nansemond River unsegmented tributaries with a DSS condemnation. CBP segment JMSMH. DSS shellfish condemnation # 063-008 A (effective 20160926).	4A	Aquatic Plants (Macrophytes)	2006	L	0.097
VAT-G13E_ZZZ02A08 / Unsegmented Estuaries - Lower Nansemond R. / Lower Nansemond River unsegmented tributaries without a DSS condemnation. CBP segment JMSMH. DSS (OPEN) shellfish direct harvesting condemnation # 063-046 (20160926) # 063-	4A	Aquatic Plants (Macrophytes)	2014	L	0.061

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

James River Basin

008 (20160926) or no DSS.

VAT-G15E_HOF01A06 / Hoffler Creek / Located along south shore of Hampton Roads Harbor. Entirety of Hoffler Cr. South shore trib to James R. west of Craney Isl. (at mouth of Elizabeth R). CBP segment JMSMH. DSS (ADMIN) shellfish harvesting condemnation # 064-018 A (effective 20080530).	4A	Aquatic Plants (Macrophytes)	2006	L	0.053
VAT-G15E_JMS05A06 / James River - Newport News Point to NW Corner Craney Isl. / Line following the Rt. 664 crossing mid-river, SW to mid-mouth Nansemond R. to SW tip Craney Isl. Line. The NW line from NW tip Craney Isl. to Lincoln Pk. CBP segment JMSMH. DSS (ADMIN) cond # 056-007 A, B, C (effective 20120529).	4A	Aquatic Plants (Macrophytes)	2014	L	3.611
VAT-G15E_SRE01A06 / Streeter Creek / Located along south shore of Hampton Roads Harbor. Entirety of Streeter Cr. South shore trib to James R. near Craney Isl. (at mouth of Elizabeth R).CBP segment JMSMH. DSS (ADMIN) shellfish harvesting condemnation # 064-018 A (effective 20080530).	4A	Aquatic Plants (Macrophytes)	2006	L	0.030

Chesapeake Bay segment JMSMH	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
Shallow-Water Submerged Aquatic Vegetation			
Aquatic Plants (Macrophytes) - Total Impaired Size by Water Type:	**118.510**		

Sources:

Source Unknown

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

Chesapeake Bay/Atlantic/Small Coastal Basins

***Cause Group Code:* C01E-16-SF** **Great Wicomico River, UT**

Cause Location: Described in VDH Notice and Description of Shellfish Condemnation Number 013-089H, 4/28/2016

City / County: Northumberland Co.

Use(s): Shellfishing

Cause(s) / VA Category: Fecal Coliform / 4A

VDH Shellfish Condemnation 013-089H, 4/28/2016

The impairment is nested in the Great Wicomico River Shellfish TMDL, which was approved by the EPA on 6/8/2006 and by the SWCB on 3/23/2007.

Assessment Unit / Water Name / Location Desc.	Cause Category	Cause Name	Cycle First Listed	TMDL Dev. Priority	Water Size
VAP-C01E_GWR02E16 / Great Wicomico River, UT / Described in VDH-DSS condemnation 013-089H, 4/28/2016	4A	Fecal Coliform	2016	L	0.033

CB5MH

Great Wicomico River, UT **Shellfishing**	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
Fecal Coliform - Total Impaired Size by Water Type:	**0.033**		

Sources:

Non-Point Source

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

Chesapeake Bay/Atlantic/Small Coastal Basins

***Cause Group Code:* C01E-17-PCB** **Chesapeake Bay and Tidal Tributaries**

Cause Location: Chesapeake Bay mainstem and its small coastal tidal tributaries

City / County: Accomack Co. Chesapeake Bay - County not applicable. Gloucester Co. Lancaster Co. Mathews Co.
Middlesex Co. Norfolk City Northampton Co. Northumberland Co. Poquoson City.
Virginia Beach City York Co.

Use(s): Fish Consumption

Cause(s) / VA Category: PCB in Fish Tissue / 5A

The Chesapeake Bay and its small coastal tidal tributaries are included under the 12/13/2004 VDH Fish Consumption Advisories for PCBs. No more than 2 meals/month are recommended of anadromous (coastal) striped bass.

Also, VDH issued additional fish consumption advisory for PCBs in the Mobjack Bay and its tributaries, particularly the East, West, and Ware Rivers (on 12/13/2004) and in the Piankatank River from Rt. 17 to Deep Point Boat Landing (10/7/2009). No more than two meals/month of gizzard shad are recommended.

The advisories are based on the results of DEQ's fish tissue monitoring program, which show elevated PCBs levels in several monitoring sites within the basin, including:

7-GWR007.97 in the Great Wicomico River
7-COC000.40 in Cockrell Creek
7-IND001.80 in Indian Creek
7-DYM000.00 in Dymer Creek
7-PNK019.85 in the Piankatank River
7-MLF002.45 in Milford Haven
7-WIN000.88 in Winter Harbor
7-EST002.65 in the East River
7-NOR003.65 in the North River
7-WAR005.77 in the Ware River

Assessment Unit / Water Name / Location Desc.	Cause Category	Cause Name	Cycle First Listed	TMDL Dev. Priority	Water Size
VACB-C10E_POC01A18 / Pocomoke Sound / Pocomoke Sound - VDH DSS #075-033 (Open)	5A	PCB in Fish Tissue	2006	L	0.205
VACB-C10E_POC01B18 / Pocomoke Sound / Pocomoke Sound - VDH DSS condemnation #075-033 (Restricted)	5A	PCB in Fish Tissue	2006	L	0.111
VACB-C10E_TNN01A06 / Tangier North Channel and Adjacent Waters, DSS Area A and B. / Waters surrounding Tangier Island. Portion of CBP segment TANMH. DSS (ADMINISTRATIVE) shellfish condemnation # 078-086, section A effective 11/6/2013	5A	PCB in Fish Tissue	2006	L	1.366
VACB-C10E_TNN01B06 / Tangier North Channel and Adjacent Waters, DSS Area C. / Waters surrounding Tangier Island. Portion of CBP segment TANMH. DSS (ADMINISTRATIVE) shellfish condemnation # 078-086, section B effective 11/6/2013	5A	PCB in Fish Tissue	2006	L	0.039
VACB-C10E_TNN01C16 / Tangier North Channel and Adjacent Waters, Open waters / Waters surrounding Tangier Island. Portion of CBP segment TANMH. Open waters of the DSS cond # 078-86 eff 11/06/2013. Split from VAC-C10E_TNN01A06 (2016).	5A	PCB in Fish Tissue	2006	L	0.196
VACB-C10E_TNN01D18 / Tyler Creek, Shanks Creek, Tangier Sound / Tyler Creek, Shanks Creek, Tangier Sound - Portion of CBP segment TANMH. Restricted waters of the DSS cond # 074-226 eff 2/26/2015. Split from VACB-C10E-TAN.	5A	PCB in Fish Tissue	2006	L	2.169
VACB-C10E-POC / Chesapeake Bay - VA portion of CBP segment	5A	PCB in Fish Tissue	2006	L	46.558

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

Chesapeake Bay/Atlantic/Small Coastal Basins

POCMH / This assessment unit is the mainstem Chesapeake Bay portion of Chesapeake Bay Program segment POCMH, located in the mesohaline area of Pocomoke sound. HUC: 02080101.					
VACB-C10E-TAN / Chesapeake Bay - VA portion of CBP Segment TANMH / This assessment unit is the mainstem Chesapeake Bay portion of Chesapeake Bay Program segment TANMH, located in the northern part of the Virginia mainstem Bay around Tangier Sound. HUC: 02080101	5A	PCB in Fish Tissue	2006	L	118.980
VACB-R01E-04CE / Chesapeake Bay - Cape Charles BSS #089-011, Section A. / Va Dept of Health Shellfish (administrative) condemnation #089-011, Opposite Cape Charles City, Section A. HUC: 02080101.[effective 2005-3-08]	5A	PCB in Fish Tissue	2006	L	0.312
VACB-R01E-04DE / Chesapeake Bay - S. Thimble Island BSS Condemnation #163 / Va Dept of Health Shellfish zone #163. Open to shellfish harvesting as of 4/25/2007. S. Thimble Island. HUC: 02080101	5A	PCB in Fish Tissue	2006	L	0.027
VACB-R01E-04EE / Chesapeake Bay - Off Little Creek BSS #068-017, Section C. / Va Dept of Health Shellfish (administrative) closure #068-017, A portion of section C. Off Little Creek. HUC: 02080101.[effective 2005-3-08]	5A	PCB in Fish Tissue	2006	L	0.540
VACB-R01E-04GE / Chesapeake Bay - Off Little Creek BSS #068-017, Areas A & B / Va Dept of Health Shellfish (administrative) closure #068-017, Off Little Creek, Sections A and B. HUC: 02080101.[effective 2005-3-08]	5A	PCB in Fish Tissue	2006	L	1.355
VACB-R01E-CB5 / Chesapeake Bay - VA portion of CBP Segment CB5MH / This assessment unit is the mainstem Chesapeake Bay portion of Chesapeake Bay Program segment CB5MH, located in the northern part of the Virginia mainstem Bay from the mouth of the Rappahannock River and northward. HUC: 02080101.	5A	PCB in Fish Tissue	2006	L	185.848
VACB-R01E-CB6N / Chesapeake Bay - Northern portion of CBP Segment CB6PH / This assessment unit is the mainstem northern portion of Chesapeake Bay Program segment CB6PH, located in the northeastern half of the Virginia Chesapeake Bay between the mouths of the James and Rappahannock Rivers. HUC: 02080101.	5A	PCB in Fish Tissue	2006	L	127.195
VACB-R01E-CB6S / Chesapeake Bay - Southern portion of CBP Segment CB6PH / This assessment unit is the mainstem southern portion of Chesapeake Bay Program segment CB6PH, located in the northeastern half of the Virginia Chesapeake Bay between the mouths of the James and Rappahannock Rivers. HUC: 02080101.	5A	PCB in Fish Tissue	2006	L	160.307
VACB-R01E-CB7N / Chesapeake Bay - Northern portion of CBP Segment CB7PH / This assessment unit is the mainstem northern portion of Chesapeake Bay Program segment CB7PH, located in the northwestern half of the Virginia Chesapeake Bay between the mouths of the James and Rappahannock Rivers. HUC: 02080101.	5A	PCB in Fish Tissue	2006	L	168.626
VACB-R01E-CB7S / Chesapeake Bay - Southern portion of CBP Segment CB7PH / This assessment unit is the mainstem southern portion of Chesapeake Bay Program segment CB7PH, located in the southwestern half of the Virginia Chesapeake Bay between the mouths of the James and Rappahannock Rivers. HUC: 02080101.	5A	PCB in Fish Tissue	2006	L	372.814
VACB-R01E-CB8 / Chesapeake Bay - CBP Segment CB8PH / This assessment unit is the mainstem portion of Chesapeake Bay Program segment CB8PH, located in the Virginia Chesapeake Bay between the mouths of the James River and mouth of Chesapeake Bay. HUC: 02080101.	5A	PCB in Fish Tissue	2006	L	141.796

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VACB-R01E-MOB / Chesapeake Bay - CBP Segment MOBPH / This assessment unit is the mainstem Chesapeake Bay and Mobjack Bay portions of Chesapeake Bay Program segment MOBPH, located off the mouth of the York River including Mobjack Bay. HUC: 02080101.	5A	PCB in Fish Tissue	2006	L	92.951
	5A	PCB in Fish Tissue	2006	L	92.951
	5A	PCB in Fish Tissue	2006	L	92.951
	5A	PCB in Fish Tissue	2006	L	92.951
VAP-C01E_ANT01A98 / Antipoison Creek / Described in the condemnation notice 017-188A, 12/16/2014.	5A	PCB in Fish Tissue	2006	L	0.042
CB5MH					
VAP-C01E_ANT01B08 / Antipoison Creek, UT / Described in the condemnation notice 017-188C, 12/16/2014.	5A	PCB in Fish Tissue	2006	L	0.004
CB5MH					
VAP-C01E_ANT01C08 / Antipoison Creek, UT / Described in the condemnation notice 017-188B, 12/16/2014.	5A	PCB in Fish Tissue	2006	L	0.013
CB5MH					
VAP-C01E_ANT02A08 / Antipoison Creek / Downstream of condemnation notice 017-188A, 12/16/2014.	5A	PCB in Fish Tissue	2006	L	0.361
CB5MH					
VAP-C01E_ANT02B12 / Antipoison Creek / Described in condemnation notice 017-188M1, 12/16/2014.	5A	PCB in Fish Tissue	2006	L	0.007
CB5MH					
VAP-C01E_ASH01A10 / Ashleys Cove / Described in VDH-DSS condemnation 016-024D, 1/28/2005	5A	PCB in Fish Tissue	2006	L	0.056
CB5MH					
VAP-C01E_BAI01A16 / Bailey Prong / Described in VDH-DSS condemnation 013-220H, 4/1/2014.	5A	PCB in Fish Tissue	2006	L	0.052
CB5MH					
VAP-C01E_BAL01A02 / Ball Creek / VDH condemnation notice 014-124B, 5/15/2001	5A	PCB in Fish Tissue	2006	L	0.080
CB5MH					
VAP-C01E_BAL02A02 / Ball Creek / From VDH-DSS SFC 014-124B, 5/15/2001, downstream to its mouth.	5A	PCB in Fish Tissue	2006	L	0.128
CB5MH					
VAP-C01E_BAR01A98 / Barrett Creek / Described in the condemnation notice, 013-089I, 7/31/2012.	5A	PCB in Fish Tissue	2006	L	0.038
CB5MH					
VAP-C01E_BAR02A08 / Barrett Creek / Described in VDH-DSS SFC 013-089H, 7/31/2012	5A	PCB in Fish Tissue	2006	L	0.008
CB5MH					

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VAP-C01E_BEL01A08 / Bells Creek / Described in VDH condemnation 016-057B, 12/13/2006.	SA	PCB in Fish Tissue	2006	L	0.042
CB5MH					
VAP-C01E_BLS01A02 / Balls Creek / Described in the condemnation notice 89B, 5/28/1997.	SA	PCB in Fish Tissue	2006	L	0.064
CB5MH					
VAP-C01E_BLS02A08 / Balls Creek / Portion of condemnation notice 013-089F, 4/28/2016 not included in 89B, 5/28/1997.	SA	PCB in Fish Tissue	2006	L	0.113
CB5MH					
VAP-C01E_BMC01A04 / Betts Mill Creek / Described in the VDH Shellfish Condemnation 013-089B, 4/28/2016	SA	PCB in Fish Tissue	2006	L	0.082
CB5MH					
VAP-C01E_BMS01A12 / Bush Mill Stream / Tidal limit to mouth at Great Wicomico River	SA	PCB in Fish Tissue	2006	L	0.095
CB5MH					
VAP-C01E_BRS01A08 / Barnes Creek / Tidal portion of Barnes Creek	SA	PCB in Fish Tissue	2006	L	0.331
CB5MH					
VAP-C01E_CHA01A08 / Dymer Creek, UT / Described in condemnation notice 016-024B, 12/30/2015.	SA	PCB in Fish Tissue	2006	L	0.018
CB5MH					
VAP-C01E_CHA01B12 / Chases Cove / Described in condemnation notices 016-024D, 12/30/2015	SA	PCB in Fish Tissue	2006	L	0.023
CB5MH					
VAP-C01E_CLE01A98 / Cloverdale Creek / Described in the condemnation notice 014-124A, 6/2/1997.	SA	PCB in Fish Tissue	2006	L	0.021
CB5MH					
VAP-C01E_CLE02A06 / Cloverdale Creek / Downstream of condemnation notice 014-124A, 6/2/1997.	SA	PCB in Fish Tissue	2006	L	0.055
CB5MH					
VAP-C01E_COC01A98 / Cockrell Creek / As described in VDH-DSS Shellfish Condemnation 012-002B, 9/22/2005.	SA	PCB in Fish Tissue	2006	L	0.612
CB5MH					
VAP-C01E_COC03A98 / Cockrell Creek / Described in the condemnation notice. VDH-DSS SFC 012-002C, 9/22/2005.	SA	PCB in Fish Tissue	2006	L	0.035
CB5MH					
VAP-C01E_COC04B10 / Cockrell Creek / VDH-DSS Condemnation Notice 012-002A, 9/22/2005	SA	PCB in Fish Tissue	2006	L	0.470
CB5MH					
VAP-C01E_COC05A06 / Cockrell Creek / From VDH-DSS SFC 012-	SA	PCB in Fish Tissue	2006	L	0.152

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002A, 9/22/2005, downstream to mouth at Fleet Point.

CB5MH

VAP-C01E_COL01A08 / Coles Creek / Described in VDH-DSS SFC 013-089C, 4/28/2016	5A	PCB in Fish Tissue	2006	L	0.019

CB5MH

VAP-C01E_CRN01A06 / Cranes Creek / Described in VDH-DSS Shellfish Condemnation 013-220C, 4/28/2016	5A	PCB in Fish Tissue	2006	L	0.019

CB5MH

VAP-C01E_CRN01B06 / Cranes Creek / Described in VDH-DSS Shellfish Condemnation 013-220M1, 8/9/2011	5A	PCB in Fish Tissue	2006	L	0.016

CB5MH

VAP-C01E_DIV01A98 / Dividing Creek / Described in VDH-DSS condemnation 015-022A, 5/9/2016.	5A	PCB in Fish Tissue	2006	L	0.091

Segment expanded in the 2018 cycle.

VAP-C01E_DIV01B12 / Dividing Creek / Portion of VDH-DSS condemnation 022, 2/27/1997 open on 015-022, 5/9/2016.	5A	PCB in Fish Tissue	2006	L	0.201

Shortened in the 2018 cycle.

CB5MH

VAP-C01E_DIV01C14 / Dividing Creek, UT / VDH-DSS condemnation 015-022G, 5/9/2016	5A	PCB in Fish Tissue	2006	L	0.009

CB5MH

VAP-C01E_DIV03A00 / Dividing Creek / From the downstream limit of VDH-DSS SFC 022, 2/27/1997, to the mouth at Chesapeake Bay.	5A	PCB in Fish Tissue	2006	L	0.816

CB5MH

VAP-C01E_DVN01A04 / Davenport Creek / Described in VDH Shellfish Condemnation 017-188A, 5/12/2012.	5A	PCB in Fish Tissue	2006	L	0.019

CB5MH

VAP-C01E_DYM01A98 / Dymer Creek / Described in the condemnation notice 016-024A, 12/30/2015.	5A	PCB in Fish Tissue	2006	L	0.177

Shrank in 2018 cycle.

CB5MH

VAP-C01E_DYM02A00 / Dymer Creek / Dymer Creek downstream of VDH-DSS SFC 016-024A 1/28/2005, to start of deep water at Grog Island unless otherwise segmented.	5A	PCB in Fish Tissue	2006	L	0.595

CB5MH

VAP-C01E_DYM02B14 / Dymer Creek / Portion of VDH-DSS SFC 016-024A 1/28/2005 open 12/30/2015.	5A	PCB in Fish Tissue	2006	L	0.135

Expanded in the 2018 cycle.

CB5MH

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Chesapeake Bay/Atlantic/Small Coastal Basins

VAP-C01E_DYM03A06 / Dymer Creek / Mouth of Dymer Creek at Grog Island	5A	PCB in Fish Tissue	2006	L	0.090
CB5MH					
VAP-C01E_FLB01A00 / Fleets Bay / Fleets Bay north of Bluff Point at Barnes Creek south to Fleets Island.	5A	PCB in Fish Tissue	2006	L	5.187
CB5MH					
Size adjusted in 2006 cycle.					
VAP-C01E_GEO01A98 / Georges Cove / Described in condemnation notice 016-024E, 1/28/2005.	5A	PCB in Fish Tissue	2006	L	0.034
CB5MH					
VAP-C01E_GOU01A06 / Gougher Creek / Described in VDH-DSS Shellfish Condemnation 013-220G, 4/28/2016	5A	PCB in Fish Tissue	2006	L	0.036
CB5MH					
VAP-C01E_GSK01A10 / Gaskin Pond / As described in VDH-DSS condemnation 011-122A, 8/31/2016	5A	PCB in Fish Tissue	2006	L	0.061
Size reduced in the 2018 cycle.					
VAP-C01E_GWR01A98 / Great Wicomico River / Portion of condemnation notice 089A, 5/28/1997 which is not administratively closed, excluding Head River Branch and Bush Mill Stream	5A	PCB in Fish Tissue	2006	L	0.268
CB5MH					
VAP-C01E_GWR01B08 / Great Wicomico River / Blackwells Creek / Portion of condemnations 013-089A & 013-089G, 4/28/2016 not included in 089A, 5/28/1997	5A	PCB in Fish Tissue	2006	L	0.125
CB5MH					
VAP-C01E_GWR01C10 / Great Wicomico River / Portion of condemnation notice 089A, 5/28/1997 which is administratively closed	5A	PCB in Fish Tissue	2006	L	0.058
CB5MH					
VAP-C01E_GWR02A00 / Great Wicomico River / From VDH-DSS SFC 013-089A, 4/28/2016, downstream to Rogue Point unless otherwise segmented.	5A	PCB in Fish Tissue	2006	L	2.065
CB5MH					
VAP-C01E_GWR02B06 / Great Wicomico River / As described in VDH-DSS Shellfish Condemnation 013-089M2, 4/28/2018	5A	PCB in Fish Tissue	2006	L	0.017
CB5MH					
VAP-C01E_GWR02C06 / Great Wicomico River at Coles Creek / As described in VDH-DSS Shellfish Condemnation 013-089M1, 4/28/2016	5A	PCB in Fish Tissue	2006	L	0.008
CB5MH					
VAP-C01E_GWR02D12 / Great Wicomico River / VDH-DSS SFC 013-089M3, 4/28/2016	5A	PCB in Fish Tissue	2006	L	0.008
CB5MH					

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Chesapeake Bay/Atlantic/Small Coastal Basins

VAP-C01E_GWR02E16 / Great Wicomico River, UT / Described in VDH-DSS condemnation 013-089H, 4/28/2016	5A	PCB in Fish Tissue	2006	L	0.033
CB5MH					
VAP-C01E_GWR03A06 / Great Wicomico River / From Rogue Point (GWR02A00) downstream to Ingram Bay at Dameron Marsh.	5A	PCB in Fish Tissue	2006	L	5.800
CB5MH					
VAP-C01E_GWR03B16 / Great Wicomico River / Described in VDH-DSS condemnation 013-220F, 4/28/2016	5A	PCB in Fish Tissue	2006	L	0.004
CB5MH					
VAP-C01E_HAP01B10 / Harpers Creek / Described in the condemnation notice 017-188M2. 12/16/2014.	5A	PCB in Fish Tissue	2006	L	0.022
CB5MH					
VAP-C01E_HAV01A08 / Harveys Creek / Described in VDH Shellfish Condemnation 014-123B, 5/9/2016.	5A	PCB in Fish Tissue	2006	L	0.045
CB5MH					
VAP-C01E_HEN01A00 / Henrys Creek / Described in VDH condemnation 016-057D, 12/19/2016.	5A	PCB in Fish Tissue	2006	L	0.017
Shrank in the 2018 cycle.					
CB5MH					
VAP-C01E_HEN01B14 / Henrys Creek / Portion of VDH condemnation 016-057C, 1/28/2005 open on 12/19/2016.	5A	PCB in Fish Tissue	2006	L	0.053
Expanded in the 2018 cycle.					
CB5MH					
VAP-C01E_HEN02A14 / Henrys Creek / Downstream of 016-057C, 1/28/2005	5A	PCB in Fish Tissue	2006	L	0.103
CB5MH					
VAP-C01E_HHB01A98 / Horn Harbor / Described in the condemnation notice 013-089D, 4/28/2016.	5A	PCB in Fish Tissue	2006	L	0.071
CB5MH					
VAP-C01E_HNT01A98 / Hunts Cove / Described in the condemnation notice 016-024B, 1/28/2005.	5A	PCB in Fish Tissue	2006	L	0.040
CB5MH					
VAP-C01E_HRB01A12 / Head River Branch / Tidal limit to mouth at Bush Mill Stream.	5A	PCB in Fish Tissue	2006	L	0.020
CB5MH					
VAP-C01E_IND01A98 / Indian Creek / VDH-DSS condemnation notice 016-057E, 12/19/2016 (not administratively condemned) and 016-057C, 12/19/2016	5A	PCB in Fish Tissue	2006	L	0.147
Shrank in the 2018 cycle.					

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CB5MH

VAP-C01E_IND01B10 / Indian Creek / VDH-DSS condemnation notice 016-057A, 12/19/2016 (administratively condemned). 5A PCB in Fish Tissue 2006 L 0.037

CB5MH

VAP-C01E_IND01C10 / Indian Creek / Downstream portion of condemnation notice 016-057A, 12/13/2006 open on 12/19/2016. 5A PCB in Fish Tissue 2006 L 0.137

CB5MH

VAP-C01E_IND01D14 / Indian Creek / Described in condemnation notice 016-057M2, 12/19/2016. 5A PCB in Fish Tissue 2006 L 0.131

Expanded upstream in the 2018 cycle.

CB5MH

VAP-C01E_IND01E16 / Indian Creek / Portion of condemnation notice 016-057A, 12/28/2012 that is open 12/19/2016. 5A PCB in Fish Tissue 2006 L 0.040

CB5MH

VAP-C01E_IND02A98 / Indian Creek / Described in the condemnation notice 016-057F, 12/19/2016. 5A PCB in Fish Tissue 2006 L 0.015

CB5MH

VAP-C01E_IND03A00 / Indian Creek / Indian Creek from end of condemnation 016-057A, 12/13/2006, downstream to mouth unless otherwise segmented. 5A PCB in Fish Tissue 2006 L 0.600

CB5MH

VAP-C01E_IND03B06 / Indian Creek / As described in VDH-DSS Seasonal Shellfish Condemnation 016-057M1, 12/19/2016 5A PCB in Fish Tissue 2006 L 0.017

CB5MH

VAP-C01E_JAR01A02 / Jarvis Creek, UT / As described in the condemnation notice 015-022F, 5/5/2014. 5A PCB in Fish Tissue 2006 L 0.026

CB5MH

VAP-C01E_JAR01B08 / Jarvis Creek / As described in VDH-DSS condemnation 015-022H, 5/9/2016. 5A PCB in Fish Tissue 2006 L 0.016

CB5MH

VAP-C01E_JAR02A10 / Jarvis Creek / Downstream of VDH condemnations 5A PCB in Fish Tissue 2006 L 0.200

CB5MH

VAP-C01E_JOH01A06 / Johnson Creek / As described in VDH-DSS SFC 016-024C, 12/30/2015 5A PCB in Fish Tissue 2006 L 0.029

CB5MH

VAP-C01E_LEE01A02 / Lees Cove / As described in the condemnation notice 016-024C, 1/28/2005 5A PCB in Fish Tissue 2006 L 0.015

CB5MH

VAP-C01E_LEE02A12 / Lees Cove / Portion of VDH-DSS SFC 016-5A PCB in Fish Tissue 2006 L 0.010

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024B, 12/16/2014 not impaired in 016-024C, 1/28/2005.

CB5MH VAP-C01E_LOC01A08 / Long Creek / Described in VDH condemnation 016-057D, 12/13/2006.	5A	PCB in Fish Tissue	2006	L	0.017
CB5MH VAP-C01E_LRC01A12 / Lawrence Cove / Described in the VDH-DSS condemnation 015-022B, 5/9/2016. Shortened slightly in the 2018 cycle.	5A	PCB in Fish Tissue	2006	L	0.744
CB5MH VAP-C01E_LTB01A02 / Little Bay / Little Bay	5A	PCB in Fish Tissue	2006	L	1.178
CB5MH VAP-C01E_LTM01A98 / Little Taskmakers Creek / Described in the condemnation notice 011-190B, 7/24/2014.	5A	PCB in Fish Tissue	2006	L	0.049
CB5MH VAP-C01E_MIL01A98 / Mill Creek / Described in the condemnation notice 123, 6/2/1997	5A	PCB in Fish Tissue	2006	L	0.241
CB5MH VAP-C01E_MIL01B06 / Mill Creek / Mouth of Mill Creek at Ingram Bay	5A	PCB in Fish Tissue	2006	L	1.173
CB5MH VAP-C01E_MIL02A08 / Mill Creek / Portion of VDH Condemnation 014-123A, 5/9/2016 not included in the notice 123, 6/2/1997	5A	PCB in Fish Tissue	2006	L	0.135
CB5MH VAP-C01E_MIL03A08 / Mill Creek / Middle Mill Creek downstream of condemnation to Ingrams Bay	5A	PCB in Fish Tissue	2006	L	0.356
CB5MH VAP-C01E_NPC01A16 / Natty Point Cove / Described in VDH-DSS condemnation 015-022C, 5/9/2016.	5A	PCB in Fish Tissue	2006	L	0.018
CB5MH VAP-C01E_OHC01A08 / Old House Cove / Described in VDH-DSS SFC 015-022F, 5/9/2016.	5A	PCB in Fish Tissue	2006	L	0.024
CB5MH VAP-C01E_OWP01A98 / Owens Pond / Downstream of VDH-DSS condemnations 011-122B and 011-122C, 8/31/2016.	5A	PCB in Fish Tissue	2006	L	0.076
CB5MH VAP-C01E_OWP02B12 / Owens Pond / VDH-DSS condemnation 011-122B, 8/31/2016.	5A	PCB in Fish Tissue	2006	L	0.037
CB5MH					

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VAP-C01E_OWP02C12 / Owens Pond / VDH-DSS condemnation 011-122C, 8/31/2016.	SA	PCB in Fish Tissue	2006	L	0.073
CB5MH					
VAP-C01E_OYS01A08 / Oyster Creek / Described in VDH condemnation 018-053A, 1/4/2005	SA	PCB in Fish Tissue	2006	L	0.103
CB5MH					
VAP-C01E_PEN01A12 / Penny Creek / Described in VDH-DSS Condemnation 013-220D, 4/28/2016	SA	PCB in Fish Tissue	2006	L	0.009
CB5MH					
VAP-C01E_PIT01A14 / Pitmans Cove / Described in condemnation notice 016-057B, 12/19/2016.	SA	PCB in Fish Tissue	2006	L	0.035
CB5MH					
VAP-C01E_PNT02A02 / Prentice Creek / Downstream of DSS condemnation 015-022E, 5/9/2016 to its mouth.	SA	PCB in Fish Tissue	2006	L	0.159
CB5MH					
VAP-C01E_PNT02B10 / Prentice Creek / Downstream limit of DSS condemnation 022C & D, 2/27/1997 to limit of 015-022E, 5/9/2016.	SA	PCB in Fish Tissue	2006	L	0.014
CB5MH					
VAP-C01E_PNT03A02 / Prentice Creek / Described in condemnation notice 022D, 2/27/1997.	SA	PCB in Fish Tissue	2006	L	0.015
CB5MH					
VAP-C01E_REA01A10 / Reason Creek / Described in VDH-DSS condemnation 013-220C, 8/23/2010	SA	PCB in Fish Tissue	2006	L	0.025
CB5MH					
VAP-C01E_TBS01A14 / Tabbs Creek, UT / Described in VDH-DSS condemnation notice 016-133B, 12/28/2012	SA	PCB in Fish Tissue	2006	L	0.016
CB5MH					
VAP-C01E_TBS01A98 / Tabbs Creek / Described in VDH-DSS condemnation notice 016-133A, 12/19/2016	SA	PCB in Fish Tissue	2006	L	0.054
Segment shrunk in the 2018 cycle.					
CB5MH					
VAP-C01E_TBS01B10 / Tabbs Creek / Portion of the condemnation notice 016-133A, 12/13/2006 open on 12/19/2016.	SA	PCB in Fish Tissue	2006	L	0.123
Size increased in the 2018 cycle.					
CB5MH					
VAP-C01E_TBS02A00 / Tabbs Creek / Tabbs Creek downstream of VDH-DSS SFC 016-133, 12/13/2006.	SA	PCB in Fish Tissue	2006	L	0.175

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CB5MH

Size adjusted in 2006 cycle.

VAP-C01E_TIP01A98 / Tipers Creek / Described in the condemnation notice 89C, 5/28/1997	5A	PCB in Fish Tissue	2006	L	0.083

CB5MH

VAP-C01E_TIP02A08 / Tipers Creek / Portion of condemnation notice 013-089E, 4/28/2016 not included in 89C, 5/28/1997	5A	PCB in Fish Tissue	2006	L	0.039

CB5MH

VAP-C01E_TOW01A06 / Towles Creek / Described in VDH-DSS Shellfish Condemnation 014-123M1, 5/9/2016.	5A	PCB in Fish Tissue	2006	L	0.027

CB5MH

VAP-C01E_TSK01A14 / Taskmakers Creek / As described in VDH-DSS condemnation 011-190C, 10/10/2012	5A	PCB in Fish Tissue	2006	L	0.021

CB5MH

VAP-C01E_WCO01A98 / Warehouse Creek / Described in the condemnation notice 89E, 5/28/1997	5A	PCB in Fish Tissue	2006	L	0.069

CB5MH

VAP-C01E_WCO02A08 / Warehouse Creek / Portion of VDH condemnation notice 013-220A, 4/28/2016 not included in 89E, 5/28/1997	5A	PCB in Fish Tissue	2006	L	0.008

CB5MH

VAP-C01E_WHY01A98 / Whays Creek / Described in the condemnation notice 089D, 4/3/2002	5A	PCB in Fish Tissue	2006	L	0.041

CB5MH

VAP-C01E_WHY03A10 / Whays Creek / Downstream of condemnation notice 089D, 4/3/2002.	5A	PCB in Fish Tissue	2006	L	0.099

CB5MH

VAP-C01E_XDL01A02 / XDL - Chesapeake Bay, UT (aka Big Fleets Pond) / As described in condemnation notice 011-190A, 7/24/2014.	5A	PCB in Fish Tissue	2006	L	0.018

CB5MH

VAP-C01E_XDZ01A10 / XDZ - Mill Creek, UT (Gascony Cove) / Tidal limit to mouth at Mill Creek	5A	PCB in Fish Tissue	2006	L	0.028
VAP-C01E_XEO01A10 / XEO - Reason Creek, UT / Described in VDH-DSS Condemnation 013-220E, 4/28/2016	5A	PCB in Fish Tissue	2006	L	0.001

CB5MH

VAP-C01E_XES01A12 / XES - Dividing Creek, UT / Described in the VDH-DSS condemnation 015-022D, 5/9/2016.	5A	PCB in Fish Tissue	2006	L	0.029

CB5MH

VAP-C01E_XEU01A02 / XEU - Prentice Creek, UT / Described in the condemnation notice 022C, 2/27/1997	5A	PCB in Fish Tissue	2006	L	0.011

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CB5MH VAP-C01E_XEV01A12 / XEV - Mill Creek, UT / Described in VDH-DSS condemnation 014-123C, 5/9/2016.	5A	PCB in Fish Tissue	2006	L	0.007
CB5MH VAP-C01E_XEW01A14 / XEW - Chesapeake Bay, UT / Tidal limit to mouth	5A	PCB in Fish Tissue	2006	L	0.022
VAP-C01E_XFC02C12 / XFC - Antipoison Creek, UT / Described in VDH-DSS condemnation 017-188D, 12/16/2014.	5A	PCB in Fish Tissue	2006	L	0.002
CB5MH VAP-C01E_XUC01A98 / XUC - Dividing Creek, UT / Described in the condemnation notice 015-022C, 4/17/2008.	5A	PCB in Fish Tissue	2006	L	0.013
CB5MH VAP-C01E_ZZZ01B14 / Unsegmented estuaries in C01 / Unsegmented portion of watershed CB03.	5A	PCB in Fish Tissue	2006	L	0.058
CB5MH VAP-C01E_ZZZ01C14 / Unsegmented estuaries in C01 / Unsegmented portion of watershed CB04.	5A	PCB in Fish Tissue	2006	L	0.823
CB5MH VAP-C01E_ZZZ01D14 / Unsegmented estuaries in C01 / Unsegmented portion of watershed CB05.	5A	PCB in Fish Tissue	2006	L	0.034
CB5MH VAP-C02E_DRN01A02 / Dragon Swamp / The tidal portion of Dragon Swamp to its mouth at the Piankatank River.	5A	PCB in Fish Tissue	2006	L	0.823
PIAMH VAP-C03E_COB02C10 / Cobbs Creek / Described in VDH-DSS condemnation 034-126B, 11/12/2014	5A	PCB in Fish Tissue	2006	L	0.086
PIAMH VAP-C03E_COR01A08 / Cores Creek / Described in VDH-DSS condemnation 034-208D, 11/21/2016.	5A	PCB in Fish Tissue	2006	L	0.018
PIAMH VAP-C03E_DAN01A08 / Dancing Creek / Described in VDH condemnation 025-076C, 11/21/2016	5A	PCB in Fish Tissue	2006	L	0.034
PIAMH VAP-C03E_FER01A98 / Ferry Creek / Described in the condemnation notice 035-076B, 11/21/2016. Expanded in the 2018 cycle.	5A	PCB in Fish Tissue	2006	L	0.125
PIAMH VAP-C03E_FRE01A02 / Frenchs Creek / As described in the condemnation notice 035-076D, 11/12/2016.	5A	PCB in Fish Tissue	2006	L	0.010
PIAMH					

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Chesapeake Bay/Atlantic/Small Coastal Basins

VAP-C03E_HEA01A02 / Healy Creek / Described in the VDH-DSS Shellfish Condemnation Notice 034-208C, 11/21/2016	5A	PCB in Fish Tissue	2006	L	0.071
PIAMH					
VAP-C03E_HRP01A98 / Harper Creek / Described in the condemnation notice 076B, 6/10/1997.	5A	PCB in Fish Tissue	2006	L	0.062
PIAMH					
VAP-C03E_JCK01A98 / Jackson Creek / Described in the condemnation notice 84A, 11/1/1996	5A	PCB in Fish Tissue	2006	L	0.019
PIAMH					
VAP-C03E_JCK01B08 / Jackson Creek / Described in the condemnation notice 033-084B, 11/12/2014.	5A	PCB in Fish Tissue	2006	L	0.013
PIAMH					
VAP-C03E_JCK01B14 / Jackson Creek / Portion of condemnation notice 84B, 11/1/1996 within 033-084M1, 11/12/2014.	5A	PCB in Fish Tissue	2006	L	0.003
PIAMH					
VAP-C03E_JCK01C08 / Jackson Creek / Portion of condemnation notice 033-084A, 11/12/2014 not included in 84A, 11/1/1996	5A	PCB in Fish Tissue	2006	L	0.002
PIAMH					
VAP-C03E_JCK01C14 / Jackson Creek, UT / Described in VDH-DSS condemnation notice 033-084C, 11/12/2014.	5A	PCB in Fish Tissue	2006	L	0.033
PIAMH					
VAP-C03E_JCK02B16 / Jackson Creek / Described in VDH-DSS condemnation notice 033-084E, 11/12/2014.	5A	PCB in Fish Tissue	2006	L	0.011
PIAMH					
VAP-C03E_JCK02C10 / Jackson Creek / Portion of VDH-DSS condemnation notice 033-084M1, 11/12/2014 not included in 084B, 11/1/1996.	5A	PCB in Fish Tissue	2006	L	0.212
PIAMH					
VAP-C03E_JCK03C10 / Jackson Creek / Described in condemnation notice 033-084D, 11/12/2014	5A	PCB in Fish Tissue	2006	L	0.013
PIAMH					
VAP-C03E_MRE01A02 / Moore Creek / As described in the condemnation notice 034-208A, 11/21/2016.	5A	PCB in Fish Tissue	2006	L	0.040
Size reduced in the 2018 cycle.					
PIAMH					
VAP-C03E_PNK01A02 / Piankatank River / Portions of VDH-DSS condemnation 035-076A, 11/21/2016 open on 6/10/1997. Segment ends at Deep Point Boat Landing.	5A	PCB in Fish Tissue	2006	L	0.558
Expanded in the 2018 cycle.					
PIAMH					

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VAP-C03E_PNK01A98 / Piankatank River / Watershed limit (start of Piankatank River) downstream to limit of SFC 035-076A, 6/10/1997.	5A	PCB in Fish Tissue	2006	L	1.280
PIAMH					
VAP-C03E_PNK02A00 / Piankatank River / Mainstem Piankatank from Deep Point Boat Landing downstream to PNK03A00, excluding the Berkley Island area.	5A	PCB in Fish Tissue	2006	L	4.007
PIAMH					
VAP-C03E_PNK02B08 / Piankatank River / Bend around Berkley Island	5A	PCB in Fish Tissue	2006	L	0.785
PIAMH					
VAP-C03E_PNK03A00 / Piankatank River / One-half mile radius around monitoring station 7-PNK005.36 on the Piankatank River between Pond Point and Iron Point.	5A	PCB in Fish Tissue	2006	L	1.167
PIAMH					
VAP-C03E_PNK04A00 / Piankatank River / Mainstem Piankatank River from PNK03A00 downstream to the point at Fishing Bay.	5A	PCB in Fish Tissue	2006	L	3.528
PIAMH					
VAP-C03E_PNK04B06 / Piankatank River / As described in VDH-DSS SFC 034-208M1, 11/21/2016.	5A	PCB in Fish Tissue	2006	L	0.040
PIAMH					
VAP-C03E_PNK04C06 / Piankatank River, Fishing Bay / As described in VDH-DSS SFC 034-208 M2, 11/21/2016.	5A	PCB in Fish Tissue	2006	L	0.085
PIAMH					
VAP-C03E_PNK04D08 / Porpoise Cove / As described in VDH-DSS SFC 034-208B, 11/21/2016	5A	PCB in Fish Tissue	2006	L	0.011
PIAMH					
VAP-C03E_PNK05A02 / Piankatank River / Piankatank River downstream of Fishing Bay at Stove Point to mouth at Chesapeake Bay	5A	PCB in Fish Tissue	2006	L	4.942
PIAMH					
VAP-C03E_PNK07B08 / Piankatank River, UT / Described in VDH-DSS SFC 034-126C, 11/12/2014.	5A	PCB in Fish Tissue	2006	L	0.007
PIAMH					
VAP-C03E_PNK08B08 / Piankatank River, UT / Described in VDH-DSS SFC 034-126D, 11/12/2014	5A	PCB in Fish Tissue	2006	L	0.003
PIAMH					
VAP-C03E_WLT01A98 / Wilton Creek / Described in the condemnation notice 034-126A, 11/12/2014	5A	PCB in Fish Tissue	2006	L	0.134
PIAMH					
VAP-C03E_ZZZ01B14 / Unsegmented estuaries in C03 / Unsegmented portion of watershed CB11.	5A	PCB in Fish Tissue	2006	L	0.175

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Chesapeake Bay/Atlantic/Small Coastal Basins

PIAMH

VAP-C04E_BEV01A08 / Belleville Creek / Described in VDH Shellfish Condemnation 042-157B, 5/27/2015.	5A	PCB in Fish Tissue	2006	L	0.037

MOBPH

VAP-C04E_BKA01A98 / Back Creek / Described in VDH condemnation notice 042-157C, 5/27/2015	5A	PCB in Fish Tissue	2006	L	0.071

MOBPH

VAP-C04E_BKA01B12 / Back Creek / Portion of VDH condemnation notice 157C, 6/3/1997 open on 5/27/2015	5A	PCB in Fish Tissue	2006	L	0.014

MOBPH

VAP-C04E_BLL01A16 / Billups Creek / Portion of condemnation notice 204, 4/4/1997 open 1/31/2014.	5A	PCB in Fish Tissue	2006	L	0.017

PIAMH

VAP-C04E_BLL01A98 / Billups Creek / Described in the condemnation notice 037-061B, 1/31/2014.	5A	PCB in Fish Tissue	2006	L	0.029

PIAMH

VAP-C04E_BLL02A16 / Billups Creek / Billups Creek not otherwise segmented.	5A	PCB in Fish Tissue	2006	L	0.312

PIAMH

VAP-C04E_BLL02C12 / Billups Creek / Described in condemnation notice 037-061M3, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.005

PIAMH

VAP-C04E_BLW01A98 / Blackwater Creek / Described in the condemnation notice 042-131A, 6/3/1997.	5A	PCB in Fish Tissue	2006	L	0.101

MOBPH

VAP-C04E_BOR01A18 / Borum Creek / Described in VDH-DSS condemnation 039-026C, 3/7/2016.	5A	PCB in Fish Tissue	2006	L	0.028

CB6PH

VAP-C04E_BRN01A04 / Barn Creek / Described in VDH-DSS condemnation notice 036-197C, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.020

PIAMH

VAP-C04E_BUR01A00 / Burke Mill Stream / From extent of tide to North River	5A	PCB in Fish Tissue	2010	L	0.025

MOBPH

VAP-C04E_DAV01A98 / Davis Creek / Described in the condemnation notice 042-131C, 6/30/2016.	5A	PCB in Fish Tissue	2006	L	0.012

Size reduced in the 2018 cycle.

MOBPH

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Chesapeake Bay/Atlantic/Small Coastal Basins

VAP-C04E_DAV02A14 / Davis Creek, UT / Described in VDH-DSS condemnation 042-131B, 7/12/2012.	5A	PCB in Fish Tissue	2006	L	0.024
MOBPH					
VAP-C04E_DOC01A98 / Doctors Creek / Portion of VDH condemnation notice 26B, 2/25/1997 open in 039-026, 3/7/2016.	5A	PCB in Fish Tissue	2006	L	0.010
CB6PH					
VAP-C04E_DOC01B14 / Doctors Creek / Described in VDH-DSS condemnation notice 039-026B, 3/7/2016.	5A	PCB in Fish Tissue	2006	L	0.005
CB6PH					
VAP-C04E_DVS01A98 / Davis Creek / Described in the condemnation notice 040-085B, 9/29/2015.	5A	PCB in Fish Tissue	2006	L	0.006
MOBPH					
VAP-C04E_DVS01B08 / Davis Creek / Described in the condemnation notice 040-085M2, 9/21/2010.	5A	PCB in Fish Tissue	2006	L	0.011
MOBPH					
VAP-C04E_DVS02A12 / Davis Creek / Described in the condemnation notice 040-085M1, 9/29/2015.	5A	PCB in Fish Tissue	2006	L	0.011
MOBPH					
VAP-C04E_DVS03A12 / Davis Creek / Described in VDH-DSS condemnation 040-085A, 9/29/2015	5A	PCB in Fish Tissue	2006	L	0.009
MOBPH					
VAP-C04E_DYE01A08 / Dyer Creek / Described in VDH-DSS Condemnation 039-100A, 2/24/2011.	5A	PCB in Fish Tissue	2006	L	0.015
CB6PH					
VAP-C04E_DYE02A04 / Dyer Creek / Downstream limit of condemnation to mouth.	5A	PCB in Fish Tissue	2006	L	0.272
CB6PH					
VAP-C04E_EDW01A98 / Edwards Creek / Portion of VDH condemnation notice 197A, 1/21/1997 open in 036-197, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.006
Segment split in the 2018 cycle.					
PIAMH					
VAP-C04E_EDW01B18 / Edwards Creek / Described in VDH condemnation notice 036-197D, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.021
PIAMH					
VAP-C04E_EDW02A98 / Edwards Creek / Described in the condemnation notice 036-197B, 1/21/1997.	5A	PCB in Fish Tissue	2006	L	0.047
PIAMH					
VAP-C04E_ELM01A98 / Elmington Creek / Described in the condemnation notice 157B, 6/3/1997.	5A	PCB in Fish Tissue	2006	L	0.023
MOBPH					

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

Chesapeake Bay/Atlantic/Small Coastal Basins

VAP-C04E_ELM01B08 / Elmington Creek / Portion of VDH condemnation notice 042-157D, 5/27/2015 not included in 157B, 6/3/1997.	5A	PCB in Fish Tissue	2006	L	0.009
MOBPH					
VAP-C04E_EST01A98 / East River / Described in the condemnation notice 92, 1/3/1995.	5A	PCB in Fish Tissue	2006	L	0.198
MOBPH					
VAP-C04E_EST01B10 / East River / Portion of condemnation notice 041-092A, 9/30/2016 open in 92, 1/3/1995.	5A	PCB in Fish Tissue	2006	L	0.101
MOBPH					
VAP-C04E_EST01D10 / East River, UT / Described in the condemnation notice 041-092C, 12/16/2010.	5A	PCB in Fish Tissue	2006	L	0.023
MOBPH					
VAP-C04E_EST02A00 / East River / East River from SFC 92 to mouth, not otherwise segmented.	5A	PCB in Fish Tissue	2006	L	2.519
MOBPH					
VAP-C04E_EST03A06 / East River, UT / Described in VDH-DSS SFC 041-212M1, 9/30/2016.	5A	PCB in Fish Tissue	2006	L	0.016
MOBPH					
VAP-C04E_EST04A02 / East River, UT / As described in condemnation notice 041-212B, 9/30/2016.	5A	PCB in Fish Tissue	2006	L	0.026
MOBPH					
VAP-C04E_EST05A06 / East River, UT (aka Mill Creek) / Described in VDH-DSS SFC 041-212M2, 9/25/2014.	5A	PCB in Fish Tissue	2006	L	0.010
MOBPH					
VAP-C04E_EST06A08 / East River, UT / Described in VDH Shellfish Condemnation 041-212G, 10/25/2005.	5A	PCB in Fish Tissue	2006	L	0.020
MOBPH					
VAP-C04E_EST07A08 / East River, UT / Described in VDH Shellfish Condemnation 041-212C, 9/30/2016.	5A	PCB in Fish Tissue	2006	L	0.014
MOBPH					
VAP-C04E_EST08A08 / East River, UT / Described in VDH Shellfish Condemnation 041-212E, 9/30/2016.	5A	PCB in Fish Tissue	2006	L	0.004
MOBPH					
VAP-C04E_GDN01A06 / Garden Creek / Tidal limit to mouth.	5A	PCB in Fish Tissue	2006	L	0.373
CB6PH					
VAP-C04E_GRE01A08 / Greenmansion Cove / Described in VDH-DSS condemnation notice 042-131E, 6/12/2014.	5A	PCB in Fish Tissue	2006	L	0.027
MOBPH					
VAP-C04E_GRE01B10 / Greenmansion Cove / Portion of VDH-	5A	PCB in Fish Tissue	2006	L	0.027

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Chesapeake Bay/Atlantic/Small Coastal Basins

DSS condemnation notice 042-131M1, 6/30/2016 not included in 042-131E, 6/12/2014.

MOBPH

VAP-C04E_HAH01A98 / Horn Harbor / Described in VDH condemnation notices 039-026A and -026E, 3/7/2016.	5A	PCB in Fish Tissue	2006	L	0.146

Size increased in the 2018 cycle.

CB6PH

VAP-C04E_HAH02A02 / Horn Harbor / From VDH-DSS condemnation 26A, 2/25/1997 downstream to the mouth, unless otherwise segmented.	5A	PCB in Fish Tissue	2006	L	1.474

CB6PH

VAP-C04E_HAH02B12 / Horn Harbor, UT / Described in VDH-DSS condemnation 039-026M2, 3/7/2016.	5A	PCB in Fish Tissue	2006	L	0.004

CB6PH

VAP-C04E_HAH02C12 / Horn Harbor / Portion of VDH-DSS condemnation 26A, 2/25/1997 open in the 039-026, 3/7/2016 condemnation.	5A	PCB in Fish Tissue	2006	L	0.054

Size reduced in the 2018 cycle.

CB6PH

VAP-C04E_HAH02D18 / Horn Harbor, UT / Described in VDH-DSS condemnation 039-026D, 3/7/2016.	5A	PCB in Fish Tissue	2006	L	0.005

CB6PH

VAP-C04E_HAH03A06 / Horn Harbor / Described in VDH-DSS SFC 039-026M1, 3/7/2016.	5A	PCB in Fish Tissue	2006	L	0.035

Size decreased in the 2018 cycle.

CB6PH

VAP-C04E_HAH04A06 / Horn Harbor, UT (Jacks Creek) / Described in VDH Shellfish Condemnation 039-100M1, 3/6/2013.	5A	PCB in Fish Tissue	2006	L	0.016

CB6PH

VAP-C04E_HKC01A08 / Hickorynut Cove / Tidal limit to mouth at Milford Haven	5A	PCB in Fish Tissue	2006	L	0.023

PIAMH

VAP-C04E_HUD01A08 / Hudgins Creek / Described in VDH-DSS Condemnation 037-061D, 2/7/2012	5A	PCB in Fish Tissue	2006	L	0.016

PIAMH

VAP-C04E_LAN01A02 / Lanes Creek / As described in condemnation notice 037-099E, 1/31/2014.	5A	PCB in Fish Tissue	2006	L	0.020

PIAMH

VAP-C04E_LAN01B08 / Lanes Creek, UT / Described in VDH Shellfish Condemnation 037-099C, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.002

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Chesapeake Bay/Atlantic/Small Coastal Basins

PIAMH VAP-C04E_MID01A02 / Winder Creek / As described in the condemnation notice 037-099B, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.025
PIAMH VAP-C04E_MIS01A04 / Miles Creek / Described in VDH Condemnation Notice 041-212D, 9/30/2016.	5A	PCB in Fish Tissue	2006	L	0.030
MOBPH VAP-C04E_MLF01A98 / Milford Haven / Described in the condemnation notice 036-197A, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.029
PIAMH VAP-C04E_MLF02A98 / Milford Haven / Described in the condemnation notice 036-197E, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.030
PIAMH VAP-C04E_MLF03A00 / Milford Haven / Downstream of SFC 036-197, 2/16/2016 except as otherwise segmented.	5A	PCB in Fish Tissue	2006	L	1.411
PIAMH VAP-C04E_MLF04A06 / Milford Haven / Hills Bay	5A	PCB in Fish Tissue	2006	L	2.283
PIAMH VAP-C04E_MLF05A06 / Milford Haven / Described in VDH-DSS condemnation 036-197M1, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.041
PIAMH VAP-C04E_MRC01A98 / Morris Creek / Described in condemnation notice 61B, 4/4/1997.	5A	PCB in Fish Tissue	2006	L	0.034
PIAMH VAP-C04E_NOR01A02 / North River / Described in condemnation notice 042-157A, 5/27/2015, excluding tidal Burke Mill Stream. Split in the 2018 cycle.	5A	PCB in Fish Tissue	2006	L	0.250
MOBPH VAP-C04E_NOR01B08 / North River / Portion of condemnation notice 042-157A, 6/21/2013 not included on the 6/3/1997 condemnation	5A	PCB in Fish Tissue	2006	L	0.135
MOBPH VAP-C04E_NOR01C18 / North River / Portion of condemnation notice 157A, 6/3/1997 open 5/27/2015.	5A	PCB in Fish Tissue	2006	L	0.067
MOBPH VAP-C04E_NOR02A02 / North River / North River and tribs from SFC 157A to Mobjack Bay, except as otherwise segmented.	5A	PCB in Fish Tissue	2006	L	5.392
MOBPH VAP-C04E_OAK01A08 / Oakland Creek / Described in the	5A	PCB in Fish Tissue	2006	L	0.030

condemnation notice 042-131B, 6/12/2014.

MOBPH

VAP-C04E_PEP01A06 / Pepper Creek / As described in the condemnation notice 040-085B, 9/26/2006.	5A	PCB in Fish Tissue	2006	L	0.031

MOBPH

VAP-C04E_PUT01A98 / Put In Creek / Portion of VDH-DSS condemnation notice 041-005A, 9/29/2015 not included in 5B, 6/5/1996.	5A	PCB in Fish Tissue	2006	L	0.095

Expanded slightly in the 2018 cycle.

MOBPH

VAP-C04E_PUT01C10 / Put In Creek / Portion of condemnation notice 5A, 6/5/1996 open on 041-005, 9/29/2015.	5A	PCB in Fish Tissue	2006	L	0.032

Shrank in the 2018 cycle.

MOBPH

VAP-C04E_PUT01D16 / Put In Creek / Described in condemnation notice 041-005B, 9/29/2015.	5A	PCB in Fish Tissue	2006	L	0.005

MOBPH

VAP-C04E_PUT02A98 / Put In Creek / Described in the condemnation notice 5B, 6/5/1996.	5A	PCB in Fish Tissue	2006	L	0.021

MOBPH

VAP-C04E_QUE01A98 / Queens Creek / Described in condemnation notices 037-099A, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.063

Size reduced in the 2018 cycle.

PIAMH

VAP-C04E_QUE01B10 / Queens Creek / Described in condemnation notices 037-099M1, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.031

PIAMH

VAP-C04E_QUE01C10 / Queens Creek / Below condemnation notices 99A, 4/7/1997 and 037-099, 2/16/2016	5A	PCB in Fish Tissue	2006	L	0.061

PIAMH

VAP-C04E_QUE01D12 / Queens Creek / Portion of condemnation notice 99A, 4/9/1997 not included in 037-099A, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.100

Expanded in the 2018 cycle.

PIAMH

VAP-C04E_QUE02A12 / Queens Creek, UT / Described in condemnation notice 037-099C, 1/31/2014.	5A	PCB in Fish Tissue	2006	L	0.019

PIAMH

VAP-C04E_RAN01A08 / Raines Creek / VDH Shellfish Condemnation 041-212I, 10/25/2005	5A	PCB in Fish Tissue	2006	L	0.039

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MOBPH VAP-C04E_RAY01A12 / Raymond Creek / Described in VDH-DSS condemnation 042-131B, 6/30/2016.	5A	PCB in Fish Tissue	2006	L	0.026
MOBPH VAP-C04E_SLO01A08 / Sloop Creek / Tidal extent of Sloop Creek.	5A	PCB in Fish Tissue	2006	L	0.050
MOBPH VAP-C04E_STO01A08 / Stoakes Creek / Described in VDH Shellfish Condemnation 037-061M1, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.006
PIAMH VAP-C04E_STO01B14 / Stoakes Creek / Tidal limit to mouth unless otherwise segmented.	5A	PCB in Fish Tissue	2006	L	0.289
PIAMH VAP-C04E_STT01A14 / Stutts Creek / Portion of condemnation notice 061A, 4/4/1997 open 2/16/2016. Expanded in the 2018 cycle.	5A	PCB in Fish Tissue	2006	L	0.028
PIAMH VAP-C04E_STT01A98 / Stutts Creek / Described in condemnation notice 037-061A and -061B, 2/16/2016. Size reduced in the 2018 cycle.	5A	PCB in Fish Tissue	2006	L	0.062
PIAMH VAP-C04E_STT01B06 / Stutts Creek, UT (Hole in the Wall) / Described in VDH-DSS condemnation 037-061M5, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.016
PIAMH VAP-C04E_STT01B10 / Stutts Creek/Morris Creek / Portion of VDH condemnation notice 037-061C, 2/16/2016 not condemned on 4/4/1997. Shrank considerably in the 2018 cycle.	5A	PCB in Fish Tissue	2006	L	0.005
PIAMH VAP-C04E_STT01C14 / Stutts Creek / Described in VDH condemnation notice 037-061M4, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.013
PIAMH VAP-C04E_STT02A00 / Stutts Creek / Morris Creek / Downstream limit of condemnation to Fanneys Point, except as otherwise segmented.	5A	PCB in Fish Tissue	2006	L	0.229
PIAMH VAP-C04E_STT04A06 / Stutts Creek / Described in VDH-DSS SFC 037-061M2, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.025
PIAMH VAP-C04E_STT05A10 / Stutts Creek (Hole in the Wall) / From Point	5A	PCB in Fish Tissue	2006	L	1.037

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Chesapeake Bay/Atlantic/Small Coastal Basins

Breeze downstream to its mouth at the Chesapeake Bay.

PIAMH

VAP-C04E_TAB01A08 / Tabbs Creek / Described in VDH Shellfish Condemnation 041-212F, 9/30/2016.	5A	PCB in Fish Tissue	2006	L	0.034

Size reduced in the 2018 cycle.

MOBPH

VAP-C04E_THO01A08 / Thomas Creek / Described in VDH Shellfish Condemnation 041-212B, 9/25/2014.	5A	PCB in Fish Tissue	2006	L	0.014

MOBPH

VAP-C04E_WHA01A06 / Wharf Creek / Described in VDH-DSS SFC 036-197M2, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.018

PIAMH

VAP-C04E_WHI01A08 / Whites Creek / Whites Creek around Festival Beach	5A	PCB in Fish Tissue	2006	L	0.046

PIAMH

VAP-C04E_WHI01B12 / Whites Creek / Stutts Creek to Festival Beach	5A	PCB in Fish Tissue	2006	L	0.271

PIAMH

VAP-C04E_WIN01A06 / Winter Harbor, UT / Described in the condemnation notice 038-178B, 3/7/2016.	5A	PCB in Fish Tissue	2006	L	0.108

Expanded in the 2018 cycle.

CB6PH

VAP-C04E_WIN01B00 / Winter Harbor / Lower Winter Harbor, not otherwise segmented.	5A	PCB in Fish Tissue	2006	L	0.183

CB6PH

VAP-C04E_WIN02B06 / Winter Harbor / Described in VDH-DSS SFC 038-178M1, 3/7/2016.	5A	PCB in Fish Tissue	2006	L	0.037

CB6PH

VAP-C04E_WIN03A06 / Winter Harbor / Northern portion of Winter Harbor	5A	PCB in Fish Tissue	2006	L	0.736

CB6PH

VAP-C04E_WIN03B18 / Winter Harbor / Described in VDH-DSS condemnation 038-176A, 3/7/2016.	5A	PCB in Fish Tissue	2006	L	0.422

CB6PH

VAP-C04E_WON01A08 / Weston Creek / Described in VDH Shellfish Condemnation 041-212A, 9/30/2016.	5A	PCB in Fish Tissue	2006	L	0.025

MOBPH

VAP-C04E_WOO01A10 / Woodas Creek / Described in the condemnation notice 041-092B, 9/30/2016.	5A	PCB in Fish Tissue	2006	L	0.029

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

Chesapeake Bay/Atlantic/Small Coastal Basins

Shrank slightly in the 2018 cycle.

MOBPH					
VAP-C04E_WTS01A08 / Whites Creek / Described in VDH Shellfish Condemnation 041-212E, 10/25/2005.	5A	PCB in Fish Tissue	2006	L	0.018
MOBPH					
VAP-C04E_XFA03A14 / XFA - North River, UT / Described in VDH-DSS condemnation 042-131A, 6/30/2016.	5A	PCB in Fish Tissue	2006	L	0.020
MOBPH					
VAP-C04E_XFE01A16 / XFE - Piankatank River, UT (aka Kibble Pond) / Described in VDH-DSS condemnation 036-197B, 2/16/2016.	5A	PCB in Fish Tissue	2006	L	0.016
PIAMH					
VAP-C04E_ZZZ01A00 / Unsegmented estuaries in C04 / Unsegmented portion of the watershed within PIAMH	5A	PCB in Fish Tissue	2006	L	0.766
VAP-C04E_ZZZ02A06 / Unsegmented estuaries in C04 / Unsegmented portion within CB6PH	5A	PCB in Fish Tissue	2006	L	0.076
VAP-C04E_ZZZ03A06 / Unsegmented estuaries in C04 / Unsegmented portion within MOBPH	5A	PCB in Fish Tissue	2006	L	0.409
VAP-C05E_FOX01A08 / Fox Mill Run / Described in the condemnation notice 96B, 8/12/1996.	5A	PCB in Fish Tissue	2006	L	0.085
MOBPH					
VAP-C05E_OLD01A12 / Oldhouse Creek / Tidal limit to mouth at Ware River	5A	PCB in Fish Tissue	2006	L	0.102
MOBPH					
VAP-C05E_WAR01A02 / Ware River / Described in the condemnation notice 096A, 8/12/1996.	5A	PCB in Fish Tissue	2006	L	0.257
MOBPH					
VAP-C05E_WAR01B08 / Ware River / Portion of VDH condemnation notice 043-096A, 5/27/2015 not included in condemnation 96A and 96B, 8/12/1996.	5A	PCB in Fish Tissue	2006	L	0.262

Shortened in the 2018 cycle.

MOBPH					
VAP-C05E_WAR02A02 / Ware River / Ware River downstream of SFC 096.	5A	PCB in Fish Tissue	2006	L	6.309
MOBPH					
VAP-C05E_WAR02B18 / Ware River / Described in VDH-DSS condemnation 043-096C, 5/27/2015.	5A	PCB in Fish Tissue	2006	L	0.010
MOBPH					
VAP-C05E_WIL01A98 / Wilson Creek / Described in the condemnation notice 106, 8/12/1996.	5A	PCB in Fish Tissue	2006	L	0.033
MOBPH					
VAP-C05E_WIL01B08 / Wilson Creek / Portion of VDH	5A	PCB in Fish Tissue	2006	L	0.241

condemnation notice 043-096B, 5/27/2015 not included in condemnation notice 106, 8/12/1996.

Expanded in the 2018 cycle.

MOBPH

VAP-C05E_XDJ01A08 / Wilson Creek, UT / Tidal limit to mouth at Wilson Creek.	5A	PCB in Fish Tissue	2006	L	0.010

MOBPH

VAP-C05E_ZZZ01A00 / Unsegmented estuaries in C05 / Unsegmented portion of the watershed.	5A	PCB in Fish Tissue	2006	L	0.154

MOBPH

VAP-C06E_BRB01A08 / Browns Bay / Described in VDH Shellfish Condemnation 125B, 12/31/1996.	5A	PCB in Fish Tissue	2006	L	0.021

MOBPH

VAP-C06E_BRB01B12 / Browns Bay / Portion of VDH Shellfish Condemnation 045-125M1, 12/9/2015 not included in 125B, 12/31/1996.	5A	PCB in Fish Tissue	2006	L	0.024

MOBPH

VAP-C06E_FSC01A98 / Free School Creek / Described in VDH Shellfish Condemnation 044-093A, 6/9/2016.	5A	PCB in Fish Tissue	2006	L	0.039

Shrank in the 2018 cycle.

MOBPH

VAP-C06E_FSC01B12 / Free School Creek / Portion of TMDL study area open for harvest on 044-093, 6/9/2016.	5A	PCB in Fish Tissue	2006	L	0.028

MOBPH

VAP-C06E_HEY01A98 / Heywood Creek / Described in the condemnation notice 044-054B, 4/2/2014.	5A	PCB in Fish Tissue	2006	L	0.081

MOBPH

VAP-C06E_HEY01B10 / Heywood Creek / Portion of condemnation notice 101, 4/1/1997 open in condemnation 044-054, 4/2/2014.	5A	PCB in Fish Tissue	2006	L	0.085

MOBPH

VAP-C06E_MNC01A98 / Monday Creek / Portion of VDH-DSS condemnation notice 25A, 12/31/1996 open 12/9/2015.	5A	PCB in Fish Tissue	2006	L	0.030

Split in the 2018 cycle.

MOBPH

VAP-C06E_MNC01B18 / Monday Creek / Described in VDH-DSS condemnation notice 045-125A, 12/9/2015.	5A	PCB in Fish Tissue	2006	L	0.053

MOBPH

VAP-C06E_ROW01A06 / Rowes Creek / Described in VDH-DSS Shellfish Condemnation 044-054M2, 4/2/2014.	5A	PCB in Fish Tissue	2006	L	0.067

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Chesapeake Bay/Atlantic/Small Coastal Basins

MOBPH VAP-C06E_SEN01A02 / Northwest Branch Severn River / Described in condemnation notice 044-093B, 6/9/2016, excluding tributary XEE.	5A	PCB in Fish Tissue	2006	L	0.092
MOBPH VAP-C06E_SEN01B16 / Northwest Branch Severn River, UT / Described in VDH-DSS condemnation notice 044-093D, 6/9/2016.	5A	PCB in Fish Tissue	2006	L	0.034
MOBPH VAP-C06E_SEN01C10 / Northwest Branch Severn River / Portion of condemnation notice 93A, 4/1/1997 open on 044-093, 6/9/2016.	5A	PCB in Fish Tissue	2006	L	0.202
MOBPH VAP-C06E_SEN02A06 / Northwest Branch Severn River / Mainstem and tribs not otherwise segmented	5A	PCB in Fish Tissue	2006	L	0.441
MOBPH VAP-C06E_SES01A00 / Southwest Branch Severn River / Mainstem	5A	PCB in Fish Tissue	2006	L	0.635
MOBPH VAP-C06E_SEV02A00 / Severn River / End of NW Branch to mouth, unless otherwise segmented.	5A	PCB in Fish Tissue	2006	L	3.258
MOBPH VAP-C06E_STR01A08 / Sterling Creek / Described in VDH Shellfish Condemnation 044-093E, 4/2/2014.	5A	PCB in Fish Tissue	2006	L	0.021
MOBPH VAP-C06E_THC01A98 / Thorntons Creek / Described in the condemnation notice 044-054A, 4/2/2014.	5A	PCB in Fish Tissue	2006	L	0.052
MOBPH VAP-C06E_THC01B10 / Thorntons Creek / Portion of condemnation notice 054, 4/1/1997 open in condemnation 044-054, 4/2/2014.	5A	PCB in Fish Tissue	2006	L	0.027
MOBPH VAP-C06E_VGH01A98 / Vaughans Creek / Described in the condemnation notice 044-093C, 6/9/2016. Shrank in the 2018 cycle.	5A	PCB in Fish Tissue	2006	L	0.061
MOBPH VAP-C06E_VGH01B10 / Vaughans Creek / Portion of condemnation notice 093B, 4/1/1997 open on 6/9/2016.	5A	PCB in Fish Tissue	2006	L	0.060
MOBPH VAP-C06E_WET01A06 / Willetts Creek / Described in VDH Shellfish Condemnation 044-054M1, 4/2/2014.	5A	PCB in Fish Tissue	2006	L	0.033
MOBPH VAP-C06E_WET01B08 / Willetts Creek / Described in VDH	5A	PCB in Fish Tissue	2006	L	0.128

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Chesapeake Bay/Atlantic/Small Coastal Basins

Condemnation 044-054C, 2/15/2006.

MOBPH

VAP-C06E_WTT01A08 / Whitaker Creek / Tidal extent of Whitaker Creek.	5A	PCB in Fish Tissue	2006	L	0.066

MOBPH

VAP-C06E_XEE01A10 / Northwest Branch Severn River, UT / Tidal limit to mouth at NW Branch Severn River	5A	PCB in Fish Tissue	2012	L	0.003

MOBPH

VAP-C06E_ZZZ01A00 / Unsegmented estuaries in C06 / Unsegmented portion of the watershed.	5A	PCB in Fish Tissue	2006	L	1.352

MOBPH

VAT-C07E_FMB01A12 / Fort Monroe Beaches / All of Fort Monroe Beach from the start of Mill Cr south to Lighthouse Old Point Comfort. Portion of CBP Segment CB8PH. No DSS shellfish condemnations.	5A	PCB in Fish Tissue	2006	L	0.333
VAT-C08E_LCC01A08 / Little Creek & Harbor / Entire area of Little Creek and upper portion of Little Creek Harbor. From headwaters of Little Cr. downstream to lower portion of Harbor at mouth of Bay. CBP segment CB8PH. DSS (ADMINISTRATIVE) condemnation # 068-017 C (effective 20050308).	5A	PCB in Fish Tissue	2006	L	1.064
VAT-C09E_BLB01A06 / Bullbegger Creek / Located southeast of Pitts Neck area. From estuarine/riverine transition (end of tidal waters) downstream to mouth (confluence with Pocomoke Sound). Portion of CBP segment POCOH. Portion of DSS condemnation # 075-033 A (effective 20160711).	5A	PCB in Fish Tissue	2006	L	0.134
VAT-C09E_POC01A06 / Pocomoke River / Located northeast of Pitts Neck area, along VA/MD border. From VA/MD state line downstream to mouth (confluence with Pocomoke Sound) within VA. Portion of CBP segment POCOH. Portion of DSS condemnation # 075-033 A (effective 20160711).	5A	PCB in Fish Tissue	2006	L	0.240
VAT-C09E_POC02A08 / Pocomoke Sound [C09 portion] / Pocomoke Sound downstream of the Pocomoke River (VA portion). Portion of CBP segment POCOH. Portion of DSS shellfish direct harvesting condemnation # 075-033 A (effective 20160711).	5A	PCB in Fish Tissue	2006	L	0.726
VAT-C09E_PTT01A06 / Pitts Creek / Located northeast of Pitts Neck area, along VA/MD border. From VA/MD state line downstream to mouth (confluence with Pocomoke River) within VA. Portion of CBP segment POCOH. Portion of DSS condemnation # 075-033 A (effective 20160711).	5A	PCB in Fish Tissue	2006	L	0.127
VAT-C09E_PTT01B10 / Pitts Creek - Upper [Admin Cond] / Located northeast of Pitts Neck area, along VA/MD border. From VA/MD state line upstream to headwaters within VA at Dunns Swamp Road. Portion of CBP segment POCOH. Portion of DSS condemnation # 075-033 A (effective 20160711).	5A	PCB in Fish Tissue	2006	L	0.069
VAT-C09E_ZZZ01A06 / Unsegmented tidal tributaries in C09E-POCOH / Evaluated non segmented portions of C09E. Portion of CBP segment POCOH. Portion of DSS shellfish direct harvesting condemnation # 075-033 (effective 20160711).	5A	PCB in Fish Tissue	2006	L	0.006
VAT-C10E_BAG01A00 / Bagwell Creek / Northwest of Town of Justisville. Entirety of creek. Portion of CBP segment POCMH. DSS shellfish direct harvesting condemnation # 077-138 A (effective	5A	PCB in Fish Tissue	2006	L	0.102

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

Chesapeake Bay/Atlantic/Small Coastal Basins

20150708).					
VAT-C10E_BAG02A10 / Bagwell Creek - Lower / Northwest of Town of Justisville. Lower DSS OPEN portion of Cr. Portion of CBP segment POCMH. DSS (OPEN) shellfish direct harvesting area # 077-138 (effective 20150708).	5A	PCB in Fish Tissue	2006	L	0.114
VAT-C10E_DEP01A06 / Deep Creek - Middle / East of town of Bayside. Middle portion of creek adjacent to Town of Deep Creek. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 077-138 C (effective 20150708).	5A	PCB in Fish Tissue	2006	L	0.090
VAT-C10E_DEP01B10 / Deep Creek - Upper / East of town of Bayside. Upper portion of creek adjacent to Town of Deep Creek. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 077-138 C (effective 20150108).	5A	PCB in Fish Tissue	2006	L	0.114
VAT-C10E_DEP02A06 / Deep Creek - Lower / East of town of Bayside. Lower portion of creek, from RM 1.6 downstream to mouth. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 077-138 (effective 20150708).	5A	PCB in Fish Tissue	2006	L	0.489
VAT-C10E_DEP03A08 / Deep Creek - Lower [No DSS] / East of town of Bayside. Lower portion of creek, from RM 1.6 downstream to mouth. Portion of CBP segment CB7PH. No DSS shellfish direct harvesting condemnation identified.	5A	PCB in Fish Tissue	2006	L	0.220
VAT-C10E_DIX01A08 / Dix Cove / Northwest of Town of Parksley. Adjacent to Bagwell & Hunting Creeks. Within CBP segment POCMH. Portion of DSS (OPEN) shellfish direct harvesting area # 077-138 (effective 20150708).	5A	PCB in Fish Tissue	2006	L	0.041
VAT-C10E_GLF01A06 / Guilford Creek - Upper / Northeast of Town of Guilford. Upper portion of creek, from end of tidal waters downstream to end of DSS condemnation portion. Portion of CBP segment POCMH. DSS shellfish condemnation # 076-176 A (effective 20160711).	5A	PCB in Fish Tissue	2006	L	0.152
VAT-C10E_GLF02A06 / Guilford Creek - Lower / Northeast of Town of Guilford. Lower portion of creek, from end of DSS condemnation downstream to mouth. Portion of CBP segment POCMH. DSS (OPEN) shellfish direct harvesting condemnation # 076-176 (effective 20160711).	5A	PCB in Fish Tissue	2006	L	0.106
VAT-C10E_GLF03A08 / Guilford Creek - Lower [No DSS] / Northeast of Town of Guilford. Lower portion of creek, from end of DSS condemnation downstream to mouth. Portion of CBP segment POCMH. No DSS shellfish direct harvesting condemnation identified.	5A	PCB in Fish Tissue	2006	L	0.460
VAT-C10E_GSH01A06 / Guard Shore Beach / In Old Cove (Beasley Bay). Located at Bailey Ridge, west of Bloxom. Portion of CBP segment POCMH. No DSS shellfish direct harvesting condemnation.	5A	PCB in Fish Tissue	2006	L	0.026
VAT-C10E_HLD01A06 / Holdens Creek - Upper / Located southeast of Joeys Neck area. From confluence Sandy Bottom Br downstream to 0.5 mi of station @ 7-HLD002.67. Portion of CBP segment POCOH. Portion of DSS condemnation # 075-033 A (effective 20160711).	5A	PCB in Fish Tissue	2006	L	0.034
VAT-C10E_HLD02A06 / Holdens Creek - Lower / Located southeast of Joeys Neck area. From 0.5 mi downstream of station @ 7-HLD002.67 downstream to mouth. Portion of CBP segment POCOH. Portion of DSS shellfish condemnation # 075-033 A (effective 20160711).	5A	PCB in Fish Tissue	2006	L	0.050

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Chesapeake Bay/Atlantic/Small Coastal Basins

VAT-C10E_HUN01A00 / Hunting Creek - Upper / W of Hopkins. Upper portion, from end of tidal waters downstream to end of DSS condemnation (downstream of Town of Hopkins). CBP segment POCMH. DSS shellfish direct harvesting condemnation # 077-138 B (effective 20150708).	5A	PCB in Fish Tissue	2006	L	0.168
VAT-C10E_HUN02A06 / Hunting Creek - Lower / West of Town of Hopkins. Lower portion of creek, from end of DSS condemnation downstream to mouth. Portion of CBP segment POCMH. DSS (OPEN) shellfish direct harvesting condemnation # 077-138 (effective 20150708).	5A	PCB in Fish Tissue	2006	L	0.674
VAT-C10E_ISB01A06 / Island Bay - [No DSS] / Between Russell Island & Long Ridge area. Portion of CBP segment CB7PH. No DSS shellfish direct harvesting condemnations.	5A	PCB in Fish Tissue	2006	L	0.953
VAT-C10E_MES01A06 / Messongo Creek - Upper / Located southeast of Marsh Market & start of Rec TMDL (213) . Running parallel with Rt 692 upstream to the end of tidal waters. POCMH. Upstream portion of DSS shellfish condemnation # 076-167 A (effective 20160711).	5A	PCB in Fish Tissue	2006	L	0.042
VAT-C10E_MES02A06 / Messongo Creek - Middle [TMDL-732] / South of Town of Belinda. Portion of CBP segment POCMH. TMDL P# 732- SF. DSS Condemnation # 076-167 (effective 20160711).	5A	PCB in Fish Tissue	2006	L	0.156
VAT-C10E_MES02B08 / Messongo Creek - Middle [No TMDL] / Located south of Saxis and Belinda Rd intersection. Portion of CBP segment POCMH. DSS OPEN condemnation # 076-167 (effective 20160711).	5A	PCB in Fish Tissue	2006	L	0.093
VAT-C10E_MES03A06 / Messongo Creek - Lower / Located south of Saxis and Belinda Rd intersection downstream to the mouth. Portion of CBP segment POCMH. No DSS shellfish direct harvesting condemnation.	5A	PCB in Fish Tissue	2006	L	1.106
VAT-C10E_MUD01A04 / Muddy Creek - Upper / Located southeast of Byrds Marsh and northeast of Town of Bloxom. From end of tidal waters downstream to Poulson Pt. Portion of CBP segment POCMH. DSS shellfish condemnation # 076-176 B(effective 20160711).	5A	PCB in Fish Tissue	2006	L	0.301
VAT-C10E_MUD02A06 / Muddy Creek - Lower / Located southeast of Byrds Marsh and northeast of Town of Bloxom. Lower portion of creek, Pettigrew Bend to end of DSS Open condemnation. Portion of CBP segment POCMH. DSS shellfish OPEN condemnation # 076-176 (effective 20160711).	5A	PCB in Fish Tissue	2006	L	0.048
VAT-C10E_MUD03A08 / Muddy Creek - Lower [No DSS] / Located southeast of Byrds Marsh and northeast of Town of Bloxom. Lower portion of creek, from end of DSS condemnation downstream to mouth. Portion of CBP segment POCMH. No DSS shellfish direct harvesting condemnation.	5A	PCB in Fish Tissue	2006	L	0.060
VAT-C10E_POC01A08 / Pocomoke Sound - Lower [C10 portion] / Pocomoke Sound downstream of the Pocomoke River (VA portion). Area adjacent to Holdens Creek. Portion of CBP segment POCOH. Portion of DSS shellfish direct harvesting condemnation # 075-033 A (effective 20131023).	5A	PCB in Fish Tissue	2006	L	1.452
VAT-C10E_STR01A08 / Starling Creek / Located on Saxis Island, southwest of Pocomoke Sound. Embayment at town of Saxis. From end of tidal waters downstream to end of DSS condemnation. Portion of CBP segment POCMH. DSS shellfish direct harvesting condemnation # 075-118 M1 (effective 20111102).	5A	PCB in Fish Tissue	2006	L	0.091
VAT-C10E_YOU01A06 / Young Creek / Northeast of Town of	5A	PCB in Fish Tissue	2006	L	0.243

Guilford and south of Jobes Island. Portion of CBP segment POCMH. DSS (OPEN) shellfish direct harvesting condemnation # 076-176 (effective 20120810).					
VAT-C10E_ZZZ01A06 / Unsegmented Bay Waters in C10E-CB7PH. / Evaluated non-segmented Bay Waters in C10E not contained within VACB-R01E-CB7S. Portion of CBP segment CB7PH. No DSS shellfish direct harvesting condemnations.	5A	PCB in Fish Tissue	2006	L	1.415
VAT-C10E_ZZZ02A06 / Unsegmented estuaries in C10E-POCMH [No DSS] / Evaluated non-segmented portions of C10E not contained within VACB-R01E-CB7S. Portion of CBP segment POCMH. No DSS shellfish direct harvesting condemnation area identified.	5A	PCB in Fish Tissue	2006	L	2.975
VAT-C10E_ZZZ02B10 / Unsegmented Bay Waters in C10E-POCMH - Doe Cr / Non-segmented portions of Bay Waters in C10E-POCMH. DSS (OPEN) shellfish direct harvesting condemnation area # 077-138 (201520708).	5A	PCB in Fish Tissue	2006	L	0.365
VAT-C11E_CED01A00 / Cedar Creek / Entire estuarine portion of creek. North shore tributary of Onancock Creek. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 080-013 C (effective 20131120).	5A	PCB in Fish Tissue	2006	L	0.063
VAT-C11E_CSX01A00 / Chesconessex Creek - South Br. - Upper / South of Chesconessex and northwest of Onancock. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 079-112 A (effective 20150708).	5A	PCB in Fish Tissue	2006	L	0.109
VAT-C11E_CSX01B10 / Chesconessex Creek - South Br. - Middle / South of Chesconessex and northwest of Onancock. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 079-112 OPEN(effective 20150708).	5A	PCB in Fish Tissue	2006	L	0.100
VAT-C11E_CSX02A06 / Chesconessex Creek - N. Branch / Lower portion of Creek, including tidal tribs., from the end DSS condemnation # 079-112 downstream to mouth. Portion of CBP segment CB7PH. Part of area contains no DSS Condemnation remainder is OPEN 079-112 (20150708).	5A	PCB in Fish Tissue	2006	L	1.832
VAT-C11E_CSX02B10 / Chesconessex Creek - N. Branch / North Branch portion of creek at marina area. DSS Admin condemnation # 079-112 B (effective 20150708). Portion of CBP segment CB7PH.	5A	PCB in Fish Tissue	2006	L	0.030
VAT-C11E_FNN01A00 / Finneys Creek - Upper / East of Bailey Neck area. South shore tributary of Onancock Creek. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 080-013 B (effective 20131120).	5A	PCB in Fish Tissue	2006	L	0.069
VAT-C11E_FNN02A00 / Finneys Creek - Lower / East of Bailey Neck area. South shore tributary of Onancock Creek. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 080-013 (effective 20131120).	5A	PCB in Fish Tissue	2006	L	0.119
VAT-C11E_LTH01A00 / Leatherberry Creek / Entire estuarine portion of creek. South shore tributary of Onancock Creek. Portion of CBP segment CB7PH. Portion of DSS (Admin Cond) shellfish condemnation # 081-013 A (effective 20131120).	5A	PCB in Fish Tissue	2006	L	0.070
VAT-C11E_MTC01A06 / Matchotank Creek - Upper / South of Broadway Neck area. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 080-169 (effective 20071219).	5A	PCB in Fish Tissue	2006	L	0.069
VAT-C11E_MTC02A06 / Matchotank Creek - Lower / South of Broadway Neck area. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 080-169 (effective	5A	PCB in Fish Tissue	2006	L	0.116

20071219) & no DSS area identified.					
VAT-C11E_OCB01A00 / Central Branch, Onancock Creek / CBP segment CB7PH. Portion of DSS (Admin Cond) shellfish condemnation # 080-013 A (effective 20131120).	5A	PCB in Fish Tissue	2006	L	0.018
VAT-C11E_OCN01A04 / Onancock Creek Mainstem - Upper [Admin Cond] / Near Town of Onancock. From junction of N, Central & S Brs downstream to end of DSS condemnation (by Finneys Wharf. CBP segment CB7PH. Portion of DSS (Admin Cond) shellfish condemnation # 080-013 A (effective 20131120).	5A	PCB in Fish Tissue	2006	L	0.129
VAT-C11E_OCN01C10 / Onancock Creek Mainstem - Upper / Near Town of Onancock. From junction of N, Central & S Brs downstream to end of DSS condemnation near Finneys Wharf. CBP segment CB7PH. Portion of DSS shellfish condemnation # 081-013 (effective 20131120).	5A	PCB in Fish Tissue	2006	L	0.097
VAT-C11E_OCN02A04 / Onancock Creek Mainstem - Lower / East of Bailey Neck area. Mainstem of Onancock Creek- lower. From Finneys Wharf downstream to mouth. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 080-013 (effective 20131120).	5A	PCB in Fish Tissue	2006	L	1.953
VAT-C11E_OCN02B08 / Onancock Creek Mainstem - Poplar Cove / East of Bailey Neck area. Mainstem of Onancock Creek. Marina in area of Poplar Cove. Portion of CBP segment CB7PH. DSS (SEASONAL) shellfish direct harvesting condemnation # 080-013 M2 (effective 20131120).	5A	PCB in Fish Tissue	2006	L	0.016
VAT-C11E_ONB01A02 / North Branch, Onancock Creek / Located near Town of Onancock. Entire North Branch, Onancock Creek. CBP segment CB7PH. DSS shellfish condemnation (Admin Cond-PROHIBITION) # 081-013 D (effective 20131120).	5A	PCB in Fish Tissue	2006	L	0.021
VAT-C11E_OSB01A02 / Southern Branch, Onancock Creek / Near Town of Onancock. Entire Southern Branch Onancock Creek. CBP segment CB7PH. Portion of DSS (Admin Cond) shellfish condemnation # 081-013 A (effective 20131120).	5A	PCB in Fish Tissue	2006	L	0.058
VAT-C11E_PRK01A08 / Parkers Creek - Upper / South shore tributary of Onancock Creek at Finneys Neck. Upstream portion of creek. Portion of CBP segment CB7PH. DSS shellfish OPEN direct harvesting condemnation # 080-013 (effective 20131120).	5A	PCB in Fish Tissue	2006	L	0.035
VAT-C11E_PRK02A08 / Parkers Creek - Middle / South shore tributary of Onancock Creek at Finneys Neck. Middle portion of creek. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 080-013 (effective 20131120).	5A	PCB in Fish Tissue	2006	L	0.041
VAT-C11E_PRK03A08 / Parkers Creek - Lower / South shore tributary of Onancock Creek at Finneys Neck. Area around marina at mouth of Parkers Creek. Portion of CBP segment CB7PH. DSS shellfish seasonal condemnation # 080-013 M1 (effective 20131120).	5A	PCB in Fish Tissue	2006	L	0.086
VAT-C11E_TAR01A06 / Tarkill Creek / Located in Sluitkill Neck area. Portion of CBP segment CB7PH. No DSS shellfish direct harvesting condemnation identified.	5A	PCB in Fish Tissue	2006	L	0.190
VAT-C11E_ZZZ01A00 / Unsegmented estuaries in C11E. / Evaluated non segmented portions of C11E not contained within VACB-R01E-CB7S. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 080-013 (20131120).	5A	PCB in Fish Tissue	2006	L	1.538
VAT-C12E_PUN01A06 / Pungoteague Creek - Upper / W of Melfa. Upper portion of Pungoteague Cr. from the end of tidal waters	5A	PCB in Fish Tissue	2006	L	0.232

downstream to Boggs Wharf and Route 634. CBP segment CB7PH. DSS condemnation # 081-119 B (effective 20130325).					
VAT-C12E_PUN01B16 / Pungoteague Creek - Middle-Upper / W of Melfa. Upper portion of Pungoteague Cr. from the Boggs Warf to Horse Hole Creek. CBP segment CB7PH. DSS OPEN condemnation OPEN # 081-119 (effective 20160401).	5A	PCB in Fish Tissue	2006	L	0.262
VAT-C12E_PUN02A06 / Pungoteague Creek - Lower / Located west of Town of Melfa. Lower portion of Pungoteague Cr. from Horse Hole Creek downstream to mouth. Portion of CBP segment CB7PH. DSS OPEN shellfish direct harvesting condemnation # 081-119 (effective 20160401).	5A	PCB in Fish Tissue	2006	L	1.186
VAT-C12E_TAY01A06 / Taylor Creek / Located southwest of Harborton. From the end of tidal waters downstream Route 628 and Eastern Shore Yacht Club. Portion of CBP segment CB7PH. Portion of DSS condemnation # 081-119 C (effective 20160401).	5A	PCB in Fish Tissue	2006	L	0.130
VAT-C12E_TAY02A14 / Taylor Creek- Mouth / Located southwest of Harborton. From Route 628 and Eastern Shore Yacht Club to Puncoteague confluence. Portion of CBP segment CB7PH. Portion of DSS condemnation # 081-119 OPEN &M1 (effective 20160401).	5A	PCB in Fish Tissue	2006	L	0.035
VAT-C12E_UNR01A06 / Underhill Creek / In area of Mount Nebo. North shore tributary to Pungoteague Cr. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 081-119 A (effective 20160401).	5A	PCB in Fish Tissue	2006	L	0.070
VAT-C12E_WRP01A06 / Warehouse Prong - Upper / Located north of Bobtown and east of Boggs Wharf. Upper portion, from headwaters to confluence with UT. Portion of CBP segment CB7PH. Portion of DSS (Admin Cond) condemnation # 081-119 D (effective 20160401).	5A	PCB in Fish Tissue	2006	L	0.042
VAT-C12E_WRP02A06 / Warehouse Prong - Lower / Located north of Bobtown and east of Boggs Wharf. Lower portion, from confluence with UT downstream to confluence with Pungoteague Cr. Portion of CBP segment CB7PH. DSS (Admin Cond) condemnation # 081-119 B (effective 20160401).	5A	PCB in Fish Tissue	2006	L	0.054
VAT-C12E_ZZZ01A00 / Unsegmented Bay Waters in C12E. / Evaluated non segmented portions of C12E, UT south of Pungoteague Cr. Portion of CBP segment CB7PH. No DSS shellfish direct harvesting condemnation identified.	5A	PCB in Fish Tissue	2006	L	0.002
VAT-C13E_BCE01A08 / Back Creek / Southwest of Fairview Neck area. North shore tributary of Nandua Cr. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 082-160 (effective 20160330).	5A	PCB in Fish Tissue	2006	L	0.141
VAT-C13E_BOS01A08 / Boggs Gut / Southwest of Fairview Neck area. South shore tributary of Nandua Cr. near mouth. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 082-160 (effective 20160330).	5A	PCB in Fish Tissue	2006	L	0.034
VAT-C13E_CHC01A00 / Church Creek / In area of Elliotts Neck. Tributary to Nassawadox Creek. Portion of CBP segment CB7PH. DSS OPEN shellfish direct harvesting condemnation # 085-185 (effective 20161013).	5A	PCB in Fish Tissue	2006	L	0.430
VAT-C13E_CHC01B16 / Church Creek -Upper / In area of Elliotts Neck. Tributary to Nassawadox Creek, upstream portion of Church Creek. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 085-185 B (effective 20161013).	5A	PCB in Fish Tissue	2006	L	0.108
VAT-C13E_CHC01C10 / Church Creek - Middle- UT North Cove / In	5A	PCB in Fish Tissue	2006	L	0.059

area of Elliotts Neck. Tributary to Church Creek - Middle, UT North Cove. Portion of CBP segment CB7PH. DSS shellfish harvesting condemnation # 085-185 A (effective 20161013).					
VAT-C13E_CRA01A06 / Craddock Creek - Upper [TMDL-bact.] / From end of tidal waters downstream to end of shellfish condemnation (area of TMDL-bact 6/07). Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 083-195 A (effective 20121210).	5A	PCB in Fish Tissue	2006	L	0.082
VAT-C13E_CRA02A08 / Craddock Creek - Lower and UT / Most of Craddock Cr. excluding SF condemnation in upper creek. Including all tribs. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 083-195 (effective 20121210).	5A	PCB in Fish Tissue	2006	L	0.911
VAT-C13E_CRR01A08 / Curratuck Creek / Southwest of Fairview Neck area. Lower south shore tributary of middle Nandua Cr. near mouth. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 082-160 (effective 20160330).	5A	PCB in Fish Tissue	2006	L	0.277
VAT-C13E_HGC01A06 / Holly Grove Cove / Located near Wellington Neck. From end of tidal waters downstream to mouth. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 085-110 E (effective 20161013).	5A	PCB in Fish Tissue	2006	L	0.143
VAT-C13E_KLL01A06 / Kelley Cove / From end of tidal waters downstream to confluence with Nassawadox Cr. (area of TMDL-bact 6/07). Portion of CBP segment CB7PH. Portion of DSS shellfish direct harvesting condemnation # 085-110 D (effective 201610137).	5A	PCB in Fish Tissue	2006	L	0.026
VAT-C13E_MAG01A08 / McLean Gut - Upper / Southwest of Fairview Neck area. Middle south shore tributary of middle Nandua Cr. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 082-160 B (effective 20160330).	5A	PCB in Fish Tissue	2006	L	0.038
VAT-C13E_MAG02A08 / McLean Gut - Lower / Southwest of Fairview Neck area. Middle south shore tributary of middle Nandua Cr. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 082-160 (effective 20160330).	5A	PCB in Fish Tissue	2006	L	0.032
VAT-C13E_NAN01A00 / Nandua Creek - Upper [TMDL-bact.] / Southeast of Hacks Neck area. The two most upstream branches of Nandua Creek, incl. Kusian Cove. Portion of CBP segment CB7PH. DSS condemnation # 082-160 A&C (effective 20160330).	5A	PCB in Fish Tissue	2006	L	0.144
VAT-C13E_NAN01B08 / Nandua Creek - Lower Upper / Southwest of Fairview Neck area. North shore tributary of Nandua Cr. near mouth. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 082-160 (effective 20160330).	5A	PCB in Fish Tissue	2006	L	0.223
VAT-C13E_NAN02A06 / Nandua Creek - Lower / Lower portion of Nandua Creek including unsegmented tidal tribs., from the confluence of Boggs Gut downstream to mouth (RM 0.0). Portion of CBP segment CB7PH. No DSS shellfish direct harvesting condemnation identified.	5A	PCB in Fish Tissue	2006	L	3.150
VAT-C13E_NSS01A06 / Nassawadox Creek - Upper [TMDL-bact.] / From end of tidal waters downstream to confluence with Kelly Cove (RM 5.2) area of TMDL-bact 6/07. Portion of CBP segment CB7PH. Portion of DSS shellfish direct harvesting condemnation # 085-110 B (effective 20161013).	5A	PCB in Fish Tissue	2006	L	0.205
VAT-C13E_NSS01B08 / Nassawadox Creek - Upper / From confluence with Kelly Cove (RM 5.2) downstream to mainstem (outside of area of TMDL-bact 6/07). Portion of CBP segment CB7PH. Portion of DSS (OPEN) shellfish direct harvesting condemnation # 085-110 (effective 20161013).	5A	PCB in Fish Tissue	2006	L	0.169

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

Chesapeake Bay/Atlantic/Small Coastal Basins

VAT-C13E_NSS02A06 / Nassawadox Creek - Lower / Mainstem of lower portion of creek to mouth. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 085-110 & 085-185 (effective 20161013).	5A	PCB in Fish Tissue	2006	L	2.121
VAT-C13E_NSS03A08 / Nassawadox Creek - Middle, N. Shore Tribs / Occohannock Neck Area. North Shore UTs to lower-middle mainstem Nassawadox. Portion of CBP segment CB7PH. Portion of DSS shellfish direct harvesting condemnation # 085-110 A &C(effective 20161013).	5A	PCB in Fish Tissue	2006	L	0.126
VAT-C13E_OCH01A06 / Occohannock Creek - Upper / Upper portion of Occohannock Creek and tidal tribs., from end of tidal waters downstream to the confluence of Wescott Cove (RM 5.3). Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 084-043 A (effective 2016116).	5A	PCB in Fish Tissue	2006	L	0.538
VAT-C13E_OCH02A06 / Occohannock Creek - Lower / Lower portion of Occohannock Creek and tidal tribs., from downstream of Youngs Pt. to mouth (RM 0.0). Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 084-043 (effective 20161116).	5A	PCB in Fish Tissue	2006	L	2.469
VAT-C13E_OCH02B08 / Occohannock Creek - Middle Marina Area / In middle portion of Occohannock Creek, marina area of Davis Wharf. Portion of CBP segment CB7PH. DSS SEASONAL shellfish direct harvesting condemnation # 084-043 M1 (effective 20161116).	5A	PCB in Fish Tissue	2006	L	0.034
VAT-C13E_OCH03A08 / Shields Cove & Fisher Cove / West of Belle Haven area. North and South shore tributaries of Occohannock Cr., NW of Youngs Pt. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 084-043 B & C (effective 20161116).	5A	PCB in Fish Tissue	2006	L	0.087
VAT-C13E_WHC01A06 / Warehouse Creek - Upper / Southeast fork of upper portion of creek. Portion of CBP segment CB7PH. DSS ADMIN-PROHIB shellfish direct harvesting condemnation # 085-110 F (effective 20161013) (VPDES outfall condemnation for Shore Memorial Hospital STP VA0027537).	5A	PCB in Fish Tissue	2006	L	0.032
VAT-C13E_WHC01B10 / Warehouse Creek - Upper Middle (Admin Cond) / Including northern fork and continuing downstream to bend near Wellington Neck. Portion of CBP segment CB7PH. DSS (Admin Cond) shellfish direct harvesting condemnation # 085-110C (effective 20161013).	5A	PCB in Fish Tissue	2006	L	0.166
VAT-C13E_WHC02A06 / Warehouse Creek - Lower / Including bend near Wellington Neck to mouth. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 085-110 (effective 20161013).	5A	PCB in Fish Tissue	2006	L	0.246
VAT-C13E_ZZZ01A00 / Unsegmented estuaries in C13E. / Evaluated non segmented portions of C13E. Portion of CBP segment CB7PH. No DSS shellfish direct harvesting condemnation identified.	5A	PCB in Fish Tissue	2006	L	0.752
VAT-C14E_BRL01A06 / Barlow Creek / In area of Old Town Neck. South shore tributary to lower Mattawoman Cr. Portion of CBP segment CB7PH. DSS OPEN shellfish direct harvesting condemnation # 086-136 (effective 20150827).	5A	PCB in Fish Tissue	2006	L	0.049
VAT-C14E_HUG01A00 / Hungars Creek - Upper / Upper portion of Hungars Creek from end tidal waters downstream to Waterford Point (RM 1.8) @ confluence with Jacobus Cr. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 086-136 A (effective 20150827).	5A	PCB in Fish Tissue	2006	L	0.138

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

Chesapeake Bay/Atlantic/Small Coastal Basins

VAT-C14E_HUG02A00 / Hungars Creek - Lower / Lower portion of Hungars Creek from Waterford Point (RM 1.8) @ confluence with Jacobus Cr. downstream to mouth. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 086-136 (effective 20150827).	5A	PCB in Fish Tissue	2006	L	1.187
VAT-C14E_HUG02B12 / UT to Hungars Creek / Northern trib between Great Neck and Sparrow Point. Restricted portion of SF. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 086-136 E (effective 20150827).	5A	PCB in Fish Tissue	2006	L	0.039
VAT-C14E_HUG02C14 / Hungars Creek - Northern Trib / Lower portion of Hungars Creek, Trib north of the mouth. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 086-136 D (effective 20150827).	5A	PCB in Fish Tissue	2006	L	0.073
VAT-C14E_JAC01A06 / Jacobus Creek - Upper South Fork / West of Johnsontown. Trib to Hungars Cr. Uppermost portion of south branch. Portion of CBP segment CB7PH. DSS (Admin - Prohibition) due to STP VA0023817 Outfall) shellfish direct harvesting condemnation # 086-136F (effective 20150827).	5A	PCB in Fish Tissue	2006	L	0.028
VAT-C14E_JAC02A06 / Jacobus Creek - Upper Forks / West of Johnsontown. Trib to Hungars Cr. Middle mainstem, north fork and lower portion of south fork. Portion of CBP segment CB7PH. DSS (Admin Cond) shellfish direct harvesting condemnation # 086-136 B (effective 20150827).	5A	PCB in Fish Tissue	2006	L	0.152
VAT-C14E_JAC03A06 / Jacobus Creek - Lower / West of Johnsontown. South shore trib. to Hungars Cr. Lower mainstem portion. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 086-136 (effective 20150827).	5A	PCB in Fish Tissue	2006	L	0.187
VAT-C14E_MAT01A06 / Mattawoman Creek - Upper / South of Wilsonia Neck. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 086-136 C (effective 20150827).	5A	PCB in Fish Tissue	2006	L	0.155
VAT-C14E_MAT02A10 / Mattawoman Creek - Lower / South of Wilsonia Neck - mouth of Mattawoman Cr. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 086-136 (effective 20150827).	5A	PCB in Fish Tissue	2006	L	0.357
VAT-C14E_THG01A06 / The Gulf - Upper / From end of tidal waters downstream to narrowing 0.45 mi. from mouth. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 087-174 A (effective 20150827).	5A	PCB in Fish Tissue	2006	L	0.090
VAT-C14E_THG02A06 / The Gulf - Lower / From narrowing 0.45 mi. from mouth downstream to mouth. Portion of CBP segment CB7PH. DSS (OPEN) shellfish condemnation # 087-174 (20150827) & no DSS.	5A	PCB in Fish Tissue	2006	L	0.204
VAT-C14E_WHS01A06 / Westerhouse Creek - North Branch& Upper Middle [TMDL] / In Church Neck area, west of Bridgetown. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 085-199 (20161013).	5A	PCB in Fish Tissue	2006	L	0.243
VAT-C14E_WHS02A06 / Westerhouse Creek - Upper South Branch [TMDL] / In Church Neck area, west of Bridgetown. Upper portion of Westerhouse Creek South Branch. Portion of CBP segment CB7PH. Portion DSS shellfish direct harvesting condemnation # 085-199 A (effective 20130924).	5A	PCB in Fish Tissue	2006	L	0.019
VAT-C14E_ZZZ01A00 / Unsegmented estuaries in C14E. / Evaluated non segmented portions of C14E - mouth of Matchotank & Hungars Crs. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 086-136.	5A	PCB in Fish Tissue	2006	L	0.838

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

Chesapeake Bay/Atlantic/Small Coastal Basins

VAT-C15E_CCB01A06 / Cape Charles Beach / Located west of Town of Cape Charles, along Chesapeake Bay. Portion of CBP segment CB7PH. DSS (Administrative) shellfish harvesting condemnation 089-011 A (effective 20051202) which is present.	5A	PCB in Fish Tissue	2006	L	0.079
VAT-C15E_CRS01A06 / Cherrystone Inlet - Upper / From Eyreville Neck end of tidal waters downstream to confluence with Chesapeake Bay. Including Old Castle Cr. Portion of CBP segment CB7PH. DSS OPEN shellfish direct harvesting condemnation # 088-139 (20161227).	5A	PCB in Fish Tissue	2006	L	2.381
VAT-C15E_CRS01B18 / Cherrystone Inlet - Eyrehall Cr / SE trib to Cherryston Inlet. Portion of CBP segment CB7PH. DSS Restricted shellfish direct harvesting condemnation # 088-139 B(20161227).	5A	PCB in Fish Tissue	2006	L	0.103
VAT-C15E_KNS01A00 / Kings Creek - Upper Forks and Middle / From end of tidal waters downstream 0.16 mi. past confluence of the two most upstream forks. Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 088-139 A (20161227).	5A	PCB in Fish Tissue	2006	L	0.093
VAT-C15E_KNS03A08 / Kings Creek - Lower Middle / From start of DSS marina area downstream to Cherrystone. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 088-139 (20161227) &Seasonal Condemnation M1.	5A	PCB in Fish Tissue	2006	L	0.247
VAT-C15E_ZZZ01A08 / Unsegmented estuaries in C15E. / Evaluated non segmented portions of C15E. Portion of CBP segment CB7PH. No DSS shellfish direct harvesting condemnation identified.	5A	PCB in Fish Tissue	2006	L	0.587
VAT-C16E_CCH01A04 / Cape Charles Harbor - Upper / From most upstream end of harbor downstream to 1/2 distance to mouth (RM 0.23). Portion of CBP segment CB7PH. DSS ADMINISTRATIVE shellfish harvesting condemnation # 089-011 B (effective 20051202) (VPDES outfall Town of Cape Charles STP VA0021288).	5A	PCB in Fish Tissue	2006	L	0.056
VAT-C16E_CCH02A00 / Cape Charles Harbor - Lower / From 1/2 distance to mouth (RM 0.23) downstream to mouth. Portion of CBP segment CB7PH. DSS ADMINISTRATIVE shellfish harvesting condemnation # 089-011 A (effective 20051202) (VPDES outfall Town of Cape Charles STP VA0021288).	5A	PCB in Fish Tissue	2006	L	0.060
VAT-C16E_KPT01A06 / Kiptopeke Beach / Located west of Cedar Grove, along Chesapeake Bay, near southern tip of Eastern Shore. Portion of CBP segment CB7PH. No DSS shellfish direct harvesting condemnation present.	5A	PCB in Fish Tissue	2006	L	0.044
VAT-C16E_OPC01A06 / Old Plantation Creek - Upper [TMDL-bact] / Upper portion of Old Plantation Creek within TMDL-Bact (33771). CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 090-152 A (effective 20151222).	5A	PCB in Fish Tissue	2006	L	0.044
VAT-C16E_OPC01B08 / Old Plantation Creek - Upper [No TMDL-bact] / Upper portion of Old Plantation Creek and one southeast embayment not within TMDL-Bact (33771). Portion of CBP segment CB7PH. DSS shellfish direct harvesting condemnation # 090-152 A (effective 20151222).	5A	PCB in Fish Tissue	2006	L	0.152
VAT-C16E_OPC02A00 / Old Plantation Creek - Lower / Lower portion of Old Plantation Creek, from approx. Red Bank (RM 2.0) downstream to mouth. Portion of CBP segment CB7PH. DSS (OPEN) shellfish direct harvesting condemnation # 090-152 (20151222).	5A	PCB in Fish Tissue	2006	L	0.926
VAT-C16E_ZZZ01A00 / Unsegmented estuaries in C16E. / Evaluated non segmented portions of C16E. Portion of CBP segment CB7PH. No DSS shellfish direct harvesting condemnation identified.	5A	PCB in Fish Tissue	2006	L	0.146

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

Chesapeake Bay/Atlantic/Small Coastal Basins

Chesapeake Bay and Tidal Tributaries

Fish Consumption

	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
PCB in Fish Tissue - Total Impaired Size by Water Type:	**1,826.332**		

Sources:

Source Unknown

Fact Sheets for Impaired (Category 4 or 5) Waters in 2018

Chesapeake Bay/Atlantic/Small Coastal Basins

***Cause Group Code:* CB8PH-SAV-BAY Chesapeake Bay segment CB8PH**

Cause Location: This cause encompasses the complete CPB segment CB8PH.

City / County: Chesapeake Bay - Countywide. Hampton City Not Applicable. Norfolk City Virginia Beach City

Use(s): Aquatic Life Shallow-Water Submerged Aquatic Vegetation

Cause(s) / VA Category: Aquatic Plants (Macrophytes) / 4A

The acres of submerged aquatic vegetation (SAV) mapped through aerial surveys do not meet the criteria. Submerged Aquatic Vegetation acres goal is 10 acres. Aerial analysis of SAV over the three most recent years of data indicate segment has attained 61% of this goal. There is insufficient data to assess the water clarity criteria.

Assessment Unit / Water Name / Location Desc.	Cause Category	Cause Name	Cycle First Listed	TMDL Dev. Priority	Water Size
VACB-R01E-04DE / Chesapeake Bay - S. Thimble Island BSS Condemnation #163 / Va Dept of Health Shellfish zone #163. Open to shellfish harvesting as of 4/25/2007. S. Thimble Island. HUC: 02080101	4A	Aquatic Plants (Macrophytes)	2006	L	0.027
VACB-R01E-04EE / Chesapeake Bay - Off Little Creek BSS #068-017, Section C. / Va Dept of Health Shellfish (administrative) closure #068-017, A portion of section C. Off Little Creek. HUC: 02080101.[effective 2005-3-08]	4A	Aquatic Plants (Macrophytes)	2006	L	0.540
VACB-R01E-04GE / Chesapeake Bay - Off Little Creek BSS #068-017, Areas A & B / Va Dept of Health Shellfish (administrative) closure #068-017, Off Little Creek, Sections A and B. HUC: 02080101.[effective 2005-3-08]	4A	Aquatic Plants (Macrophytes)	2006	L	1.355
VACB-R01E-CB8 / Chesapeake Bay - CBP Segment CB8PH / This assessment unit is the mainstem portion of Chesapeake Bay Program segment CB8PH, located in the Virginia Chesapeake Bay between the mouths of the James River and mouth of Chesapeake Bay. HUC: 02080101.	4A	Aquatic Plants (Macrophytes)	2006	L	141.796
VAT-C07E_BCB01A06 / Buckroe Beaches / From northeast of Buckroe Beach southwest to parallel with start of Mill Cr. Portion of CBP Segment CB8PH. No DSS shellfish condemnations.	4A	Aquatic Plants (Macrophytes)	2006	L	0.224
VAT-C07E_FMB01A12 / Fort Monroe Beaches / All of Fort Monroe Beach from the start of Mill Cr south to Lighthouse Old Point Comfort. Portion of CBP Segment CB8PH. No DSS shellfish condemnations.	4A	Aquatic Plants (Macrophytes)	2006	L	0.333
VAT-C07E_GRV01A06 / Grandview Pier & Saltponds Beaches / From Grandview beach southwest to northeast of Buckroe Beach. Offshore of Buckroe Beach VDH monitoring. area Portion of CBP Segment CB8PH. No DSS shellfish condemnation present.	4A	Aquatic Plants (Macrophytes)	2006	L	0.241
VAT-C07E_GRV02A10 / Grandview Pier & Saltponds Beaches [No TMDL] / From southernmost point of Grandview Beach southwest to northeast of Buckroe Beach. Shoreward of GRV01A06. Portion of CBP Segment CB8PH. DSS ADMIN shellfish condemnation # 055-216 A (effective 20080530).	4A	Aquatic Plants (Macrophytes)	2006	L	0.119
VAT-C08E_CBB01A06 / 13th View Beach / Located along Chesapeake Bay, in Norfolk. Portion of CBP segment CB8PH. No DSS shellfish direct harvesting condemnations present.	4A	Aquatic Plants (Macrophytes)	2006	L	0.353
VAT-C08E_CBB01B14 / Sara Constance Park and Ocean View Park Beaches / Located along Chesapeake Bay, in Norfolk. Portion of CBP segment CB8PH. No DSS shellfish direct harvesting	4A	Aquatic Plants (Macrophytes)	2006	L	0.140

condemnations present.

VAT-C08E_CBB01C16 / 10th View Beach / Located along Chesapeake Bay, in cities of Norfolk and Virginia Beach. Portion of CBP segment CB8PH. No DSS shellfish direct harvesting condemnations present.	4A	Aquatic Plants (Macrophytes)	2006	L	0.152
VAT-C08E_CBB02A16 / Ches Bay Beaches / Located along Chesapeake Bay, in cities of Norfolk and Virginia Beach. Portion of CBP segment CB8PH. No DSS shellfish direct harvesting condemnations present.	4A	Aquatic Plants (Macrophytes)	2006	L	0.675
VAT-C08E_CBB03A16 / Chicks Beach / Located along Chesapeake Bay near Chesapeake Bay Bridge Tunnel, in cities of Norfolk and Virginia Beach. Portion of CBP segment CB8PH. No DSS shellfish direct harvesting condemnations present.	4A	Aquatic Plants (Macrophytes)	2006	L	0.433
VAT-C08E_CBB04A16 / Shore Drive Beaches -East / Located along Chesapeake Bay, Virginia Beach. Portion of CBP segment CB8PH. No DSS shellfish direct harvesting condemnations present.	4A	Aquatic Plants (Macrophytes)	2006	L	1.041
VAT-C08E_LCC01A08 / Little Creek & Harbor / Entire area of Little Creek and upper portion of Little Creek Harbor. From headwaters of Little Cr. downstream to lower portion of Harbor at mouth of Bay. CBP segment CB8PH. DSS (ADMINISTRATIVE) condemnation # 068-017 C (effective 20050308).	4A	Aquatic Plants (Macrophytes)	2006	L	1.064

Chesapeake Bay segment CB8PH	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
Shallow-Water Submerged Aquatic Vegetation			
Aquatic Plants (Macrophytes) - Total Impaired Size by Water Type:	**148.492**		

Sources:

Agriculture	Atmospheric Deposition - Nitrogen	Clean Sediments	Industrial Point Source Discharge
Internal Nutrient Recycling	Loss of Riparian Habitat	Municipal Point Source Discharges	Non-Point Source
Sediment Resuspension (Clean Sediment)	Source Unknown	Sources Outside State Jurisdiction or Borders	Wet Weather Discharges (Non-Point Source)
Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO)			

Appendix I

SWPPP Amendments, Modifications and Updates

SWPPP Amendment, Modification and Update Log

Documentation of SWPPP amendment, modification, or update must be noted and retained with the SWPPP as required by the General VPDES Permit for Discharges of Stormwater from Construction Activities. The operator shall record these actions according to Part II B of the Permit.

SWPPP Amendment, Modification and Update Log

Date	Description of Amendment, Modification, or Update
Responsible Party	_____
Responsible Party	_____
Responsible Party	_____
Responsible Party	_____

"I certify under penalty of law that I have read and understand this document in accordance with the General VPDES Permit for Discharges of Stormwater from Construction Activities. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."
Operator or Delegated Authority Signature

Appendix J

Environmental Documents

WETLAND DELINEATION

The project area does not include any the waters of the U.S. or surrounding wetlands within the construction limits. No impacts to these wetlands are anticipated.