Fairfax Water

8560 Arlington Boulevard
Fairfax, Virginia 22031
www.fairfaxwater.org

CONSTRUCTION PRACTICE MANUAL

WATER MAIN INSTALLATION SPECIFICATIONS FOR DEVELOPERS

February 2025

SECTION 00010

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INTRODUCTION AND DEFINITIONS

INTRODUCTION

The Fairfax Water Construction Practice Manual establishes the technical requirements for construction of water mains to be owned, operated and maintained by Fairfax Water; and provides contractors and developers with a set of guidelines to ensure conformance with Fairfax Water's construction principles. Although the goal of this manual is to be comprehensive, it is understood that a unique situation may arise requiring a modification of Fairfax Water's standard construction. Final acceptance of any system, including variances from and exceptions to these guidelines when deemed appropriate, is ultimately at the direction and discretion of Fairfax Water. This manual is a supplemental reference, to be used in conjunction with Fairfax Water's Approved Products List, Standard Details, the Fairfax County Public Facilities Manual (PFM) and all other Fairfax Water publications governing construction, and is not intended to supersede any of these documents.

DEFINITIONS

Definitions: The following words and terms, or pronouns used in their stead, shall, wherever they appear in this document, be construed as follows, unless a different meaning is clear from the context:

"Approved Drawings" shall mean only those drawings specifically referred to as such in the Specifications pertaining to the Developer's project drawings approved by Fairfax County.

"Approved Products List" shall mean the document, latest edition, published by Fairfax Water that lists by category, manufacturers' products approved for use in the Fairfax Water system available at: www.fairfaxwater.org/developers-engineers, latest edition.

"Fairfax Water" shall mean the organization and its representatives chartered by the Virginia State Corporation Commission as a public, non-profit water utility.

"Authorized Representative" shall mean a representative of Fairfax Water acting within the scope of his duties.

"Contractor" shall mean the corporation, limited liability company, partnership or other entity which contracts with the Developer to perform the Work.

"Developer" shall mean the entity that has obtained an Approved Plan from Fairfax County.

"Engineer" shall mean the Engineer or Engineers employed by the Developer to act as such and designated to observe the performance of the Work of the Contractor.

"Project" shall mean the entire improvement, which is subject to the Specifications.

"Standard Details" shall mean those details provided by Fairfax Water within this document and found at: www.fairfaxwater.org/developers-engineers, latest edition.

"Shop Drawings" shall mean all drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for the Contractor and submitted by the Contractor or Developer to illustrate some portion of the Work. Shop Drawings are not Approved Drawings as so defined.

"Specifications" shall mean all of the directions, requirements and standards of performance applying to the Work, hereinafter detailed and designated as such.

"Work" shall mean everything explicitly or implicitly required to be furnished and done by the Contractor or Developer pursuant to the Specifications and Approved Drawings.

END SECTION 00070

SECTION 00200

INSTRUCTION TO CONTRACTORS AND DEVELOPERS

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section specifies the general policies and procedures for Fairfax Water Construction and Final Acceptance requirements.

1.02 REQUIREMENTS FOR CONSTRUCTION

A. Fairfax Water maintains a list of Approved Products, which may be found online at: www.fairfaxwater.org/developers-engineers. Please refer to this list before ordering materials; this list supersedes any product information mentioned in this manual.

B. Fairfax Water Standard Details may be found at: www.fairfaxwater.org/developers-engineers.

C. Fairfax Water does not issue or obtain permits for construction. The contractor shall obtain all necessary permits prior to beginning work.

D. The Developer/Engineer/Contractor is responsible for providing two copies of County approved and stamped Site Plans, Minor Site Plans, or Rough Grading Plans to Fairfax Water prior to construction. One copy of the Land Use Permit, showing water installation/removal is approved, shall be provided with Rough Grading Plans.

E. Rough Grading Plan approval by Fairfax Water allows the contractor to install the water mains; however, prior to construction the developer must submit a letter to Fairfax Water's Construction Department stating the mains will not be filled, flushed, tested, tapped, sampled, or connected to any active Fairfax Water line until Fairfax County site plan approval is obtained and approved plans are transmitted to Fairfax Water. Please call the Fairfax Water Construction Department at (703) 289-6388 for letter requirements.

F. Prior to beginning work, construction plans must be approved and all easements recorded. Please call the Fairfax Water Construction Department at (703) 289-6388 to confirm that this has been completed before scheduling work.

G. All scheduled outages require a minimum of 72 hours notice so that Fairfax Water may provide sufficient notice to its customers. All scheduled outages which affect customers must take place Tuesday through Thursday; no outages will be scheduled for Mondays, Fridays, Weekends, or any Holidays. All shutdowns will only be scheduled which do not affect Fairfax Water's normal operation. The Contractor may be required to work overtime, nights and weekends in making these connections if connections need to be made at times other than those specified. The Contractor may be required to use more than one crew to work simultaneously on multiple connections.

H. All water outages shall be at the discretion of the Fairfax Water Inspector.

I. Provide the Fairfax Water Construction Department a minimum 72-hour notice prior to starting work at (703) 289-6388.

J. Schedule a meeting with the Fairfax Water Inspector or Inspection Supervisor prior to starting work in order to review materials, sequencing plan and constructability issues.

K. Once construction starts, all issues that cannot be resolved by the Fairfax Water Inspector or Inspection Supervisor will be handled by the Chief Construction Engineer who can be reached at (703) 289-6361.

L. Fairfax Water maintains a List of Approved Wet Tap Contractors. Only contractors and their foremen who are on this list are authorized to make taps in our system. Please consult this list before scheduling a wet tap to assure that the contractor you intend to use is on this list. See list of approved wet tap contractors, which may be found online at: www.fairfaxwater.org/list-approved-wet-tap-contractors

M. A Fairfax Water Inspector must be present to inspect all aspects of the water main construction to assure conformance with approved plans and Fairfax Water specifications (i.e. materials, bedding, backfill, polyethylene encasement, thrust blocks, restraining systems, all connections etc.). If the work has been backfilled without inspection, it will be rejected and the contractor will be required to re-excavate it for inspection prior to filling, testing, and sampling.

N. All ductile iron pipe shall be push-on joint. Mechanical joint pipe will not be allowed unless specifically approved by the Fairfax Water Inspector.

O. All ductile iron pipe shall be encased in polyethylene tubing in accordance with the DIPRA specification and bedded and encased in VDOT 21A stone per Fairfax Water Standard Details.

1.03 REQUIREMENTS FOR FINAL ACCEPTANCE

A. General:

1. All water mains and appurtenances installed, tested, sampled, and placed in service.

2. All easements recorded.

3. All plans and revisions approved.

4. Refer to Fairfax Water Standard Details, Fairfax Water Design Practice Manual, and the Fairfax County PFM for additional details and/or requirements.

B. Valve Boxes:

1. All valve boxes intact, to grade, cleaned out and centered over operating nut.

2. All valves operating properly.

3. Valve Box covers with Fairfax Water identifier.

4. Concrete pads installed around valve boxes in non-paved areas.

5. Operating nut or valve stem extension within four feet of finished grade.

6. Minimum two-inch overlap between top and bottom sections of valve boxes.

7. No paving adjusters will be permitted.

C. Fire Hydrants:

1. Fire Hydrants facing correctly and functioning properly.

2. Grade around fire hydrant to bury line.

3. Painted in accordance with Fairfax Water specifications.

4. No plantings or structures within five feet of fire hydrant.

5. Hydrant proper distance from curb.

6. Fire hydrant not in sidewalk.

D. Corrosion Control:

1. Corrosion Control measures in place per approved plan and functioning properly.
2. Recent test report.
3. Certification Letter indicating properly functioning system.
4. As-builts of test stations submitted and approved.
5. Test Station boxes intact with numbers in brass marker.
6. Test Stations in non-paved areas with concrete pad.

E. Meter Boxes:

1. Standard Fairfax Water approved Meter boxes and covers.
2. Meter set fifteen inches below surface grade.
3. Top of box matches surface grade.
4. Cover and box intact and not damaged.

F. Easement Areas:

1. Easements properly graded.
2. Easement restoration complete per approved plan.
3. Structures and Plantings are in conformance with easement agreement language.
4. No other utilities located parallel in easement.

G. Asphalt Paving:

1. Final lift of asphalt in place.

Note: This is not an exhaustive list; there may be additional requirements that have not been named above.

END SECTION 00200

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SECTION 01330

SUBMITTALS

PART 1 GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. This Section specifies the general methods and requirements of submissions applicable to Shop Drawings and Product Data. Detailed submittal requirements are specified in subsequent sections.

B. All submittals shall be clearly identified by reference to Section Number, Paragraph, Drawing Number or Detail as applicable. Submittals shall be clear and legible and of sufficient size for presentation of data.

1.02 SHOP DRAWINGS AND ENGINEERING DATA.

A. General

1. Submittals shall verify compliance with all current Fairfax Water published Approved Products and Standard Details, and shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, and operation of component materials and devices; the external connections, anchorages, and supports required; performance characteristics; and dimensions needed for installation and correlation with other materials and equipment. When an item consists of components from several sources, Contractor shall provide a complete initial submittal including all components. Unless otherwise stated on the approved plans, or directed by a Fairfax Water Inspector, Shop Drawings and Product Data consistent with the published Approved Products list do not need to be submitted for Fairfax Water approval.

2. Where required, Shop Drawings shall be sealed by a Professional Engineer licensed in the Commonwealth of Virginia.

3. All submittals, regardless of origin, shall be stamped with the approval of Contractor and identified with the name and number of the Project, Contractor's name, and references to applicable specification paragraphs and Approved Drawings. Each submittal shall indicate the intended use of the item in the Work. When catalog pages are submitted, applicable items shall be clearly identified and inapplicable data crossed out. The current revision, issue number, and date shall be indicated on all drawings and other descriptive data.

4. When requested, two copies of each shop drawing and necessary data shall be submitted to Fairfax Water.

5. Facsimile (fax) copies will not be acceptable.

6. Electronic Submittals: The Contractor has the option to transmit submittals electronically in a PDF format to Fairfax Water.

7. Submittals shall contain:

a. The date of submission and the dates of any previous submissions.

b. The Project title and number.

c. Contractor identification.

d. The names of:

1) Contractor

2) Supplier

3) Manufacturer

e. Identification of the product, with the section number, page and paragraph(s).

f. Field dimensions, clearly identified as such.

g. Relation to adjacent or critical features of the work or materials.

h. Applicable standards, such as ASTM or Federal Standards numbers.

i. Identification of deviations from Approved Drawings and Specifications.

j. Identification of revisions on resubmittals.

k. A blank space suitably sized for any necessary Contractor, Engineer, or Fairfax Water stamps.

l. Where calculations are required to be submitted by the Contractor, the calculations shall have been checked by a qualified individual other than the preparer. The submitted calculations shall clearly show the names of the preparer and of the checker.

1.03 PROFESSIONAL ENGINEER (P.E.) CERTIFICATION FORM.

A. If specifically required in other related Sections, submit a P.E. Certification for each item required, in the form attached to this Section, completely filled in and stamped.

P.E. CERTIFICATION FORM

The undersigned hereby certifies that he/she is a Professional Engineer licensed in the Commonwealth of Virginia and that he/she has been employed by

_____to design
(Name of Contractor)

_____
(Insert P.E. Responsibilities)

in accordance with Section _____for the

_____ Project.

The undersigned further certifies that he/she has performed the design of the _____

_____

_____, that said design is in conformance with all applicable local, state and federal codes, rules, and regulations, and that his/her signature and P.E. stamp have been affixed to all calculations and drawings used in, and resulting from, the design.

The undersigned hereby agrees to make all original design drawings and calculations available to Fairfax Water (Owner) or the Owner's representative within seven days following written request therefore by the Owner.

_____	_____
P.E. Name	Contractor's Name
_____	
P.E. License Number	
_____	_____
Signature	Signature
_____	_____
Address	Title
	_____
	Address

END OF SECTION 01330

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SECTION 01720

FIELD ENGINEERING AND SURVEYING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The requirements related to construction to designated lines, grades and elevations.

1.02 CONSTRUCTION TO LINES AND GRADES

A. All work shall be constructed in accordance with the lines, grades, and elevations shown on the Approved Drawings. The full responsibility for keeping alignment and grade shall rest upon the Contractor. Included shall be preparation of cut sheets.

1.03 SURVEYS

A. Horizontal and Vertical Controls: Base horizontal and vertical control points will be established or designated by the Engineer. All additional survey, layout, preparation of cut sheets, and measurement work shall be performed by a Land Surveyor, licensed in the Commonwealth of Virginia, employed by the Contractor or Developer as a part of the Work. Stakeout for all water mains, with offsets of 8'-12', shall be performed at intervals of 50 feet, at all appurtenances, and as otherwise directed by Fairfax Water. Contractor shall submit cut sheets for review and approval by Fairfax Water prior to beginning water main installations. Cut sheets shall be stamped with the seal of a Land Surveyor or Professional Engineer, licensed in the Commonwealth of Virginia. The Contractor shall not begin work until provided a Fairfax Water-approved copy of the cut sheet.

1.04 PROTECTION OF SURVEY DATA

A. Safeguarding Points: The Contractor shall safeguard all points, stakes, grade marks, monuments, and benchmarks made or established on the Work. The Contractor shall re-establish them if disturbed or destroyed and rectify all improperly installed Work.

B. Safeguarding Property Corners: The Contractor shall safeguard all existing and known property corners, monuments, and marks adjacent but not related to the Work and shall re-establish them if disturbed or destroyed.

1.05 RECORDS

A. Maintain a complete, accurate log of all control and survey work as it progresses.

B. Maintain an accurate record of all changes, revisions and modifications. See Design Practice Manual regarding plan revision requirements and procedures.

END OF SECTION 01720

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SECTION 02315

EXCAVATING, BACKFILLING, AND COMPACTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating Trenches for Water Mains and Appurtenant Facilities

B. Rock Excavation

C. Backfilling and Compacting

1.02 REFERENCES

A. Land Use Permit Manual, Virginia Department of Transportation.

B. Road and Bridge Specifications, Virginia Department of Transportation.

C. ASTM D698 - Test Methods for Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. Hammer and 12-inch Drop.

D. Manual of Accident Prevention in Construction. Associated General Contractors of America.

E. Occupational Safety and Health Standards-Excavation; Final Rule 29 CFR Part 1926, OSHA.

F. Virginia Work Area Protection Manual

G. Fairfax County Public Facilities Manual

H. Virginia Administrative Code - Chapter 309 Rules for Enforcement of the Underground Utility Damage Prevention Act

1.03 SUBMITTALS

A. Submit Shop Drawings and material certificates of compliance in accordance with Section 01330 – Submittals.

B. Materials and Certifications:

1. Select Fill: Submit letter of certification and list of material composition and properties from each supplier of select fill.

2. Compaction Test Reports: Submit reports for each location of field compaction test. Reports shall include results of field density tests, moisture consent, and degree of compaction.

1.04 DEFINITIONS

A. Utility: Buried pipe, conduit, or cable, surface features such as swales and ditches, and overhead wires or cables including their supports.

B. Earth: The softer materials of the outer surface of the earth. The basic constituents are the products of rock disintegration, glaciation, and erosion, consisting of boulders, cobbles, pebbles, sand, silt, and clay.

C. Rock: The hard, firm and stable parts of the earth's crust which shall include all materials which cannot be removed by excavation equipment of appropriate size and power for the diameter pipe being installed and requires blasting or manual or mechanical barring, wedging or hammering for removal from their original beds. Specifically included are ledges, bedrock, boulders, cement, grout, masonry or concrete larger than 1 cubic yard in volume.

1.05 ADDITIONAL REGULATORY REQUIREMENTS

A. Naturally Occurring Asbestos: The Contractor shall comply with all applicable regulations of OSHA and the Fairfax County Health Department concerning Working requirements in areas containing naturally occurring asbestos deposits.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. Select Fill: Select fill shall meet the following requirements:

1. Crushed Stone: Crushed Stone shall consist of 21A crushed stone conforming to VDOT specifications, or an approved substitute. NOTE: No. 57 stone shall be used (in lieu of 21A stone) at creek crossings and in areas containing groundwater.

2. The conversion factor for Select Fill supplied by weight instead of volume will be 3000 pounds per cubic yard.

B. Suitable Fill: Suitable fill material shall conform to the following requirements.

1. Type I: Type I material shall consist of clean earth excavated from the trench containing no stone larger than ¾ inch across.

2. Type II: Type II suitable material may be substituted for Type I suitable material, in the area from 12 inches above top of pipe to original grade. Type II material shall contain good earth and stone excavated from the trench.

a. Stone material contained in Type II suitable fill shall not exceed 6 inches across and shall be uniformly distributed.

b. Type II suitable material shall not consist of more than 50 percent stone by volume.

2.02 BEDDING MATERIALS

A. Bedding: Pipe bedding shall be Crushed Stone and shall meet the requirements of Paragraph 2.01.A.1 above.

PART 3 EXECUTION

3.01 PREPARATION

A. Identify: Required lines, levels, contours, and datum.

B. Protect Existing Vegetation: Protect plant life, lawns, and other features remaining as a portion of final landscaping.

C. Protect Existing Features: Protect bench marks, existing structures, fences, sidewalks, paving, mailboxes, gas line markers, curbs, and other similar features from excavation equipment and vehicular traffic.

D. Clearing: The site of all open cuts and excavation shall be first cleared of trees, stumps, shrubs, underground and other obstructions prior to excavation.

1. Clearing within easements and rights-of-way shall be limited to the construction limits shown on the Approved Drawings.

2. Remove and dispose of cleared materials and debris unless otherwise directed by the Inspector.

3. Remove topsoil and stockpile for use in restoration of excavated areas.

3.02 EARTH EXCAVATION

A. Shaping and Trimming: Excavate trenches to the widths and depths specified below, except where indicated otherwise.

1. Trench width at bottom of pipe:

Nominal Pipe Diameter (Inches)	Trench Width (Inches) Ductile Iron
3 – 4	24
6 – 16	OD + 18
24 – 36	OD + 24
42 – 48	OD + 30

2. Trench Bottom: Grade and align pipe trench bottoms to provide bearing for the full length of the pipe barrel. Provide bell holes for the proper assembly of pipe joints.

B. Additional Excavation: In the event the Inspector determines the bedding materials in any area to be unsuitable, with or without the concurrence of the Contractor, the Contractor shall promptly follow the direction of the Inspector in addressing such condition. Where additional excavation is required, the Contractor shall replace the removed material with Class D concrete, or select fill material as directed by the Inspector.

C. Unauthorized Excavation: Wherever the excavation is carried beyond or below the lines and grades given by the Approved Plans, except as specified above, all such excavated space shall be refilled with such material and in such manner as may be directed in order to ensure the stability of the various structures. Beneath all structures, space excavated without authority shall be refilled by the Contractor with Class D concrete or select fill materials, as directed by the Inspector.

D. Disposal of Material: Top soil suitable for final grading shall be stored on the site separately from other excavated material. Other surplus excavated material unsuitable for backfilling or in excess of that required for constructing fills and embankments as shown on the Approved Drawings shall be removed by the Contractor.

E. Removal and disposal of Petroleum-Contaminated Soil and Groundwater: In areas where petroleum-contaminated soils are encountered along the proposed water main alignment, the contractor, as directed by Fairfax Water, shall remove and dispose of all contaminated soils within the pipeline trench where the Total Petroleum Hydrocarbon (TPH) concentration exceeds 50 mg/kg. The contractor shall remove the subject soils as directed by Fairfax Water in accordance with applicable regulations of the Virginia Department of Environmental Quality (VDEQ), the U.S Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and industry-recognized removal procedures. Suitable clean fill material will be put in place above newly installed water main, if non-paved area, in accordance with Fairfax Water's standard Trench Details. Additionally, the Contractor shall install flowable-fill trench plugs at each end of the limit of contaminated soils, as required by Fairfax Water.

The Contractor shall also obtain all necessary permits and inspections as required by local, state, and federal laws, rules, and regulations for the proper handling of the contaminated soil from its discovery to its disposal.

3.03 ROCK EXCAVATION

A. Limits of Rock Excavation: Excavate rock within the widths and depths specified for earth excavation and specified in this paragraph.

1. Proposed Structures: Excavate only to the bottom of structure.

2. Rock Trench: Remove rock to a minimum of 6 inches below the bottom of pipe and replace with 6 inches of select fill material for pipe bedding.

3. Existing Structures: Excavate rock within 5 feet of existing structures and utilities by wedging, barring or other approved method.

4. Rock excavation may be performed by the use of a rock trenching machine or other approved method. Machine shall be adequate to excavate rock of the type and in the quantities necessary to perform the work required by this project.

5. When the use of a rock trenching machine is inappropriate (such as at utility crossings), rock shall be excavated by barring, wedging or other approved methods.

B. Blasting

1. Blasting shall not be permitted.

C. Protection of Backfill Material

1. Excavated materials from rock excavation operations, that are deemed suitable for use as backfill, shall be placed back in the trench, compacted, and protected from inclement weather prior to re-excavation for, and during new pipeline installation. If the Contractor fails to protect the suitable material, thereby allowing it to become unsuitable, he shall provide select fill.

2. Unsuitable Materials: Refer to the provisions for disposal of materials under the earth excavation requirements of this specification section.

3.04 BACKFILLING

A. Pipe Trenches: Backfill trenches to original grade or to such other grades as shown or directed.

1. Manual Backfilling: Backfill around pipe manually with select fill, from 6 inches below the pipe up to 6 inches above the pipe in non-paved areas, unless specified otherwise herein. Limits of select fill in paved (roadway) areas, at stream crossings, under asphalt trails, or other designated areas shall be as defined on the Trench details on the Approved Drawings. If rock is encountered, backfill around pipe (with select fill) from below pipe, in accordance with limits of rock excavation defined in paragraph above, up to 6 inches above the pipe. This material shall be placed in layers approximately 6 inches thick, up to the limits indicated (on the trench details) on the Approved Drawings, each layer being thoroughly tamped and compacted in place to a minimum of 95% of maximum dry density in accordance with ASTM D698 and VDOT Road and Bridge specifications. Tamp using tools of approved weight to the following points:

Nominal Pipe Diameter	Top of Manual Backfilling
16 Inches and Under	12 Inches Above Top of Pipe
Greater than 16 Inches	6 Inches Above Top of Pipe

2. Backfilling by machine in non-paved areas: After backfilling around the pipes as specified above, the remainder of the trench may be backfilled by machine with suitable fill, but the Work shall be done in such a way as to prevent dropping of material directly on top of the pipe or structure. Material shall be deposited in uniform horizontal layers up to 2 feet in depth and compacted to a minimum 85% density in accordance with ASTM D698. If, due to rain or other causes, the material is too wet for satisfactory compaction, it shall be allowed to dry partially before compacting.

3. Select fill: Where select fill material is required by the Inspector to bed and backfill the pipe, this material shall be consolidated to the identical points specified where suitable fill material is used as backfill. The use of select material shall be based upon the actual trench conditions encountered and depth shall be determined by the Inspector.

4. Prevention of Settlement: Where structures such as pipelines, walks, asphalt trails, driveways and roadways are to be constructed or replaced later, on backfilled areas, the entire backfill in such areas placed in layers, rolled, rammed, or otherwise thoroughly compacted to a minimum of 95% of maximum dry density to prevent settlement.

5. Use of water for compaction is prohibited.

B. Backfilling Around Structures: Backfilling around thrust collars, and other structures and conduits shall be performed manually.

1. Removal of foreign matter: Remove lumber, rubbish, braces and refuse from behind walls prior to starting backfill operation.

2. Backfill shall be compacted to a minimum 95% density.

C. Backfilling in VDOT Right-Of-Way: The following additional requirements apply for work performed in VDOT right-of-ways:

1. Backfill compaction: All backfill shall be placed in layers of not greater thickness than 6 inches, and shall be compacted to at least 95% of maximum dry density in accordance with Virginia Department of Transportation Road and Bridge Specifications. Compact with pneumatic tampers or by other approved methods. Compaction by water shall not be permitted.

2. Rejection of unsuitable materials: The VDOT inspector or the Fairfax Water Inspector may, at their discretion, reject backfill material which they determine to be unsuitable.

3. Backfill requirements beneath aggregate surfaces: When the excavation is made beneath aggregate surfaces, the top 10 inches of the trench must be replaced in accordance with VDOT standards.

D. Compaction testing by an independent testing laboratory approved by Fairfax Water shall be provided.

1. One compaction test shall be made for each 250 linear feet of pipeline installed. Test location and depth will be as directed by Fairfax Water or VDOT. Testing shall be continued along the backfill benching so as not to delay pipe laying activities.

3.05 EARTH EMBANKMENTS

A. General: Fills and embankments, required for the construction or completion of the Work shall be constructed where shown on the Approved Drawings and to the lines and grades given by the Engineer.

B. Removal of Vegetation: The entire surface of the ground to be covered with embankment shall be stripped of all grass, vegetation, topsoil, or destructible material of any kind, including rubbish, before any embankment material is placed.

C. Embankment Materials: Earth embankment shall be made of the best material available from the excavation, so far as this is sufficient and of satisfactory character. No rubbish or other destructible matter shall be used in embankments. Any additional material needed for earth embankment shall be from borrow pits approved by the Engineer, and this material shall be reasonably free from vegetable matter, large boulders, or rocks, greater than 6 inches in diameter, and shall be a material that can be solidly compacted and will remain stable when wet.

D. Water main installation in areas of fill: Wherever water main is to be installed upon proposed fill, the fill material shall be placed, compacted, and tested to a minimum of 2 feet above the top of the proposed water main elevation in accordance with this section, prior to water main installation.

E. Placement and Compaction Requirements: Wherever any structure is to be built upon embankments or fill, the earth for the embankment shall be placed in layers of 8 inches in loose depth, and each layer shall be thoroughly sprinkled and compacted before the next layer is added. If, due to rain or other causes, the material is too wet for satisfactory compaction, it shall be allowed to dry partially before compacting. The layers shall extend entirely across the fill and shall be approximately level. Each layer shall be thoroughly compacted by the travel of trucks, where possible, or other machines. If ordered by the Engineer, the earth shall be compacted by rolling with a sheeps foot or tamping roller having a minimum weight on each tamper of 200 pounds per square inch of cross-sectional tamping area. The earth embankment, as specified above, shall be left to stand for as long a time as possible during the progress of construction and shall not be built upon until approved by the Engineer. The Contractor shall conduct compaction testing in accordance with Section 3.04.D above.

F. Finish grading: Before leaving the Work or before topsoil is placed, the top and slopes of all embankments shall be carefully trimmed to the slopes, lines and grades established by the Engineer, and any depressions shall be brought to grade with acceptable material. In general, for lawn areas, the embankments shall be fine graded to a true surface 4 inches below the established grade. For other areas, the embankments shall be fine graded to the established grade.

G. Removal of unsatisfactory material: If any of the material is not sufficiently compacted in and by the methods being used, such material shall be removed from the embankment and replaced with approved material compacted to meet the required density.

3.06 RESTORATION

A. Complete finish grading and restoration of excavated areas in accordance with the Approved Drawings.

B. Pavement: Refer to the provisions of the Approved Drawings and the Virginia Department of Transportation Special Provisions for Pavement Open Cuts.

END OF SECTION 02315

SECTION 02400

TRENCHLESS CROSSINGS AND OPEN CUT CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Trenchless Crossings: Perform crossings by one or more of the following methods:

1. Boring
2. Liner plate tunneling

B. Pipe Installation: Pipe installation within encasing conduit

1.02 REFERENCES

A. ASTM A123 Standard Specification for Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products

B. ASTM A153 Standard Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware

C. ASTM A307 Standard Specification for Carbon Steel Bolts and Studs

D. ASTM C62 Specification for Building Brick (Solid Masonry Units Made From Clay or Shale)

E. AREMA Manual for Railway Engineering – American Railway Engineering and Maintenance-of-Way Association (AREMA)

F. Virginia Administrative Code 20VAC5-309-150 – Requirement for Trenchless Excavation

G. VDOT Road and Bridge Specifications

1.03 DEFINITIONS

A. Trenchless Crossing: The installation of a system consisting of conduit and appurtenances such as tunnel liner plate or casing pipe and a carrier pipe (water main) by one or a combination of methods commonly known as jacking, boring or tunneling. Trenchless Crossing shall be considered equivalent with Tunneled Crossings in these documents.

B. Open Cut Casing: The installation of steel casing pipe and a carrier (water main) by the open trench excavation method.

1.04 SUBMITTALS

A. Submit Shop Drawings, installation procedures and qualifications, and material certificates of compliance in accordance with Section 01330 – Submittals.

B. Shop Drawings: Furnish Shop Drawings for the following items:

1. Casing pipe
2. Casing insulators:
    a. Type
    b. Number
    c. Spacing
    d. Installation instructions
3. Liner plate:
    a. Cross section dimensions
    b. Diameter
    c. Thickness

d. Grout hole locations

C. Methods and Procedures: Provide an outline of the methods and procedures, including drawings, specifications and methods of operation for the following:

1. Boring/Jacking equipment and methods: Provide materials outlining methods of operation, design and specifications for boring operation.

2. Liner plate construction methods: Provide an outline of the methods to be used in prosecuting Work.

3. Open cut casing methods: Provide an outline of the methods to be used in prosecuting work.

D. Design Data:

1. Liner plate: Submit design drawings and load computations for liner plate. Drawings shall be sealed and signed by a Professional Engineer licensed in the Commonwealth of Virginia.

2. Grout mixture: Submit grout mixture design for filling voids outside liner plate.

1.05 QUALIFICATIONS

A. Trenchless Crossing and Open Cut Casing Contractor: Trenchless Crossings shall be constructed by personnel fully qualified and experienced for the Work. The Contractor shall have a minimum of five (5) years experience of the type, size and complexity similar to work on this project. Qualifications shall be submitted to Fairfax Water upon request.

B. The Contractor shall provide the services of a competent superintendent and trenchless crossing installation crew, who shall have been in charge of installing at least five (5) trenchless crossing projects of the type, size and complexity similar to work on this project.

C. Upon request, the Contractor shall submit the Boring Superintendent's and installation crew's experience in installing the trenchless crossing and the method of installation. Give project titles, casing/pipe diameter and length, locations, reference contacts, addresses, and telephone numbers.

1.06 REGULATORY REQUIREMENTS

A. Governmental Agencies: Cooperate with the governmental agency such as Virginia Department of Transportation (VDOT) or other agency with jurisdiction over the roadway or crossing.

1. Materials shall conform to the regulating agency's standards or Fairfax Water's if more rigorous.

2. The approval of all materials and methods shall be obtained from the appropriate agency prior to start of Work.

PART 2 PRODUCTS

2.01 STEEL CASING PIPE

A. Materials: Welded steel pipe for boring and jacking highway crossings shall be carbon steel, in accordance with ASTM A139, Grade B, and shall have a minimum wall thickness of 0.50 inches, in accordance with VDOT requirements. Joints for casing pipe shall be squared and continuously welded.

B. Size: See Approved Drawings for casing pipe size required.

2.02 CASING INSULATORS

A. Approved Manufacturers: In accordance with Fairfax Water's Approved Products List. This document is available at Fairfax Water's internet website – www.fairfaxwater.org/developers-engineers.

2.03 END CLOSURES

A. Materials:
1. Brick: ASTM C62 grade MW or better
a. New, whole bricks of uniform standard commercial size with straight parallel edges and square corners.
2. Mortar: composed of one part cement, two parts sand, and water.

2.04 GROUT

A. Materials: Grout for filling voids outside of liner plates shall consist of Portland cement, fine aggregate, and water.
1. Fine aggregate: refer to Section 03300 Cast-In-Place Concrete
2. Admixtures: Submit information on admixtures proposed to improve flow ability of grout mixture.

2.05 LINER PLATE

A. Approved Manufacturers: See Fairfax Water's Approved Products List.

2.06 CORROSION CONTROL

A. Refer to Section 13110 for requirements.

2.07 SLED ASSEMBLIES

A. Provide design where project requirements dictate.

PART 3 EXECUTION

3.01 PREPARATION

A. Identify: Required lines, levels, contours and datum.

3.02 PROTECTION

A. Existing Structures: Protect existing structures and benchmarks from excavation equipment.

B. Highways: Protect highway being crossed from damage or disturbance due to excavation or settlement.

C. Utilities: Maintain and protect above and below grade utilities that are to remain. Contractor shall be responsible for verifying locations of all underground utilities at Trenchless Crossings.

3.03 ACCESS PIT CONSTRUCTION

A. Safety: Take all measures necessary to assure safe working conditions including the following:
1. Provide protective concrete barriers and steel plating at top of access pits.
2. Provide excavation support system in accordance with OSHA and other applicable standards.

B. Water Control: Maintain excavation free of water.

C. Bore Pit Requirements: Size the access pits to permit the Work to be performed safely and at the lines and grades shown on the Approved Drawings.

3.04 TRENCHLESS CROSSING CONSTRUCTION

A. General: The Contractor has the option of installing liner plate in lieu of jacking or boring.
1. Increase in size of encasing conduit or other material changes required by the Contractor's selection of liner plate shall be his responsibility. Any changes must be approved by Fairfax Water before installation.
2. Carrier pipe within casing/liner plate installation shall be restrained.

B. Boring Method:

1. Boring machine: Boring machines shall afford adequate protection against loss of ground, and permit ground support adjacent to trenchless crossing's face as required by ground conditions.

    a. Use a method of advancing the boring machine that ensures correct alignment at all times without binding or imposing excessive loads on the initial trenchless crossing supports or upon the supporting ground.

2. Deviation from line and grade shall not exceed 3 inches in any direction at any point along the casing pipe.

C. Liner Plate Method:

1. General: Discontinue trenchless crossing operations when cave-ins or loose materials are encountered or anticipated. Provide approved shoring and fill voids in accordance with VDOT requirements with pressure grouting prior to continuing Work.

    a. Bulkhead trenchless crossing heading at any interruption of the tunneling operation.

    b. Conduct trenchless crossing operation continuously on a 24-hour basis when so directed by VDOT or other agency with jurisdiction over the crossing.

2. Trimming excavation: Exercise care in trimming excavation surface to provide a snug fit of liner plates against undisturbed material.

    a. Advance excavation only the amount required for installation of the succeeding liner plate section.

    b. Support vertical face of excavation to prevent sloughing.

3. Rock excavation and removal: Remove rock encountered in the excavation by means of air hammers in a manner that minimizes the occurrence of voids outside the liner plates.

4. Deviation from line and grade shall not exceed 3 inches in any direction, at any point along the trenchless crossing.

5. Grouting: Place a uniform Portland cement grout mixture under pressure behind the liner plates to fill voids existing between liner plate and undisturbed material.

    a. Install a threaded plug in each grout hole as grouting is completed there.

    b. Keep grouting of liner plate within 4 feet of tunnel heading. Grout entire length of liner plate installed when trenchless crossing operations cease overnight.

D. Open Cut Casing Method:

1. Excavate trench and provide 6-inch compacted select fill bedding for steel casing pipe.

2. Deviation from line and grade: Deviation from line and grade shall not exceed 3 inches in any direction at any point along the casing pipe.

E. Corrosion Control:

1. Install test stations and other corrosion control measures in accordance with Section 13110- Cathodic Protection.

3.05 CARRIER PIPE INSTALLATION

A. Pipe Joints: Assemble carrier pipe for installation within casing pipe or liner plate tunnel in accordance with Sections 02510.

B. Casing Insulators: Install insulators in accordance with Approved Drawings. Center-to-center spacing shall not exceed that indicated on Fairfax Water Standard Details.

3.06 END CLOSURES

A. Masonry Closures: Seal ends of encasing conduit with brick masonry and mortar.

B. Drainage from encasing conduit: Provide means for drainage from encasing conduit.

END OF SECTION 02400

NO TEXT THIS PAGE

SECTION 02510

WATER MAINS AND APPURTENANCES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

Contractor shall furnish all labor, supervision, tools, equipment and incidentals required to deliver and install ductile iron pipe (DIP), polyvinyl chloride (PVC) or high density polyethylene (HDPE), fittings, specials, and accessories for the water pipeline as required by the Approved Drawings and required to complete the Work.

1.02 RELATED SECTIONS

A. Section 02315 – Excavating, Backfilling, and Compacting

B. Section 02512 – Thrust Restraints

C. Section 02513 – Disinfection of Water Distribution Systems

D. Section 02514 – Leakage Tests

E. Section 03300 – Cast-In-Place Concrete

F. Section 13110 – Cathodic Protection

1.03 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise required by the Approved Drawings.

1. ANSI/AWWA C110/A21.10 Ductile-Iron and Gray-Iron Fittings.
2. ANSI/AWWA C111/A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. ANSI/AWWA C115/A21.15 Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
4. ANSI Standard B16.1 Cast Iron Pipe Flanges and Flanged Fittings.
5. ANSI/AWWA C600 Installation of Ductile-Iron Mains and Their Appurtenances.
6. ANSI/AWWA C104/A21.4 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
7. ANSI/AWWA C151/A21.51 Ductile-Iron Pipe, Centrifugally Cast.
8. ASTM A325 Standard Specification for Structural Bolts.
9. ANSI/AWWA C153/A21.53 Ductile-Iron Compact Fittings.
10. ANSI/AWWA C116/A21.16 Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings.
11. ANSI/AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-inch through 60-inch.
12. ANSI/AWWA C906 Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 65-inch, for Waterworks.
13. ANSI/AWWA C504 Rubber-Seated Butterfly Valves.
14. ANSI/AWWA C502 Dry-Barrel Fire Hydrants.
15. ANSI/AWWA C509 Resilient-Seated Gate Valves for Water Supply Service.
16. ANSI/AWWA C206 Field Welding of Steel Water Pipe.

17. ISO 8179 - Ductile Iron Pipes, External Zinc Coating.
18. Commonwealth of Virginia/State Board of Health, Waterworks Regulations.
19. Fairfax Water, Planning and Engineering Division, Approved Products List.

1.04 SUBMITTALS

A. Shop Drawings: Upon request, submit for the following in accordance with Section 01330:
   1. Pipe, fittings, valves and valve boxes, and specials
   2. Adapters
   3. Mechanical couplings
   4. Temporary bulkheads
   5. Connections to other mains
   6. Valve or other water main closures
   7. Product Data: as required to completely describe the materials being furnished including, but not limited to:
      a. Design drawings, calculations, specifications, and product data sheets necessary to fully describe all materials, components, and finished products and to show conformance with the Approved Drawings.
      b. Dimension drawings showing full details of the pipe.
   8. Other items required by the Approved Drawings, or requested by the Inspector.

B. Letter of Certification from Contractor: Upon request, the Contractor shall submit a letter certifying that valves, pipe, fittings and related items comply with Fairfax Water's Approved Product List whenever applicable.

C. Marking Schedule: Marks to be used on the outside of finished Materials to identify pipes, fittings, specials, and accessories shown on shop drawings and laying schedules.

D. Affidavit of Compliance: Upon request, the Contractor shall furnish affidavit of compliance certifying that the Materials being furnished comply with all applicable provisions of referenced AWWA Standards and Fairfax Water Standards. Prior to shipment of any butterfly valve, furnish certification of compliance with ANSI/AWWA C504, Section 5.1.2 (Leakage Tests), including date tested and test pressure.

E. Acceptance of any submittal by Fairfax Water shall not relieve the Contractor of his responsibility to meet the requirements of the Approved Drawings and Fairfax Water Standards.

F. Laying Schedules: Furnish laying schedules for ductile iron water mains 24-inches in diameter and larger.
   1. Contractor shall submit layout drawings and tabulated schedules designating each pipe, fitting, special, and accessory item necessary to complete the Work in sequence of installation. Coordinate identification of each piece with shop drawings, product data, and marking schedule.
   2. Include the following information:
      a. Quantities and laying lengths of each piece.
      b. Centerline stations and offsets with respect to the Project baseline at each change in horizontal or vertical geometry.
      c. Centerline grade with respect to horizontal between each change of grade.
      d. Centerline elevation referenced to Project vertical datum at each change in horizontal geometry and grade.

e. Orientation of outlets and bends.

f. Joint opening dimensions other than zero for each joint, to nearest 1/8-inch: top or bottom, left or right.

g. Laying schedules shall not allow deflection of restrained joints.

h. Areas requiring special embedment conditions as shown on the Drawings.

3. Laying schedule joint opening shall not exceed 75 percent of the pipe manufacturers maximum recommended joint opening.

G. Installation Experience:

1. The Contractor shall provide the services of a competent foreman, who has at least 5 years of experience installing water mains and prior supervisory experience with respect to installing at least 5,000 linear feet of ductile iron water main 16-inches and less. For work involving the installation of water main greater than 16-inches, the Contractor shall provide the services of a competent superintendent who has at least 5 years of experience installing water mains and prior supervisory experience with respect to installing at least 5,000 linear feet of 24-inches or larger ductile iron water main.

1.05 REGULATORY REQUIREMENTS

A. Commonwealth of Virginia/State Board of Health: Water main installation shall be in accordance with the Waterworks Regulations of the State Board of Health.

B. Reduction of Lead in Drinking Water Act. All products and materials shall comply with Public Law 111-380.

1.06 DELIVERY, STORAGE AND HANDLING OF MATERIALS

A. Ductile Iron Pipe and Polyvinyl Chloride Pipe: Loading, unloading, handling, inspection and storage of ductile iron and gray iron pipe, fittings, accessories, and appurtenances shall be performed in accordance with AWWA C600/C605 and approved submittals.

1. Store pipe, fittings, valves, and appurtenant materials in a manner that will protect them from becoming dirty or damaged prior to installation.

a. Pipe, fittings, valves, and appurtenant materials, which are visibly dirty, shall be cleaned to the Inspector’s satisfaction or replaced at the Contractor’s expense prior to installation.

B. Arrange deliveries of products in accordance with construction schedules to facilitate inspection prior to installation.

C. Coordinate deliveries to avoid conflict with Work and conditions at site.

D. Do not have products delivered to Project site until related Shop Drawings have been approved by Fairfax Water.

E. Use web slings or forklifts to handle the pipe. Metal chains, cable tongs or other equipment likely to cause damage to the coating shall not be used. Hooks shall not be used on the ends of the pipe.

F. Where forklifts are used, their bearing surfaces must be padded with protective forklift sleeves/pads or suitable material approved by Fairfax Water.

G. Web slings shall be of a type and width that will not damage the coating. Slings shall not pass through the pipe.

H. If cables or chains are used during transportation, they must be properly padded with approved suitable material to protect the coating from damage. Use padded separator strips between pipe and cable or chains.

I. Pipe, fittings, and specials shall be unloaded opposite to or as close to the place where they are to be laid as is practical to avoid unnecessary handling.

J. Materials cracked, gouged, chipped, dented or otherwise damaged will not be accepted. Minor defects in the pipe or coatings may be repaired at the site by a method approved by the manufacturer of the materials and by the Inspector. Damaged pipe, fittings, specials and accessories shall be repaired or replaced by the Contractor.

K. The Inspector reserves the right to inspect all materials at the site. Any materials rejected by the Inspector shall not be used in the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fairfax Water publishes an Approved Products List, which lists, by category, manufacturer's products approved for use in Fairfax Water's system. Manufacturers' products covered by the categories included in this document that are not specifically listed are not approved for use. This document is available from Fairfax Water's internet website- www.fairfaxwater.org/developers-engineers.

B. Paint Coatings: Refer to Section 09900.

C. Gasket Lubricants: Only non-toxic lubricants recommended by the pipe manufacturer and approved by the Virginia Department of Health for use in potable water shall be used on gaskets. Petroleum-based or other types of lubricants that can damage the gasket shall not be used.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing field conditions.

B. Perform test pits at least 100 feet in advance of all utility crossings and interconnection locations, and as required on the Approved Drawings or by Call Before You Dig regulations.

C. Inspect water main materials for cleanliness and absence of damage.

D. Verify that excavation base is dry and ready to receive the Work and that excavation, foundations, dimensions and elevations are as indicated on laying schedules (for 24-inch and larger diameter pipe) or accepted by Inspector.

E. Verify that rated working pressure of the item to be installed is satisfactory for the service shown on the Approved Drawings.

3.02 GENERAL

A. Installation of each pipe joint and appurtenance shall be made in the presence of an Inspector. The Contractor shall coordinate his construction activities daily with the Inspector and shall notify the Inspector 48 hrs. minimum prior to each installation.

B. Install materials as shown, specified, or recommended by the manufacturer and in conformance with reference standards and accepted Shop Drawings.

C. Cover over the pipe shall be as shown on the Approved Drawings, specified or otherwise accepted by the Inspector.

D. Earthwork shall be as shown on the Approved Drawings and specified in the applicable Sections of these Specifications.

E. Take field measurements as necessary to ensure proper fitting of Work.

F. Changes in alignment and grade shall be made by deflecting joints except where bends or similar fittings are shown.

G. All materials shall be carefully examined for cracks, dents, damage or other defects before installation. Defective materials shall be rejected, removed and replaced. Any material found to be broken or defective after it has been installed shall be rejected, removed and replaced as specified in this Section.

3.03 PREPARATION

A. Ductile Iron Pipe and Fittings:

1. Push-on Joints

a. Thoroughly clean the groove and bell socket and insert the gasket, making sure that it faces the proper direction and is correctly seated.

b. After cleaning any dirt or foreign material from the plain end, apply lubricant in accordance with the pipe manufacturer's recommendations.

c. When pipe is cut in the field, bevel the plain end with a grinder or heavy file to remove all sharp edges.

2. Mechanical Joints: The socket and plain end shall be wiped clean of all sand and dirt and any excess coating in the bell shall be removed. The plain end, bell socket and gasket shall be washed with a soap solution. Apply lubricant in accordance with the pipe manufacturer's recommendations.

3. Flanged Joints: Rust-prevention grease shall be removed from the flanges using a solvent-soaked rag. The flanges and gasket shall then be wiped clean of all dirt and grit.

4. All joints shall be made in the presence of an Inspector.

5. Keep a sufficient quantity of joint lubricant, gaskets, welding rod, joint lining and coating material on hand at all times.

3.04 DUCTILE IRON AND POLYVINYL CHLORIDE PIPE INSTALLATION

A. Excavating, Trenching and Backfilling: shall be in accordance with Section 02315.

1. All Work shall be constructed in accordance with the lines and grades shown on the Approved Drawings. Contractor shall assume the full responsibility for establishing and maintaining alignment and grade.

2. The Contractor shall lay all pipes in trenches in accordance with the pipe manufacturer's approved laying schedule, when applicable, and the requirements of Section 02315 and this Section.

3. In areas where excavated soils contain a Total Petroleum Hydrocarbon (TPH) concentration level of 10 mg/kg, or to the extent directed by Fairfax Water, the contractor shall install fluorocarbon rubber (FKM) gaskets, as approved by Fairfax Water, in accordance with the pipeline manufacturer’s installation requirements. Refer to Section 02315 for removal and disposal requirements of petroleum-contaminated soils.

B. Pipe Laying:

1. Proper and suitable tools and appliances for the safe and convenient cutting, handling and laying of the pipe and fittings shall be used. The pipe and fittings shall be thoroughly cleaned by power washing before they are laid and shall be kept clean until they are accepted in the completed Work. Special care shall be exercised to avoid leaving bits of wood, dirt and other foreign particles in the pipe. If any such particles are discovered before final acceptance of the Work, they shall be removed and the pipe, valves and fittings replaced at the Contractor's expense. All mains shall be kept absolutely clean during construction. In matters not covered by these Specifications, laying of ductile iron and polyvinyl chloride/high density polyethylene pipe shall meet the requirements of AWWA Standards C600 and C605. Exposed ends of uncompleted lines shall be capped or otherwise temporarily sealed with approved watertight bulkheads at all times when pipe laying is not actually in progress.

2. Pipe laid in excavations shall be laid on good foundation, trimmed to shape and, secured against settlement. At joints, enough depth and width shall be provided to permit the making of the joints and the inspection of the bottom half of the joint. All elbows and tees shall be properly backed up and anchored so that there will be no movement of the pipe in

the joints due to internal or external pressure. Pipes shall have solid bearing throughout their entire length.

3. The Contractor shall lay all pipes in strict accordance with the manufacturer's recommended procedures. When it is necessary to deflect pipe from a straight line, in either the horizontal or vertical direction, or as otherwise directed by the Approved Drawings or the laying schedule for curves, pipe deflections shall have a maximum joint deflection eighty per cent of the value shown in the joint deflection tables in AWWA C600. Under normal laying conditions, the depth of cover shall be 4 feet.

4. Where pipe is laid in rock trenches, a minimum space of 6 inches of the rock shall be removed below the outside bottom of the pipe and shall be filled with select material to the limits of, and in accordance with Section 02315 before the pipe is laid.

5. When special beddings are shown on the Approved Drawings or are ordered by the Inspector, they shall conform to the requirements of Section 02315 of these Specifications.

6. Temporary bulkheads shall be installed at the ends of sections where adjoining water mains have not been completed. All such bulkheads shall be removed when the need for them has passed or when ordered by the Inspector.

C. Joining Pipe and Fittings:

1. When joining pipes and fittings, the Work shall be done in strict accordance with the requirements of AWWA C600, the manufacturer's printed instructions, approved submittals and these Specifications.

2. Push-on joints shall be assembled with general procedure to be as follows:

   a. Prepare pipe and joint as described in this specification Section.

   b. Push the plain end into the bell of the pipe. Keep the joint straight while pushing. Make deflection after the joint is assembled.

3. Mechanical joints shall be assembled with general procedure to be as follows:

   a. Prepare the socket and plain end as described in this specification section.

   b. Place the gland on the plain end with the lip extension toward the plain end of the pipe, followed by the gasket with the narrow edge of the gasket toward the end of the pipe.

   c. The pipe shall be pushed into the bell socket and the gasket pressed firmly and evenly around the entire socket. The gland is then pushed up to the bell and centered on the pipe. Glands may require a wedge under the top side to assist in centering the gland lip against the gasket.

   d. The bolts shall then be inserted and tightened with the fingers until all are even. A ratchet wrench shall be used to complete the tightening of the bolts, care shall be exercised to tighten the opposite nuts to keep the gland square with the socket and the bolt stress evenly distributed. The following torque shall be applied:

BOLT SIZE	TORQUE
5/8-inch	45-60 Ft. lb.
3/4-inch	75-90 Ft. lb.
1-inch	100-120 Ft. lb.
11/4-inch	120-150 Ft. lb.

   e. Once the installation of all nuts and bolts has been completed, petrolatum tape and compatible primer shall be applied in accordance with Section 13110 of these specifications.

4. Flanged joints: shall be assembled with general procedure to be as follows:

   a. Prepare flanges in accordance with the requirements of this specification Section.

b. The flanges shall be accurately aligned, using a spirit level, and pipe properly supported before the gasket and bolts are inserted. The rubber gasket shall be carefully placed to ensure full flow and proper sealing of the joint.

c. Bolt threads shall be given a light coat of thread lubricant and then inserted and the nuts turned up by hand. Bolts shall then be pulled up with a wrench employing the crossover method. Applied torques shall be in strict accordance with the manufacturer's requirements.

D. Pipe Cradles Encasements and Other Support: Where concrete cradles or encasements are required, they shall be constructed in accordance with Section 03300 of these specifications, and the Approved Drawings.

E. Thrust Restraints: Thrust Restraints including restraining glands, concrete anchors and thrust collars, strapping, or other approved restraining devices shall be in accordance with Section 02512 of these specifications, and the Approved Drawings.

F. Corrosion Control: Provide corrosion control measures in accordance with Section 13110 of these specifications, where indicated.

G. Temporary Bulkheads: At the ends of sections where adjoining pipelines have not been completed and are not ready to be connected, install temporary, externally braced test plugs approved by the Inspector. All such externally braced test plugs shall be removed when the need for them has passed or when ordered by the Inspector.

H. Pipe Installed within Structures and Concrete Encasements: Where temporary supports are used, they shall be sufficiently rigid to prevent shifting of the pipe. No reinforcing in structure or concrete encasements shall touch the pipe.

I. Sanitary Sewer Crossings:

1. Maintain required separation between water and sewer facilities in accordance with Virginia State Board of Health "Waterworks Regulations".

2. Provide concrete pier supports for existing sanitary sewer pipe crossing over the water main in accordance with the Approved Drawings.

J. Utility Crossings:

1. Separation of 6-inch or less requires expansion material and shall be in accordance with the Fairfax Water Approved Products List.

K. Cathodic Protection: Provide field-applied petrolatum tape coating per Section 13110 for:

1. Buried mechanical joints, buried bolts, nuts, couplings harness tie rods, saddles, iron and steel anchors, and other connecting hardware.

2. Service clamps, other transition fitting between copper services and ductile iron pipe.

3. Pipe embedded in concrete anchor blocks or otherwise in contact with concrete, extending through the concrete adjacent 6 inches in both directions.

4. Provide other corrosion control measures where indicated per Section 13110.

L. Polyethylene Encasement: Provide and install in accordance with the Fairfax Water Approved Products List and ANSI/AWWA C105/A21.5.

1. Contractor shall install a single layer of polyethylene encasement film over all water mains.

2. Overlapping Sections: Provide 2-foot overlap between sections of polyethylene. Completely tape overlapping sections to hold securely in place during backfilling, using compatible polyethylene tape.

3. Repair of Openings in Encasement: Repair holes, slits, or openings of any size, to restore integrity of polyethylene in accordance with manufacturer’s recommendation.

4. Installation at Hydrants and Interconnections: Provide opening or other means at base of hydrant riser to avoid water accumulation under encasement because of water relief.

5. Backfill around polyethylene encasement shall be VDOT 21A stone, in accordance with the Standard Details.

M. All work performed by the Contractor shall conform to applicable sections of the Virginia State Board of Health “Waterworks Regulations” and these Specifications during the installation, testing and disinfection of waterworks facilities.

3.05 VALVES AND HYDRANTS

A. Joints: Joints shall be made up in accordance with the procedures outlined in this specification Section.

B. Valves:

1. Butterfly valves shall be tested by Contractor prior to installation, in accordance with Section 02514.

2. Valves shall be carefully erected in their respective positions free from distortion and strain with operators vertical unless otherwise shown on the Approved Drawings. The valves shall be placed and left in satisfactory operating condition. Restrain valves as required.

3. Unless otherwise shown or specified, direct burial valves and valves in vaults or manholes shall have 2-inch square operating nuts. If the operating nut is 4-feet or more below grade, it shall be provided with extended shafts and 2-inch operating nuts extending to 3-feet below grade.

4. Natural rubber seat rings shall be coated with an approved opaque material that shall protect the rubber from attack by ozone and other deleterious materials.

5. Rubber seated valves, which are to be stored for longer than three months shall be partially opened to prevent damage or permanent deformation to the seat ring.

6. Valve boxes shall be adjusted with the tops at the proper grade. Valve boxes in unpaved areas shall be installed with concrete in accordance with the Standard Details. The top section of the valve box will overlap the lower section with a minimum lap of 2-inches.

C. Hydrants: Hydrants shall stand plumb and shall have their hose nozzles parallel to the water main and their pumper nozzles facing the street or as directed by the Inspector. The hydrant shall be turned on its base in order to have the pumper nozzles facing the street. All hydrants shall be coated in accordance with Section 09900.

3.06 CONNECTIONS TO THE WATER SYSTEM

A. The Contractor shall connect the pipelines to existing water mains and make provisions for the phase connections, as shown on the Approved Drawings. When system shutdown is necessary, the Contractor shall provide the Fairfax Water a minimum of 72 hours notice prior to each scheduled tie-in, so that advance notice may be given to the affected customers.

B. The Contractor shall meet with the Inspector and provide a written narrative for review and approval of his proposed scheduling and construction procedures for the connection(s). Approval of the Contractor’s connection(s) schedule and construction procedures by the Inspector does not relieve the Contractor from his total responsibility to see that the connection(s) is successfully completed within the designated time frame.

C. Fairfax Water will coordinate closing all valves in making shutdown and open all valves in restoring pressure to the existing main and initiating pressure in the new installation. Connections to water mains shall be made by the Contractor only after complete preparation for such Work has been made.

D. At each location where a new water main is to be connected to the existing water main, the Contractor shall not order material for the connection until he has dug a test pit and verified the exact location, size, outside diameter, roundness, elevation, material, joint location, type and direction of the existing water main. The Contractor shall dig test pits only in the presence of the Inspector. If the test pit shows there is a conflict with an existing utility or a water main

connection has to be modified, the Contractor shall submit test data information to the Engineer. The Engineer will review and modify the Approved Drawings as required.

E. Prior to the commencement of any water main interconnection work, the Contractor shall have all necessary materials, tools and equipment at the work site. Pipe, fittings and valves shall be pre-assembled as much as possible to reduce the time of water service interruption. Also, the geometry of the connection shall be verified by the Contractor prior to starting the connection. Where existing mains are provided with fittings for the purpose of connecting to the new main, the Contractor shall remove the plugs or bulkheads, clean the ends, prepare them for connection to the new pipeline, and make the new joint.

F. The Contractor shall work continuously and expeditiously around the clock using multiple crews until the connections are successfully installed and water service is restored. Where the new water main is to be connected at more than one point to the existing water system, connections shall proceed simultaneously. All connection work must be successfully completed within the time specified by Fairfax Water, unless noted differently in writing by Fairfax Water. The Contractor shall commit the necessary personnel and equipment required to perform the simultaneous connections within the time constraints agreed to by Fairfax Water. Proposed water mains must be in service before the existing water mains can be abandoned.

G. The water released by cutting or opening existing mains shall be removed and the excavation kept dry until all necessary Work within the excavation has been completed.

H. The Contractor shall provide all necessary labor and equipment to cut a sample (coupon) from existing ductile iron and cast iron pipe that will be tied into, removed, or abandoned as part of this project. Size, location, and number of coupons shall be as directed by the Inspector. Coupons produced as a result of tapping operations shall also be collected. The Contractor shall provide coupons to the Fairfax Water Inspector upon completion of work.

I. No shutdowns, which result in customers being out of service, will be allowed during Thanksgiving week or Christmas week, unless otherwise approved by Fairfax Water.

3.07 AIR RELEASE AND BLOW-OFF CONNECTIONS

A. Air Release or Blow-Off Connections: Connections for air releases and blow-offs shall be installed in accordance with the details on the Approved Drawings.

B. Provide approved tapping saddles where pipe walls are insufficient to embed three threads in metal.

3.08 LEAKAGE TESTS

A. Perform leakage tests in accordance with Section 02514. Make necessary repairs and repeat tests until required results are obtained.

3.09 DISINFECTION

A. Disinfect finished water mains and appurtenances in accordance with Section 02513. Repeat disinfection and testing until required results are obtained.

3.10 DISPOSAL OF ASBESTOS CEMENT PIPE

A. The Contractor shall comply with the requirements of 29CFR 1926.1101.

3.11 ABANDONMENT OF EXISTING WATER MAINS

A. Upon completion of the installation, acceptance, and placing into service of the proposed water main within the limits indicated on the Approved Drawings, or as directed by the Inspector. Abandonment of existing mains will include, but not be limited to: closing all valves, removing valve boxes, waterline markers, cutting and plugging existing water mains, removing existing water mains (as required), backfilling, compacting, and other associated work, where indicated on the Approved Drawings and where directed by the Inspector. Refer to the Design Practice Manual and Approved Drawings for additional abandonment requirements.

3.12 METERS, SERVICE CONNECTIONS, AND PRIVATE FIRE LINES

A. Generally

1. Exterior meters less than 3 inches will be installed by Fairfax Water.
2. Interior meters 3 inches and larger and fire lines will be installed by the Contractor. For additional information regarding meters and service installation specifications see Fairfax Water Standard Details.
3. All exterior meters with domestic service tapped off fire lines will be installed by the Contractor.
4. Meters will be furnished to the Contractor after all testing has passed and connection fees are paid. For additional information regarding obtaining a meter contact Customer Service at (703) 698-5800 and review the Rules and Regulations for the Furnishing of Water Service, which may be found online at www.fairfaxwater.org/rules-and-regulations.

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END OF SECTION 02510

SECTION 02512

THRUST RESTRAINTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete Thrust Anchors

B. Concrete Thrust Collars

C. Mechanical Joint Restraints

1.02 SUBMITTALS

A. Submit material lists and calculations for thrust restraints not shown or different from that shown on the Drawings, in accordance with Section 01330 – Submittals.

B. Submit description and installation instructions for restraining glands.

1.03 REFERENCES

A. ASTM F3125 Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated.

B. ASTM A536 Specification for Ductile Iron Castings.

C. AWWA C111/A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

D. AWWA C153/A21.53 Ductile-Iron Compact Fittings.

E. AWWA C110/A21.10 Ductile Iron and Gray Iron Fittings, 3-Inch through 48-Inch, for Water and Other Liquids.

PART 2 PRODUCTS

2.01 DUCTILE IRON AND PVC RESTRAINING GLANDS

A. Fairfax Water publishes an Approved Products List, which lists, by category, manufacturer's products approved for use in Fairfax Water's system. Manufacturers' products covered by the categories included in this document that are not specifically listed are not approved for use. This document is available from Fairfax Water's internet website – www.fairfaxwater.org/developers-engineers.

2.02 CONCRETE MIXES

A. Concrete for Thrust Anchors and Thrust Collars: Provide concrete in accordance with the requirements of Section 03300.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide thrust restraints shown or otherwise necessary to resist movement in new or existing water mains.

B. Restrain existing valves as directed by Fairfax Water Inspector when making connections to existing facilities.

3.02 CONCRETE THRUST ANCHORS

A. Provide concrete thrust anchors at all bends, tees, plugs, caps, and hydrants, and where shown otherwise on the Approved Drawings.

B. Dimensions: Refer to the Approved Drawings or Fairfax Water published Standard Details for dimensions of thrust anchors.

C. Installation: Bearing area for thrust anchors shall be against undisturbed earth. The face of the excavation shall be flat and at the proper angle to the fitting.

1. Install thrust anchors such that pipe and fitting joints are accessible for repair.

2. Brace the elbow (bowl) of each hydrant against the required area of unexcavated earth at the end of the trench with concrete thrust anchor.

D. Installation: Provide and place concrete in accordance with requirements of Section 03300.

3.03 CONCRETE THRUST COLLARS

A. Provide concrete thrust collars at the locations shown on the Approved Drawings.

B. Dimensions: Refer to the Approved Drawings for dimensions of thrust collars.

C. Reinforcement: Provide reinforcing steel where shown on the Approved Drawings and in accordance with Section 03300.

D. Installation: Provide and place concrete in accordance with requirements of Section 03300.

3.04 CONCRETE

A. Curing: Cure all concrete thrust anchors for a minimum of seven days prior to pressure testing, unless noted otherwise (i.e. locations of high-early strength concrete) on the Approved Drawings or directed by the Inspector.

B. Backfilling: Backfill around concrete thrust anchors according to the requirements of Section 02315 - Excavating, Backfilling and Compacting, and the following:

1. Do not backfill thrust anchors or thrust collars until a minimum of four hours has elapsed.

3.05 RESTRAINING GLANDS

A. Install mechanical joint restraint in accordance with the manufacturer's instructions.

END OF SECTION 02512

SECTION 02513

DISINFECTION OF WATER DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disinfection: Disinfection of potable water distribution and transmission systems.

B. Testing: Testing and reporting results.

1.02 REFERENCES

A. AWWA B300 Hypochlorites.

B. AWWA B301 Liquid Chlorine.

C. AWWA C651 Disinfecting Water Mains.

D. AWWA C655 Field Dechlorination

E. Waterworks Regulations - Commonwealth of Virginia/State Board of Health.

1.03 SUBMITTALS

A. Test Reports: Indicate results comparative to specified requirements.

B. Dechlorination methods and chemicals to be used as specified herein.

1.04 PROJECT RECORD DOCUMENTS

A. Record Documents: Submit prior to project final acceptance:

1. Disinfection report; record:

a. Type and form of disinfectant used.

b. Date and time of disinfectant injection start and time of completion.

c. Test locations.

d. Initial and 24-hour disinfection.

e. Date and time of flushing start and completion.

f. Disinfectant residual after flushing in ppm for each outlet tested.

g. Method of chlorination.

1.05 QUALITY ASSURANCE

A. Performance Standard: Work shall be performed in accordance with the Virginia State Board of Health "Waterworks Regulations," AWWA C651, and as modified herein.

B. Bacteria Tests will be performed by Fairfax Water’s laboratory. See Quality Control Section for additional criteria.

PART 2 PRODUCTS

2.01 DISINFECTION CHEMICALS

A. Chemicals: AWWA B300, Hypochlorite, or AWWA B301, Liquid Chlorine.

2.02 OTHER PRODUCTS

A. Corporation Stops: Mueller H-10013 Corporation Stops

PART 3 EXECUTION

3.01 EXAMINATION

A. Cleaning and Inspection: Verify that the water main has been cleaned and inspected.

3.02 EXECUTION

A. Disinfection of Water Mains under 24 Inches: Disinfect water mains in accordance with AWWA Standard C651 and the Commonwealth of Virginia/State Board of Health Waterworks Regulations.

B. Disinfection of Water Mains 24-Inches and Greater: Disinfection of water mains 24-inches and greater in diameter shall be performed using either the Continuous Feed, Slug, or Spray Method in accordance with AWWA Standard C651 and the Commonwealth of Virginia/State Board of Health Waterworks Regulations. In the event AWWA Standards and the Virginia Waterworks Regulations differ, the more restrictive shall control.

C. Fairfax Water will provide the water for the initial filling of the water main, testing and chlorination, unless otherwise directed by the Inspector. If requested, the Contractor shall utilize only the existing taps and hydrants available on existing, adjacent water mains to obtain water for filling the new mains and shall submit a detailed filling and testing procedure to the Inspector for review and approval, in accordance with Section 02514. The Contractor shall provide all pumps, hoses, control valves, approved cross-connection control (backflow prevention) devices, sleeves, plugs/caps, and other equipment associated with the filling, leakage testing, sampling and flushing the water main. The Inspector will provide the meter and pressure gauges for testing purposes.

D. Leakage Testing: Pressure test water main in accordance with Section 02514.

E. Flushing: The water main shall be flushed at locations approved by the Inspector, and in the following manner:

1. General: Let water flow at the maximum rate possible, with a minimum velocity of 3.0 ft/sec through the water main being flushed, until it is clear (<1.0 NTU) and a chlorine residual is obtained which is comparable to the source water. The Inspector will advise the Contractor on how long to flush.

    a. The Inspector will be present at the start of the flushing process to verify procedures.

2. Flushing from fire hydrants:

    a. Open fire hydrant valve, street valve and source valve completely for free discharge. Use the diffuser if necessary.

    b. If a fire hydrant cannot provide for a free discharge even with a diffuser, either install a hand control valve on the 2-1/2-inch hose connection (with fire hose if necessary) or use the fire hydrant street valve to control flow. Do not use the fire hydrant valve to control flow.

3. Flushing from Blow-Offs: For blow-offs, attach the 2-inch connector pipe with adapter and attach hose if required, and open blow-off valve to control flow.

4. Time Requirements: If over a week has elapsed between the pressure test and sampling, the new main shall be re-flushed upon direction of the Inspector. If the time period has been in excess of a month or transported water was utilized for pressure testing, special procedures may be required as directed by the Inspector.

3.03 QUALITY CONTROL

A. Water Samples: In accordance with AWWA C651, bacteriological samples shall be collected at regular intervals not to exceed 1,200 feet. Two consecutive negative samples shall be collected at least 16 hours apart for each sample location.

1. Scheduling: After the water main has been pressure tested, the Inspector will schedule collection of the samples. Samples will not be scheduled in advance of the pressure test.

2. Cancellations: Cancellations or sample failures will be scheduled in turn with original samples.

3. Unsatisfactory Sample: If the samples fail, the Contractor shall reschedule and repeat the flushing and sampling process.

4. Additional Disinfection: If the second sets of samples fail, the water main shall be disinfected again, with a chlorine solution and shall be allowed to sit for a minimum of 24 hours. The flushing and sampling process shall then be repeated.

B. Failure to Meet Quality Standards

1. Water Quality: Should the initial treatment, as determined by the laboratory tests, fail to result in a water comparable in quality to the water served to the public from the existing water supply system, disinfection and flushing shall be repeated until satisfactory results are obtained.

3.04 ENVIRONMENTAL PROTECTION

A. Discharge of Disinfected Water:

1. Discharge: The Contractor shall assume full responsibility for the discharge of disinfected water. Disinfected water with a free chlorine residual in excess of 2.0 mg/l shall not be discharged into Fairfax Water's distribution system.

2. Controls: The Contractor shall provide siltation control as required to protect against soil erosion in accordance with Virginia Erosion and Sediment Control Law and Regulations.

3. Responsibilities: The Contractor shall be responsible for any damage to vegetation, trees, streams, ponds, and lakes caused by the discharge of heavily chlorinated water. The Contractor shall perform the necessary measures to dechlorinate the water prior to discharging water into any stormwater system, estuary, or other environmentally sensitive area, in accordance with AWWA Standards C651 and C655. All highly chlorinated water supplemented with chlorine and used for disinfection purposes shall be dechlorinated by the Contractor prior to discharge to the environment or storm sewer network. Within the City of Falls Church, all highly chlorinated disinfection water and distribution system flushing water shall be completely dechlorinated by Contractor prior to discharge. Contractor shall be required to completely dechlorinate all discharges if required by federal, state, or local regulations. Damages or injury from discharges of disinfection water shall be the responsibility of the Contractor and shall be remedied at his expense. Acceptable chemicals used for dechlorination are listed in AWWA Standard C655 - "Field Dechlorination." The Contractor's proposed dechlorination agent shall be submitted to the Owner for approval prior to its use.

END OF SECTION 02513

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SECTION 02514

LEAKAGE TESTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydrostatic pressure and leakage tests

1.02 SUBMITTALS

A. Upon Inspector request, submit detailed description of filling and testing procedures including, but not limited to, the following:

1. Schedule of test sections and piezometric test elevations in accordance with the requirements of Section 01330.
2. Type and location of bulkheads; provisions for thrust restraint.
3. Proposed sources of water and points of introduction into the pipeline.
4. Proposed equipment and methods for admitting test water and filling and dewatering the pipeline.
5. Proposed sequence of activities.
6. Proposed methods and details for testing pipe, joints, closures, etc., installed after completion of hydrostatic tests.

PART 2 PRODUCTS

2.01 MEASURING DEVICES

A. The Inspector will provide meters and pressure gauges, calibrated and suitable for use in testing.

PART 3 EXECUTION

3.01 GENERAL

A. The water mains shall be tested for leakage by the Contractor in the presence of the Inspector. A maximum of 2,500 linear feet of water main may be tested at one time, unless otherwise approved by the Inspector.

B. Each section of water main between adjacent butterfly valves (assemblies) shall be tested separately. The maximum differential pressure across any butterfly valve during testing shall not exceed the test pressure recommended by the valve manufacturer, or as specified by the Inspector. The Contractor shall provide all temporary bulkheads and thrust restraint to isolate the water main test section, and shall provide all long solid sleeves necessary to make the permanent connection to the system.

C. The Contractor shall notify Fairfax Water when the Work is ready for testing and tests shall be made as soon thereafter as practicable under the direction of the Inspector. Personnel for reading meters, gauges or other measuring devices will be furnished by Fairfax Water, but all other labor, equipment and materials shall be furnished by the Contractor, unless otherwise specified.

D. Testing of the pipelines shall not be made until at least seven days have elapsed after all concrete thrust blocking has been installed.

E. The Inspector reserves the right to check the completed pipeline for vertical alignment prior to filling with water and testing. The Contractor shall not allow water in any pipelines without the express written permission of the Inspector.

F. All air valves shall be installed as indicated on the Approved Drawings and individually checked

for proper operation prior to filling the water main for testing. If for any reason it is necessary to drain the water main, the Contractor shall take all precautions required to ensure the safety of personnel entering and inspecting the water main. When draining the water main, all air valves shall be rechecked for proper operation. Pipelines containing large orifice valves shall be filled at a maximum rate of one foot per second.

G. Each butterfly valve shall be tested for leakage by Contractor, in the presence of a Fairfax Water representative who shall observe and confirm that each valve passes the test, prior to installation. Replacement of any defective butterfly valves, including shipping, shall be at no additional cost to Fairfax Water. Contractor shall provide a tapped Mechanical Joint plug (of the valve size) and test assembly and Fairfax Water will provide meters and pressure gauges along with the water supply. The butterfly valve testing procedure, which does not replace or relieve any of the other testing requirements in Section 02514, is as follows:

1. Install the plug on one side of the valve body and with the valve closed, fill with water and pump it up to the valve's rated pressure. Check visually on the other side of the disk to see if it leaks; no water or air bubbles shall be present. Leave pressurized for ten (10) minutes and then check the gauge to see if it holds pressure.

2. Remove the plug and install on the other side of the valve body. With the valve closed, fill with water and pump it up to the valve's rated pressure. Check visually on the other side of the disk to see if it leaks; no water or air bubbles shall be present. Leave pressurized for ten (10) minutes and then check the gauge to see if it holds pressure.

H. Each insulated flange assembly shall be tested for leakage by Contractor, in the presence of a Fairfax Water representative who shall observe and confirm that each assembly passes the test, prior to installation. Replacement of any defective insulated flange component, including shipping, shall be at no additional cost to Fairfax Water. Contractor shall provide tapped Mechanical Joint caps (of the insulated flange size) and test assembly and Fairfax Water will provide meters and pressure gauges along with the water supply. The insulated flange testing procedure, which does not replace or relieve any of the other testing requirements in Section 02514, is as follows:

1. Assemble the insulated flange assembly according to manufacturer's and Fairfax Water's requirements. Install a cap on each end of the assembly, fill with water and pump it up to the greater of a hydrostatic pressure of 150 psi or 150 per cent of the maximum expected working pressure at the insulated flange unless otherwise shown or directed by Fairfax Water. Check visually to see if it leaks; no water or air bubbles shall be present. Leave pressurized for ten (10) minutes and then check the gauge to see if it holds pressure.

I. Perform disinfection and bacteriological sampling in accordance with Section 02513.

3.02 TESTING

A. The pipeline shall be filled with water in accordance with Section 02513 for a minimum of 24 hours immediately prior to testing for leakage.

B. The piping shall be tested under the greater of a hydrostatic pressure of 150 psi or 150 per cent of the maximum expected working pressure at the high point of the line unless otherwise shown or directed by the Inspector. The piping shall be tested to the target pressure no more than once an hour. Additionally, if required by the Inspector, a leakage test at working pressure shall be performed. Air shall be purged from the pipeline through previously installed appurtenances in the pipe prior to testing. The test pressure shall be applied to the piping by means of a hand pump, or other approved method, and shall be maintained for minimum of two hours. The test pressure shall not vary by more than 5 psi.

C. The usage as determined by the above test shall not exceed the allowable usage as given by the following formula:

$$L = \frac{SD(P)^{0.5}}{148{,}000}$$

Where:

L = allowable usage, in gallons per hour

S = length of pipe tested, in feet

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch (gauge)

Actual usage shall be the amount of water (per hour) used to pump the line back up to the target test pressure. If this amount exceeds the “allowable usage” determined by the formula above, the test has failed.

3.03 REPAIRING LEAKS

A. When usage occurs in any test, defective pipe, valves, fittings, appurtenances, or joints shall be located and repaired by the Contractor. If the defective portions cannot be so located, the Contractor shall remove and reconstruct as much of the original Work as necessary to obtain a water main that does not exceed the allowable usage upon testing.

END OF SECTION 02514

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SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Steel Reinforcing Bars

B. Steel Reinforcing Fabric

1.02 REFERENCES

A. ACI-318 Building Code requirements for reinforced concrete

B. Concrete Reinforcing Steel Institute (CRSI) Manual of Practice

C. ASTM A615 Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement

D. ASTM A185 Welded Steel Wire Fabric for Concrete Reinforcement

E. ASTM A497 Welded Deformed Steel Wire Fabric for Concrete Reinforcement

F. ACI 315 Manual of Standard Practice for Detailing Reinforced Concrete Structures

1.03 SUBMITTALS

A. Shop Drawings: Submit completely detailed Shop Drawings and schedules for steel reinforcing bars in accordance with Section 01330 - Submittals.

B. Certificates: Submit mill test certificates for the Chemical and Physical properties of steel reinforcing bars and steel welded wire fabric in accordance with the requirements of Section 01330.

1.04 DELIVERY, STORAGE AND HANDLING

A. Delivery: Reinforcing steel, as delivered to the Work, shall be in bundles strongly tied. Each group of both bent and straight bars shall be identified with a metal tag giving the identifying number corresponding to the bar schedules and diagrams. All reinforcing shall be properly stored in an orderly manner, at least 12 inches off the ground, and kept clean and protected from the weather.

B. Protection: Reinforcing steel shall be delivered without rust other than such as may have been accumulated during transportation to the Work. It shall at all times be fully protected from moisture, grease, dirt, mortar or concrete. Before being placed in position, it shall be thoroughly cleaned of all loose mill scale and rust and of any dirt, coatings or other material that might reduce the bond. If there is a delay in depositing concrete, the steel shall be inspected and satisfactorily cleaned immediately before the concrete is placed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcing Steel: Reinforcing steel shall be in accordance with the provisions of ACI 318 and Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice and the following.

B. Bars: Bars for concrete reinforcement shall be new steel rolled from open hearth steel billets and shall meet the requirements of ASTM A615, Grade 60. Rerolled materials shall not be permitted. Bars shall be deformed in conformity with ASTM A615 and shall be free of defects. Spiral reinforcing steel shall be fabricated from cold drawn wire in accordance with ASTM A82 or hot rolled plain or deformed bars conforming to ASTM A615, Grade 60.

C. Welded Wire Fabric: Fabric shall be of the electrically welded type, with wires arranged in rectangular patterns of the sizes shown or specified.

1. Welded smooth wire fabric shall conform to ASTM A185

2. Welded deformed wire fabric shall conform to ASTM A497

2.02 FABRICATION

A. Bending Steel Bars: Bars shall be cut to required length and accurately bent by approved methods before placing. Bars shall be bent in the shop unless written approval of field bending is obtained from the Inspector. If field bending is permitted, it shall be done only when the air temperature is above 30 degrees F where the bending operation is performed. Bars shall have a minimum inside radius of bend as specified in the CRSI Manual of Standard Practice.

PART 3 EXECUTION

3.01 INSTALLATION

A. Bars:

1. Placement: The bars shall be placed in the exact positions and with the spacing shown or required, and shall be securely fastened in position at the intersections to prevent displacement during the placing of the concrete. The bars shall be fastened with black annealed wire of not less than 16 gauge or other approved devices. Spacing chairs of type approved by the Inspector shall be furnished and properly placed to support and hold reinforcing bars in position in all beams and slabs, including slabs poured directly on the subgrade. Splices in tension reinforcement shall be as specified in the latest edition of ACI 318. Bar splices shall be staggered, where possible.

   a. Refer to the Approved Drawings for bar lap splice lengths.

   b. Maintain minimum 1-1/2” clearance between rebar and pipes, sleeves or anchor rings.

2. Projecting Ends: On any section of the Work where horizontal bars run further than the length of the forms, the form or head against which the work ends shall be perforated at the proper places to allow the bars to project through a distance at least equal to the lap specified. The projecting ends, however, unless otherwise directed by the Inspector, shall be of different lengths so that laps in bars in the same plane do not occur adjacent to each other.

B. Welded Wire Fabric: Steel reinforcing fabric shall be placed in the positions shown, specified, or required to fit the Work. Suitable spacing chairs or supports shall be furnished and placed to maintain the mesh in correct location. Where flat mesh is required, the mesh shall be rolled or otherwise straightened to make a perfectly flat surface before placing. The length of laps not indicated shall be approved by the Inspector.

1. Extend all slab reinforcement into the floor slab, wall or roof in accordance with the ACI Code. If such extensions are not obtainable, the bars shall terminate with a standard hook.

2. Cut or bend reinforcing steel bars as needed so that they do not continue through openings in slabs and walls.

3.02 PROTECTION

A. Unless otherwise noted on the Shop Drawings, the following concrete covers shall be provided for reinforcement in cast-in-place concrete:

Concrete cast against and permanently exposed to earth:	3”
Formed concrete exposed to earth, liquid or weather:	
#5 and Smaller:	1-1/2”
#6 and #11:	2”
Formed concrete not exposed to earth, liquid or weather:	1-1/2”

END OF SECTION 03200

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete Materials

1. Cement
2. Aggregates
    a. Sand
    b. Stone and Gravel
3. Water
4. Admixtures

1.02 REFERENCES

A. ACI 212 Guide for Use of Admixtures in Concrete
B. ACI 229 Controlled Low Strength Materials
C. ACI 304 Placing Concrete by Pumping Methods
D. ACI 306 Recommended Practice for Cold Water Concreting
E. ACI 308 Recommended Practice for Curing Concrete
F. ACI 318 Building Code Requirements for Reinforced Concrete
G. ACI 347 Recommended Practice for Concrete Formwork
H. ACI 614 Recommended Practice for Measuring, Mixing and Placing Concrete
I. ASTM C33 Specification for Concrete Aggregates
J. ASTM C39 Compressive Strength of Cylindrical Concrete Specimens
K. ASTM C42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
L. ASTM C94 Specification for Ready Mix Concrete
M. ASTM C109 Compressive Strength of Hydraulic Cement Mortars
N. ASTM C136 Sieve Analysis of Fine and Coarse Aggregates
O. ASTM C138 Test for Unit Weight, Yield and Air Content of Concrete
P. ASTM C143 Test for Slump of Portland Cement Concrete
Q. ASTM C150 Specification for Portland Cement
R. ASTM C171 Sheet Materials for Curing Concrete
S. ASTM C172 Sampling Fresh Concrete
T. ASTM C173 Test for Air Content of Freshly Mixed Concrete by Volumetric Method
U. ASTM C191 Time of Setting of Hydraulic Cement by Vicat Needle
V. ASTM C192 Making and Curing Concrete Specimens in the Laboratory
W. ASTM C260 Air-entraining Admixtures for Concrete
X. ASTM C309 Liquid Membrane-Forming Compounds for Curing Concrete
Y. ASTM C494 Chemical Admixtures for Concrete

Z. ASTM C596 Measuring the Drying of Shrinkage of Mortar Containing Portland Cement

AA. ASTM C827 Tests for Early Volume Change of Cementitious Mixtures

BB. ASTM D412 Specification for Concrete Drain Tile

CC. Federal Specification TT-S227E

DD. Federal Specification TT-S230C

EE. Corps of Engineers C572

FF. VDOT Road and Bridge Specifications, Latest Edition

1.03 DEFINITIONS

A. Class A. Concrete: Class A concrete is high-strength concrete intended principally for precast concrete units.

B. Class B. Concrete: Class B concrete is designed for high strength and watertightness and is intended for use in reinforced concrete structures such as thrust collars, columns, walls, beams, slabs, and, in general, where forms, other than simple forms, are required.

C. Class C Concrete: Class C concrete is designed for high strength and watertightness and is intended for use for bottoms of structures, electrical duct encasement, and, in general, where concrete is deposited directly on the bottoms of slopes or excavations and where only simple forms are required.

D. Class D Concrete: Class D concrete is designed as low-strength, plain or reinforced concrete and is intended for use in workmats beneath structures, soil stabilization, pipe cradles, encasement, valve box corrosion control test station pads, guard posts, thrust anchors, filling and other similar purposes.

1. Boulders or Rock Fragments: Clean boulders or rock fragments excavated during construction may be embedded, in quantities approved by the Inspector, in large volumes of concrete to provide added bulk.

a. Place boulders or rock fragments carefully so that no voids are left in the concrete.

E. High-Early Strength Concrete: High-Early strength concrete is designed to achieve Class B through Class D 7-day compressive strengths in as little as 1 day and is intended for use in situations where thrust anchors and collars need to achieve 7-day compressive strength early in order to minimize out of service water mains. High-Early strength concrete may be used only when shown on the Approved Drawings or approved by the Inspector.

F. Architectural Concrete: Is defined as the ultimately exposed areas of exterior and interiors of buildings, chambers, galleries, vaults, foundations, parapets (including portions to be covered by roofing or flashing material), tanks and basins limited on the interior to a point that is 2 feet below the normal water level.

G. Mass Concrete: Mass concrete is any cast-in-place concrete with dimensions large enough to require that measures be taken to cope with the generation of heat and attendant volume change to reduce cracking.

H. Flowable Fill Concrete (Controlled Low Strength Material): Flowable fill concrete shall be liquid enough to flow, be self-leveling, excavatable, and have a minimum 28-day compressive strength of 30 psi but not more than 100 psi. Non-excavatable flowable fill concrete shall have a minimum 28-day compressive strength of 125 psi but no more than 200 psi (to be excavatable by machine equipment). Materials shall comply with the recommendations within chapter 3 of ACI 229, latest revision, which include cement, aggregates, fly ash, water, admixtures, slag and other nonstandard materials.

1.04 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings in accordance with the requirements of Section 01330 for the following:

1. Architectural formwork
2. Steel forms

B. Samples: Provide representative samples of the following items in accordance with the provisions of Section 01330.

1. Aggregate: Provide a 50-pound sample 15 days prior to the first day concrete is used.
2. Fine Aggregate for Architectural Concrete: Submit a representative color sample for approval 15 days prior to the first day of use.

C. Concrete Mix Design: Concrete mix designs shall be prepared and submitted to the Engineer for approval for each type required.

1.05 REGULATORY REQUIREMENTS

A. American Concrete Institute: Perform Work covered by this Section in accordance with the requirements of the American Concrete Institute.

B. Concrete shall conform to applicable sections of VDOT Road and Bridge Specifications.

1.06 DELIVERY, STORAGE AND HANDLING

A. Cement:

1. Delivery: Cement delivered to the jobsite shall be in strong, well-made bags marked with the brand, name of manufacturer and net weight.
2. Storage: Store cement in weathertight building with a wood floor raised above the ground and protected from dampness.
    a. Stack and store individual shipment in a manner that permits each shipment to be readily accounted for at all times.
    b. Provide all facilities necessary to permit sampling and inspection of each shipment.
    c. Do not use cement that has deteriorated.
    d. Cement remaining in storage prior to shipment for a period exceeding 6 months after testing shall be re-tested and rejected if it fails to meet any requirements of these Specifications.
    e. Do not use previously accepted cement that has been in storage more than 1 year from the time of original acceptance.

B. Aggregate: Keep aggregates clean and free from all other materials during transportation and handling. Keep fine and coarse aggregates separated from each other until measured in batches and placed in the mixture.

1. Stockpiling: Unless finish screening is provided at the batch plant, stockpile aggregates in a manner to prevent segregation and in accordance with ACI Standard 614.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. W. R. Grace and Co.

B. Sonneborn-Contech

C. Sika Chemical Corporation of Lyndhurst, NJ

2.02 MATERIALS

A. Cement: Provide standard Portland cement, Type I, Type II, or Type III (High-Early strength) which meets the requirements of ASTM C150:

1. Domestic manufacturers: Provide cement that is produced domestically.

2. Architectural Concrete: Provide cement that is uniform in color and type from one manufacturer for use in architectural concrete.

B. Fine Aggregate: Fine aggregate shall be natural sharp sand meeting the requirements of ASTM C33 except as modified herein:

1. Limits for deleterious substances: The limits for deleterious substances shall be as set forth in Table 1 of ASTM C33 for concrete subject to abrasion.

2. Color: Fine aggregate for architectural concrete shall be of one type and color.

a. Fine aggregate subjected to the test for organic impurities and producing a color darker than standard will be rejected without exceptions.

3. Soundness: Fine aggregate shall meet the requirements of the soundness test set forth in paragraph 7.1 of ASTM C33.

4. Fine aggregate for mortar and grout: Fine aggregate for mortar and grout shall be well graded within the following limits by weight when tested in accordance with ASTM C1126.

SIEVE	PERCENTAGE PASSING
No. 4	100
No. 8	96 to 100
No. 16	40 to 65
No. 30	15 to 35
No. 50	5 to 15

C. Coarse Aggregate: Coarse aggregate shall consist of gravel or crushed stone and shall meet the requirements of ASTM C33. The limits for deleterious substances and physical property requirements given in Table 3 of ASTM C33 shall apply for each class designation without exception. Coarse aggregate shall be graded according to Sizes 46 and 57 in Table 11 of the Standard.

1. Coarse Aggregate Specification: Size No. 57 shall be used for all thin or closely reinforced concrete work, such as floors and roofs less than 7-inches thick, walls less than 9-inches thick, and all beams. For all other concrete work, Size No. 46 shall be used.

2. Color: Coarse aggregate for concrete shall be of one type and color.

D. Admixtures: The use of admixtures shall be limited to the following:

1. Air-entraining: All concrete, except Class D, shall contain an air-entraining admixture conforming to ASTM C260 and sufficient to produce from 4.5 to 6.5 percent entrained air in the concrete.

2. Water reducing: Water reducing admixtures, conforming to ASTM C494, Type A, shall be used when approved by the Engineer.

3. Set retarding: Set retarding admixtures, conforming to ASTM C494, Type D, shall be used when approved by the Engineer.

4. Fly ash: Fly ash, for use in flowable fill, shall conform to Section 241 of the VDOT Road and Bridge Specifications.

E. Water: Water used in mixing concrete shall be clean and shall not contain deleterious amounts of acids, alkalies or organic materials. All water shall be furnished from sources approved by the Engineer.

F. Expansion Joint Material: Joint filler shall be closed-cell PVC foam of the thickness shown.

G. Waterstops: Provide waterstops made of extruded polyvinyl chloride.

1. Requirements for plastic and waterstops: Provide plastic waterstops that meet the requirements of Corps of Engineer Specification ORD-C572, except as modified herein.

a. The Shore A durometer hardness shall be between 65 and 75.

b. The minimum tensile strength shall be 1850 psi.

c. Specific gravity shall not exceed 1.38.

d. Waterstops shall have ribbed longitudinal strips.

2. Dimensions: Unless otherwise shown, provide waterstops which are flat, a minimum of 6-inches wide, not less than 1-1/4-inches thick at the narrowest point, and not less than 3/8-inches thick immediately adjacent to the center.

H. Membrane Waterproofing: Provide membrane waterproofing which meets the requirements of ASTM C309 and is a semi-flexible material composed of an asphaltic core to which is bonded on independent weather proof coating. The coating is to be bonded during the manufacturing process.

1. Protective coating requirements: Protective coating shall form a continuous layer over the waterproofing core.

2. Membrane vapor transmission rate: Membrane shall have a constant rate of water vapor transmission not greater than 0.0066 grains per square foot per hour measured in accordance with ASTM E96.

I. Joint Sealant: Joint sealant materials may be either a single component urethane compound meeting the requirements of Fed. Spec. TT-S-230C or a two-component urethane compound meeting the requirements of Fed. Spec. TT-S-227E, except as modified herein.

1. Urethane sealant: The urethane sealant shall be 100 percent polymer, non-extended, containing no solvent, lime, or coal tar. Color shall be as selected by the Engineer, but shall not be black. Sealant properties shall conform to the following Table:

PROPERTY	VALUE	TEST METHOD
Maximum Final cure (days)	10	ASTM D412
Tensile strength (psi)	75-50	ASTM D412
Minimum elongation (1%)	400	ASTM D412
Modulus @ 100% elongation (psi)	35-50	Fed. Spec.
Shore A hardness	20-35	Shore Durometer
Solid content (1%)	98-100	
Peel content (1%)		Fed. Spec.

PROPERTY	VALUE	TEST METHOD
Minimum recovery (1%)	90	Fed. Spec.
Initial tack-free cure (hrs.)	24-48	Fed. Spec.

2. Joint sealant for unbonded joints: Where removable concrete slabs are not poured in place, horizontal and vertical joints shall be filled with self-leveling or non-sagging colma joint sealer, respectively, as manufactured by the Sika Chemical Corporation of Lyndhurst, NJ, or approved equal.

J. Sheet Curing Materials:

1. Paper shall consist of only ply of an approved type of fiber reinforced waterproof building paper, consisting of cross fibers embedded in asphalt between two layers of waterproof building paper.

2. Polyethylene film shall be white, opaque sheeting a minimum of 4 mils in thickness. The sheeting shall be manufactured from virgin resins and shall contain no scrap or additives.

2.03 MIXES

A. Concrete: Concrete to be used in the respective places shown on the Approved Drawings or as specified shall be divided according to compressive strength.

B. Concrete classifications: Refer to these Specifications and the Approved Drawings to determine which class of concrete to use in a given application.

1. Class A concrete shall have 7-day test strength of 3400 psi and 28-day test strength of 5000 psi.
2. Class B concrete shall have 7-day test strength of 2700 psi and 28-day test strength of 4000 psi.
3. Class C concrete shall have 7-day test strength of 2700 psi and 28-day test strength of 3000 psi.
4. Class D concrete shall have 7-day test strength of 1300 psi and 28-day test strength of 2000 psi.
5. High-Early Strength concrete shall have 1-day test strength equal to the applicable Class B, C, or D 7-day test strength requirement above.

C. Concrete mix design: Prepare mix designs for each type of concrete required in accordance with ACI 613.

1. Concrete of any class, which is to be placed by pumping methods, shall require a separate mix design.

D. Admixtures: Admixtures shall be used as directed in these Specifications.

1. When more than one admixture is to be used, each admixture shall be dispensed separately into the mix, and at separate times during the mixing in accordance with ACI 212.

E. Cement content: Concrete, except Class D, shall not contain less than 517 pounds of cement per cubic yard.

F. Water-cement ratio: Concrete mixtures shall be proportioned to give adequate workability for the use intended without exceeding the following prescribed quantities of mixing water:

CONCRETE CLASS	TOTAL WATER – U.S. GALLONS PER 94 LB. SACK OF CEMENT
B	5-1/2
C	5-1/2
D	7-1/4

1. For Class A and High-Early strength concrete, the quantity of mixing water shall be determined on the basis of either laboratory trial batches or field experience in accordance with ACI 318.
2. The quantity of water used in each batch shall be the total quantity, including surface moisture contained in the aggregates.

G. Ready mixed concrete: Ready mixed concrete shall meet the requirements of ASTM C94 except as modified in these Specifications.

2.04 GROUT

A. Grout: Grout shall be a flowable, prepackaged, non-shrink and non-stain grout without dependence on gas expansion forces or enlargement of metal particles for its non-shrink characteristics.

B. Packaging: The grout shall be packed in moisture-proof bags with general instructions for placement printed on the bag.

PART 3 EXECUTION

3.01 PREPARATION

A. Measurement and Mixing: Measurement and mixing of concrete shall be subject to the review of the Engineer in all respects and shall be performed in accordance with the recommendations of ACI 304, as modified herein.

1. Measuring requirements: Measure cement, fine and coarse aggregates separately by weight by equipment providing accuracy within 1 percent of the net load weighed. Water shall be measured by a suitable device, accurate to within 1 percent of the total amount required for the batch.

2. Measuring equipment: The accuracy of the weighting equipment shall meet the requirements of the United States Bureau of Standards and standard testing weights and other necessary equipment shall be available at all times for testing the equipment.

3. Mixing: Concrete shall be mixed in rotary, batch type mixer of adequate design to produce a thorough mix, homogenous in composition and uniform in color. Each batch of 1 cubic yard or less shall be mixed not less than 1-1/2 minutes after the last of the ingredients have been added to the mixer. The mixing time shall be increased 15 seconds for each additional cubic yard or fraction thereof.

B. Ready-Mixed Concrete:

1. Rate of delivery: The rate of delivery of the mixed concrete shall be such that the interval between placing of fresh concrete in contact with concrete already placed from previous batches shall not exceed 45 minutes. The elapsed time between the introduction of mixing water to the cement and aggregates and depositing concrete in the Work shall not exceed 60 minutes, including mixing and agitating time.

2. Delivery equipment: Delivery of concrete in non-agitating equipment shall not be permitted.

3. Addition of water: No water shall be added to the concrete at the site unless accepted by the Engineer for a specific batch. Acceptance of such addition to one batch shall not be construed as acceptance of additions to subsequent deliveries.

3.02 INSTALLATION

A. Forms:

1. General: The design and engineering of the formwork, as well as its construction, shall be the responsibility of the Contractor. Forms shall be designed, detailed and constructed in accordance with ACI 347 including all tolerances, except as modified herein. Beam and girder soffits shall be erected with a camber as indicated on the Approved Drawings. Where camber is not given, a minimum camber of ¼-inch in 10-feet of span shall be provided. The forms shall be sufficiently braced, shored, and wedged to prevent deflection.

   a. Provide ¾-inch bevel strips at the external angles of walls, beams, pilasters and columns and girders.

   b. Provide sufficient forms for repeated uses to ensure the required rate of progress.

      1) Thoroughly clean and inspect all forms before use.

   c. Apply a suitable form oil to the inside surface immediately before, during, or after erection of forms or thoroughly wet form just prior to placing concrete.

      1) No form oil shall be permitted on the reinforcing steel.

   d. The Contractor shall be responsible for remedying any defects resulting from form use, inspection and prior acceptance by the Engineer notwithstanding.

2. Plywood forms: Forms for all interior exposed concrete surfaces and designated areas of exterior exposed concrete surfaces shall be constructed of plywood not less than 5/8-inch thick for straight sections and 3/8-inch thick for curved sections. Plywood shall be Douglas Fir, 5-ply for 5/8-inch or thicker, and 3-ply for 3/8-inch, made with a waterproof glue and manufactured especially for concrete formwork. Edges shall be square in both directions, and adjoining panels shall match in thickness, width, and length. Full-size sheets of plywood shall be used. Forms shall be placed so that marking will be symmetrical. Plywood shall be thoroughly oiled on contact faces and edges with raw linseed oil or other accepted form of lacquer.

3. Steel forms: Construct forms accurately in modular sizes and in such minor multiple widths and lengths as will permit plates and filler to be erected to correct alignment.

    a. Coat steel forms prior to each use with a light, clear paraffin-base oil or other acceptable commercial preparation that shall not discolor concrete.

    b. Wire brush plates after each use.

B. Placing Concrete:

1. General: Place concrete only in presence of the Inspector in forms that have been accepted by him. Where procedure is not specified, place concrete in accordance with ACI 304.

2. Continuous Operation: Concreting operations shall be continuous until the section, panel, or scheduled placement is completed. Should the concreting operations be unavoidably interrupted, construction joints shall be formed at proper locations as specified.

3. No Placement after Initial Set: No concrete shall be placed after its initial set has occurred, and no re-tempered concrete shall be used under any conditions.

4. Minimum Handling: Concrete shall be conveyed and placed with minimum handling and by means of buckets, buggies, chutes, pumps, or other approved equipment that will prevent segregation of the ingredients. The slope and length of chutes shall be subject to the acceptance of the Inspector. Outlets of chutes, hoppers, and conveyor belts shall be provided with suitable baffles to prevent segregation. Apparatus shall be kept clean and flushed with water before and after each run. Concrete shall be deposited in the forms as close as possible to its final position and, in no case, more than 5-feet in a horizontal direction therefrom. Re-handling of concrete will not be permitted.

5. Placement in Layers: Place concrete in layers shallow enough so that the previous layer is still soft when the next layer is added. The two layers can be vibrated together.

    a. The maximum layer depth shall not exceed 18-inches.

    b. The elapsed time between placing layers shall not exceed 45 minutes.

6. Elimination of Voids: Take special care to place concrete against the forms, particularly in angles, and corners in order to prevent voids, pockets and rough areas and to assure continuous contact of the entire surface of the reinforcing steel and inserts with concrete.

    a. Rod or spade concrete, if needed, to work coarse material away from forms.

7. Protection: Protect freshly placed concrete against damage from the elements or other sources.

8. Vibrating: Consolidate all concrete by means of mechanical internal vibrators applied directly into the concrete in a vertical position.

    a. The intensity and duration of vibration shall be sufficient to cause concrete to flow, to compact thoroughly and to embed reinforcement, pipes, conduits, and similar Work completely. Vibrators shall not, however, be used to cause concrete to move more than a short distance horizontally. Vibrators shall be inserted and withdrawn at points 18- to 30-inches apart, and vibration shall be stopped immediately when sheen of mortar first appears on the surface.

    b. Vibrators shall operate at a speed of not less than 4500 cycles per minute. Each tool shall weigh approximately 15 pounds and shall be capable of producing a visible effect upon concrete mixture with a 1-inch slump for a distance of at least 18-inches from the vibrator. A sufficient number of vibrators shall be on hand to assure that the incoming concrete can be properly compacted within 15 minutes after placing. Reserve vibrators shall be on hand for the time when others are being serviced. No placement of any concrete shall be made with a single vibrator on hand.

C. Special Requirements:

1. Hot Weather Requirements: Follow the requirements of ACI 305 and the following for placement of concrete during hot weather.

   a. Concrete in excess of 90 degrees F. at the time of placement shall not be used.

   b. A water reducing set retarding admixture may be used in accordance with the provisions of these Specifications when concrete temperature is consistently about 75 degrees F. and a noticeable decrease in slump or an increase in mixing water demands occur.

2. Cold Weather Requirements: Follow the requirements of ACI 306 and the following for placement of concrete during cold weather.

   a. Set accelerators shall not be permitted.

   b. Protect concrete placed in the Fall from the time of the first frost until mean daily temperature at the site falls below 40 degrees F. from freezing for a minimum period of 24 hours after it is placed.

   c. While mean daily temperatures are below 40 degrees F., the temperature of the concrete shall be not less than 50 degrees F. and shall be maintained at this temperature for at least 72 hours, or, if structural requirements are critical, until such time as is required to develop the necessary compressive strength. The internal temperature for concrete at the time of placing during this period shall not exceed 60 degrees F.

   d. Protect concrete, placed in the spring after mean daily temperature rises above 40 degrees F. from freezing in a similar manner to that described in the preceding sentences, until danger of freezing is past.

D. High-Early Concrete

1. When use of high-early strength hydraulic cement concrete is required, it shall conform to the requirements specified in Table II-17 in Section 217 of the VDOT Road and Bridge Specification, except that the 28-day strength shall be obtained in 7 days. Up to 800 pounds per cubic yard of Type I of Type II cement may be used to produce high-early strength concrete in lieu of using Type III modified cement.

2. Hydraulic cement concrete shall conform to the requirements of Section 217 for Class A3 paving concrete except that the compressive strength shall be at least 3,000 psi within 24 hours. The accelerated strength gain shall be achieved by the use of 800 +/-50 pounds per cubic yard of Type III cement conforming to the requirements of AASHTO M-85 and approved air-entraining, accelerating, and water-reducing admixtures conforming to the requirements of Section 215. If calcium chloride is permitted as an accelerating admixture, it shall be limited to 2 percent by mass. The air content shall be 6 +/- 2 percent. The water/cement ratio shall be not more than 0.42 by weight. The Contractor shall prepare a sufficient number of trial batches in the presence of the Inspector to verify the strength and workability of the mixture design when required.

E. Curing:

1. General: Follow recommendations of ACI 318 and the following for curing concrete.

   a. Protect concrete surfaces, which will normally be exposed to the atmosphere, against drying too rapidly for a minimum period of 7 days.

      1) Refer to requirements of applicable subparagraphs on hot or cold weather curing.

   b. Curing procedure shall begin immediately following placing the concrete.

      1) If a delay in application of curing procedure occurs, cover concrete with moistened burlap held in complete contact with the surface or kept moist by continuous sprinkling.

c. Use one of the following methods, subject to approval of the Inspector, for curing concrete.

2. Water Curing: Use quilted covers, wetted and applied to the concrete surface as soon as forms have been removed or, in the case of slabs, as soon as concrete has set sufficiently to prevent marring of finish.

   a. Quilted covers shall consist of an outer covering of burlap or cotton, and a needled, punched or sandwiched inner layer of cotton batting, in all weighing a minimum of 20 ounces per square yard.

   b. Maintain covering materials in a thoroughly saturated condition sufficient to show the presence of free water between mat and concrete surface at all times throughout curing period.

3. Sheet Curing: Sheet curing of concrete slabs is accomplished through use of sheet materials such as waterproof paper or polyethylene film, both meeting the requirements of ASTM C171, applied to the concrete surface as soon as it has set sufficiently to prevent marring.

   a. Wet concrete surface thoroughly, then place sheet goods in direct contact and anchor in a manner that assures continuous contact during curing period.

   b. Lap sheet materials a minimum of 3-inches, then tape, glue or cement seams.

   c. Sheeting materials shall not discolor concrete surface.

4. Membrane Curing: Begin membrane curing immediately after removal of forms, or in the case of uniformed surfaces, as soon as water sheen is no longer visible on the concrete surface.

   a. Coat the entire exposed surface with a liquid membrane-forming compound containing a temporary color indicator.

   b. Apply membrane coating by means of an approved pressure spray distributor at the rate of 1 gallon of material per 200 square feet of concrete surface.

      1) Do not apply membrane curing to the faces of construction joints or other surfaces against which additional concrete will be placed. Keep those surfaces continuously wet by other means.

      2) Do not apply membrane coating to surfaces which are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete, such as other concrete, liquid floor hardener, waterproofing, damp-proofing, membrane roofing, floor painting and other coatings and finish materials, unless otherwise specified.

5. Special Requirements:

   a. During hot weather, protect concrete surfaces from drying by continuous moist curing for a period of at least 24 hours.

      1) Start curing procedure as soon as concrete surface has hardened sufficiently to withstand surface damage.

      2) If moist curing is not carried beyond 24 hours, cover surface, while damp, with a suitable heat-reflecting plastic covering or spray with a white pigmented curing compound.

   b. During cold weather, protect concrete against freezing in accordance with ACI 306 and the following:

      1) When protection against low temperatures is removed at the end of the required period, remove it in a manner such that the resulting temperature drop in any part of the concrete does not exceed 40 degrees F. during the first 24-hour period.

      2) Do not permit concrete in heated enclosures to dry out.

F. Joints and Bonding: Make construction joints where indicated or permitted. Locate joints to assure stability, strength and watertightness.

1. Corners: Build all corners monolithically. Concrete on either side of the corners shall be continuous to the points shown on the Approved Drawings or as directed.

2. Placing Concrete in Beams, Girders, or Slabs: Allow a minimum of 2 hours to elapse after concrete in the columns or walls before depositing concrete in beams, girders, or slabs supported thereon.

3. Horizontal Keyways: Build horizontal keyways to facilitate the drainage of flushing water from the keyways.

4. Requirements for Joints: Provide joints with continuous straight and regular keys or grooves.

   a. Bring exposed concrete surfaces to a true level line at the top of all horizontal construction joints.

   b. In the case of exposed construction joints, locate a row of form ties in the concrete 4- to 6-inches from the joint to tighten the forms for subsequent sections of construction.

   c. Install waterstops, where required, in accordance with the provision of these Specifications.

5. Continuous Placing between Construction Joints: The placing of concrete shall be carried on continuously between the construction joints shown on the Approved Drawings or as directed by the Engineer.

   a. If, for any reason, it becomes necessary to stop placing concrete at locations other than those indicated, both the proposed location and method of making the joint shall be subject to the Inspector's approval.

6. Placement against Existing Concrete: Concrete surfaces, against which the new concrete is to be placed, shall be thoroughly cleaned and wetted. Just prior to placing new concrete, horizontal surfaces and joints shall be slushed with at least 2-inches of cement grout of the same mixture as the concrete but with coarse aggregate omitted. Special care shall be used in placing and puddling concrete at vertical joints to ensure a bond with existing concrete. Vertical construction joints shall not be made in watertight construction, unless shown on the Approved Drawings.

G. Finishing Concrete Surfaces:

1. General: Finish exposed exterior concrete surfaces to achieve neat and smooth architectural effects, except where textured surface is indicated.

   a. Finish top edges of wall within a 1/2-inch radius, unless beveled edges or other details are shown.

   b. Immediately after stripping the forms, without exception, inspect all concrete surfaces. Remove all fins, offsets, burrs, ridges or other unsightly marks from the concrete surfaces.

   c. Tie holes, pour joints, voids, stone pockets, or other defective areas shall be patched, in accordance with the recommendations of the manufacturers of the various bonding compounds, before the concrete is thoroughly dry. Defective areas shall be chipped way or bush-hammered to a depth of not less than 1-inch with all edges perpendicular. Obtain a roughened dust-free surface. The areas to be patched, including at least 5-inches of the adjoining surface, shall be wetted continually for a minimum of 1 hour prior to placing the patching mortar. A bonding material or agent consisting of a mixture of cement, water and an additive, the amount as recommended by the manufacturer, such as EUCO liquid, Rhoplex 330 or approved substitute, shall then be scrubbed onto the surface, followed immediately by the patching mortar. The material for patching shall consist of the same material and of approximately the same proportions as used for the concrete, omitting the coarse aggregate and mixing with water and an additive

as previously specified. For exposed concrete, white cement shall be substituted for part of the gray cement so that the patch will match the color of the surrounding concrete. The proportion of white and gray cement shall be as determined by the patches made on the sample panels. The amount of water shall be as little as consistent with the requirements of handling and placing. The mortar shall not be re-tempered. The mortar shall be thoroughly compacted and screed off so as to leave the patch slightly higher than the surrounding surface. It shall then be left undisturbed for a period of 1 to 2 hours to permit initial shrinkage before being finally finished. The patch shall be finished to match the adjoining surface and shall be cured as specified for the original concrete.

2. Exterior concrete surfaces: Exposed exterior concrete surfaces defined as architectural concrete, except in the case of textured concrete surfaces, shall be given a uniform light rubbed finish.

    a. After the patching has been completed, the surfaces shall be given a uniform rubbed finish as follows: Mix 1 part Portland cement and 1-1/2 parts fine sand with sufficient water to make a grout having the consistency of thick paint. Wet the concrete surface, and brush the grout uniformly over the entire area, completely filling air bubbles and holes. Immediately after applying the grout, float the surface with a wood float, scouring the wall vigorously. Allow the cement to set for 1 or 2 hours, depending upon the weather.

    If hot and dry, keep the walls damp during this period using a fine fog spray. When the grout has hardened sufficiently so that it can be scraped from the surface with the edge of a steel trowel without removing the grout from the small air holes, cut off all that can be so removed. Allow the surface to dry thoroughly, and then rub it vigorously with burlap to remove completely all dried grout. There should be no visible film of grout remaining after this rubbing, and no grout shall be left on the surface overnight. Sufficient time shall be allowed for grout to dry after it has been cut with the trowel, so that it can be wiped off clean with the burlap. The finished surfaces shall have a uniform, fine sand finish.

H. Expansion Joints: Provide joint filler for all expansion joints; finish expansion joints with a joint sealant where shown or specified.

1. Placing joint filler: Place joint filler against the completed portion of the Work before concrete for next section is placed.

    a. Fasten filler to hardened concrete with a compatible adhesive in accordance with the manufacturer’s instructions.

    b. Extend filler through the thickness of the wall or slab.

        1) Joint filler shall be flush with the finished surface, except where a joint sealant is shown.

    c. In joints having a waterstop, fit filler accurately on each side of the waterstop to prevent intrusion of concrete.

2. Joint prime and sealant application: Prepare joint surfaces by removing all foreign matter and concrete laitance so that concrete surfaces are free of all oil, grease, wax, waterproofing compounds or form release materials prior to application of primer and sealant.

    a. Prime all concrete joint surfaces without exceptions.

    b. Priming of other surfaces shall be according to the sealant manufacturer’s recommendations and subject to Inspector’s approval.

    c. Apply primer by brushing or spraying on joint surfaces.

    d. Apply sealant within 2- to 24-hours after application of the primer.

e. For horizontal joints, apply sealant by pouring directly from a suitably shaped container or by flowing from a bulk-loading gun.

f. Fill vertical joints from a gun, beginning at the bottom to avoid bulging and the formation of air voids.

g. Fill overhead joints from a gun, by laying a bead along each side of the joint and then filling the middle.

h. Immediately after application, tool sealant in accordance with manual instructions in order to establish contact with joint surfaces and to provide a smooth sealant face.

3. Joint Depth: Control joint depth with the use of joint fillers and backup materials.

a. Fillers and backup material in contact with sealant shall be non-impregnated and free from asphalt, creosote, oil or extractable plasticizer.

b. Backup material shall be closed cell polyethylene foam, such as Sealtight Backer Rod or Sonofoam Backer Rod with a diameter 1/4-inch larger than the joint width.

c. Joint widths and sealant depths shall be as shown, except that sealant depth shall not exceed 1/2-inch.

I. Waterstops: Waterstops for corners and intersections shall be prefabricated so that only butt joints need to be made in the field.

1. Corners and Intersections: Field fabrication of corners and intersections requires the Inspector's approval. Miter and assemble corners and intersections with approved equipment as described for field joints.

2. Field Joints: Make field joints by cutting the ends of the sections to be spliced so they will form a smooth, even butt joint.

a. Heat the cut ends with splicing tool until plastic melts. Press ends together until the plastic cools.

b. Splicing shall cause as little damage to the continuity of the ribbed strips as possible.

J. Unbonded Joints: Where removable concrete slabs are poured in place, slab must be prevented from bonding to walls or other rigid parts of the structure.

1. Preventing bonding: Prevent bonding by the use of membrane waterproofing material

a. Place material over the bearing surface of the wall or other supporting part of the structure in order to isolate it from the new concrete being placed.

b. Install material in layers as required to produce a total thickness of at least 1/8-inch.

2. Filling unbonded joints: Where removable concrete slabs are not poured in place, fill horizontal and vertical joints with self-leveling or non-sagging Colma joint sealer

K. Mass Concrete: Any concrete placement of 100 or more cubic yards with a minimum dimension of 3 feet will be considered mass concrete.

1. Provisions during Placement: Make special provision to lower the temperature of the concrete as it is placed and to limit the maximum temperature rise in the concrete during hydration.

a. The provisions may include pre-cooling the mix, reduction in cement content and substitution of possolan or blast furnace slag cement for part of the Portland cement, as approved by the Engineer.

2. Provisions after Placement: Make provisions to avoid thermal shock due to too rapid cooling of the concrete after the initial curing period.

3.03 FIELD TESTS

A. Slump Tests: Conduct slump tests in accordance with ASTM C143 and the following

1. Allowable Slump: Provide a concrete mixture that has a slump of 5-inches or less if placement is to be done by pumping and 4-inches or less if placement is to be accomplished by methods other than pumping.

2. Tolerances: A tolerance of up to 1-inch greater than these amounts shall be allowed for individual batches provided the average to all batches or the 10 most recent batches, whichever is fewer, does not exceed the maximum allowable slump.

3. Excessive Slump: Concrete with excessive slump shall be rejected and no additional concrete shall be delivered until the case of the deficiency is determined and corrected.

B. Air Content Tests: Tests to determine air content of fresh concrete shall be taken twice daily, at least 4 hours apart and shall be performed in accordance with the applicable ASTM Standards.

C. Number of tests required. Unless otherwise required, a minimum of one strength test shall be made for each 50 cubic yards or fraction thereof for each mix design of concrete placed in any one day.

D. Sample collection and storage: Sampling of fresh concrete shall be in accordance with ASTM C172. Laboratory and field test cylinders shall be made and, for the first 24 hours, cured and stored in a tightly constructed, firmly braced wooden box, constructed to maintain the temperature immediately adjacent to the specimens in range of 60 degrees F. to 80 degrees F. and prevent loss of moisture from the specimens. The storage temperature shall be thermostatically controlled when necessary.

1. Loss of moisture shall be prevented by covering cylinders with wet burlap, damp sand or other approved means. Test cylinders cast in cardboard molds shall not be stored in contact with wet burlap, damp sand or any other material that will allow the outside surfaces of the mold to absorb water for the first 24 hours. Cylinders shall be removed from storage after 24 hours, and after removal of molds, the laboratory-cured cylinders shall be stored in a moist condition in the laboratory at a temperature of 65 degrees F. to 75 degrees F. until the time of the test. The field-cured cylinders shall be removed from storage after 24 hours and stored in the structure as near the point of sampling as practicable, with the same protection on all surfaces as the structure that they represent.

E. Testing: Cylinders shall be tested in accordance with ASTM C39. Each strength test will consist of 3 laboratory-cured and 1 field-cured cylinders. One laboratory-cured cylinder shall be tested at 7 days. Normally 2 laboratory-cured cylinders and 1 field cured cylinder shall be tested at 28 days. If the 7-day laboratory cured-cylinder is not satisfactory, one of the remaining laboratory-cured cylinders shall be tested at 7 days instead of 28 days. Testing requirements for High-Early strength concrete will be directed by the Inspector.

F. Testing Laboratory: The concrete testing laboratory will be employed directly by the Developer, which will pay all fees associated with concrete testing work. The Contractor shall assist the testing laboratory whenever necessary to accomplish the required tests.

G. Strength Requirements: The average strength of the test cylinders for any portion of a structure shall be equal to or greater than the strength specified, and at least 90 percent of all tests shall indicate a strength equal to or greater than the strength specified. In cases where the average strength of the test specimens for any portion of the structure falls below the specified requirements, the Engineer shall order a change in the mix proportions or water content for the remaining portion of the Work and shall require the Contractor to secure test specimens of the hardened concrete represented by these cylinders. The number of test cylinders for each concrete placement shall be as directed by the Inspector. Specimens shall be secured and tested in accordance with ASTM C42.

H. Failure to achieve required strength: If the specimen tests further substantiate that the concrete represented by the cylinders and specimens is below the specified strength requirements, the concrete shall be removed and replaced at the expense of the Contractor.

3.04 CLEANING

A. Removal of Forms: Forms shall not be removed until the concrete has hardened sufficiently to support its own load plus any superimposed loads that may be placed thereon. Forms, form ties and bracing shall not be removed without the specific permission of the Contractor's licensed Professional Engineer.

1. Minimum shoring times: Leave forms in place at least the minimum length of time specified below. Removal can proceed only if the minimum specified strength for the given period of time has been achieved.

	MIN. TIME	MIN. STRENGTH (PSI)
Columns and Walls	2 days	1500
Side forms for girders and beams	2 days	1500
Bottom forms of slabs:		
Under 10-feet clear span	4 days	2300
10- to 20-feet clear snap	7 days	2700
Over 30-feet clear span	10 days	2900
Bottom forms of beams & girders:		
Under 10-feet clear span	7 days	2700
10- to 20-feet clear span	14 days	3200
Over 20-feet clear span	21 days	3600

a. The preceding times may be decreased if field concrete strengths, determined from test cylinders made in accordance with the provisions of these Specifications, equal or exceed the strengths listed previously.

b. Increase the minimum times if concrete temperature following placement is permitted to drop below 50 degrees F.

2. Re-shoring: The Contractor may elect to use re-shoring techniques where form panels are stripped in a pattern or sequence such that part of the original shores remain or re-shoring is simultaneously provided so that the partially cured concrete is not overstressed. Re-shoring shall not commence until the Contractor's licensed Professional Engineer has reviewed the re-shoring system and examined the concrete to satisfy himself that it has properly hardened and will not be damaged by re-shoring in any way.

3. Form ties: Withdraw the removable portion of the form ties from the concrete immediately after forms are removed.

a. Fill holes with grout from a grout gun.

b. Finish the surface with a steel spatula or by rubbing with sackcloth.

c. On architectural concrete and on exposed interior surfaces of buildings where appearance is important, add white cement to patching grout.

4. Concrete finishing: Take care in removing forms, wales, shorings, supports and form ties to avoid spalling or marring the concrete. Start patching rubbed finish as required immediately following form removal without exception. Concrete placements shall be sequenced to minimize shrinkage cracks.

END OF SECTION 03300

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SECTION 03400

PRECAST CONCRETE VAULTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precast Concrete Vaults

1.02 REFERENCES

A. ASTM C857 Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

B. ASTM C858 Underground Precast Utility Structures

C. ASTM C891 Installation of Underground Precast Concrete Utility Structures

D. ASTM C1037 Inspection of Underground Precast Concrete Utility Structures

E. VDOT Road and Bridge Specifications

F. VDOT Road and Bridge Standards

1.03 DEFINITIONS

A. Class A Concrete: Refer to Section 03300 for definition

1.04 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings, associated details, and design calculations for the following items in accordance with Section 01330 - Submittals.

1. Precast concrete vaults

B. Design Data: Submit design data, sealed and signed by a licensed Professional Engineer, for the following items in accordance with Section 01330 - Submittals.

1. Precast concrete vaults

C. Test Reports: Submit test reports for the following in accordance with Section 01330 - Submittals.

1. Slump
2. Air content
3. Compressive strength

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fairfax Water publishes an “Approved Products List” which lists, by category, manufacturer’s products approved for use in Fairfax Water’s system. Manufacturers’ products covered by the categories included in this document which are not specifically listed are not approved for use. This document is available from Fairfax Water’s internet web site - www.fairfaxwater.org/developers-engineers.

2.02 MATERIALS

A. Materials shall be in accordance with the referenced Specifications and standards.

2.03 TESTS

A. Slump: Perform slump tests in accordance with the requirements of ASTM C143 and Section 03300.

B. Air Content: Perform tests for air content in accordance with the requirements of ASTM C138 or ASTM C173.

C. Strength: Perform strength tests in accordance with ASTM C39 for each mix design of six concrete cylinders at intervals as follows:

Test Intervals	Number of Cylinders
3 Days	Test 1 cylinder
7 Days	Test 2 cylinders
28 Days	Test 3 cylinders

2.04 VAULT DETAILS

A. Manufacture vaults to the dimensions shown on the Approved Drawings and in accordance with approved Shop Drawings. Comply with ASTM C857 and C858.

2.05 INSPECTION DURING MANUFACTURE

A. Comply with ASTM C1037.

B. Inspector shall be an individual assigned by the manufacturer.

2.06 PIPE AND FITTINGS

A. Pipe, fittings, and appurtenances shall be in accordance with Section 02510.

2.07 ACCESS DOORS AND LADDERS

A. Access doors and ladders shall be in accordance with Section 05500.

PART 3 EXECUTION

3.01 GENERAL

A. Comply with ASTM C891.

3.02 PREPARATION

A. Field Measurements: Verify that survey benchmarks and elevations are as intended.

B. Excavation for Precast Vaults: Excavate for precast vaults in accordance with the requirements of Section 02315 - Excavating, Backfilling and Compacting.

C. Preparation for Setting Vaults: Prepare subgrade in accordance with manufacturer's recommendations.

3.03 INSTALLATION

A. Installation of Precast Vaults: Install precast vaults in accordance with the manufacturer’s recommendations and the requirements of these specifications.

B. Furnish and install a tight-fitting plug in unused vault openings.

END OF SECTION 03400

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal Fabrications

1. Access doors
2. Vault ladders
3. Safety posts

1.02 RELATED SECTIONS

A. Section 03400 - Precast Concrete Vault

1.03 REFERENCES

A. ASTM A27 Specification for Mild to Medium Strength Carbon-Steel Castings for General Application.

B. ASTM A47 Specification for Malleable Iron Castings

C. ASTM A48 Specification for Gray Iron Castings

D. ASTM A148 Specification for High-Strength Steel Castings for Structural Purposes.

E. ASTM B26 Specification for Aluminum-Alloy Sand Castings

F. ASTM B148 Specification for Aluminum-Bronze Sand Castings

G. AISC Steel Construction Manual, Latest Edition

1.04 SUBMITTALS

A. Product Certification: Upon request, submit manufacturer's certification in accordance with the requirements of Section 01330, showing the true weights of the castings or comply with the provisions of "Certification" Article of this document.

B. Submit Shop Drawings and installation instructions for access doors, safety posts and ladders.

1.05 CERTIFICATION

A. Weighing Facilities: Provide facilities for weighing castings in the presence of the Inspector if weight certification from the manufacturer is not available.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fairfax Water publishes an “Approved Products List,” which lists, by category, manufacturer’s products approved for use in Fairfax Water’s system. Manufacturers’ products covered by the categories included in this document which are not specifically listed are not approved for use. This document is available from Fairfax Water’s internet web site - www.fairfaxwater.org/developers-engineers.

2.02 MATERIALS

A. Standards: Metal castings shall meet the requirements of the following standards:

1. Gray Iron: ASTM A48
2. Malleable Iron: ASTM A47
3. Carbon Steel: ASTM A27

4. Alloy Steel: ASTM A148
5. Aluminum: ASTM B26
6. Aluminum Bronze: ASTM B148
7. Silicon Bronze: Navy Specification 46B28
8. Manganese Bronze: Federal Specification QQ-B-726d

2.03 CASTINGS

A. Castings: Castings shall be made accurately to the dimensions shown on the Approved Drawings.

B. Grinding: Grind or plane castings where necessary to secure perfectly flat and true surfaces.

C. Thicknesses: Make allowances in patterns needed so that specified thicknesses are not reduced.

D. Defective Castings: Plugging of defective castings shall not be permitted. Defective castings shall be replaced.

2.04 VAULT ACCESS DOORS

A. Access doors shall be as shown on the Approved Drawings and in accordance with Fairfax Water's Approved Products List.

B. Provide a Model 2 "LadderUp" safety post with each access door. Device shall be manufactured of high strength steel with telescoping tubular section that locks automatically when fully extended. Upward and downward movement shall be controlled by a stainless steel spring balancing mechanism. Finish shall be hot dip galvanized. Unit shall be completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturer's instructions.

C. Provide a Miller Durahoist wall mount sleeve with each access door. Secure sleeve with 4 insert-type fasteners and bolts.

D. Each door shall be provided with insulation. Insulation shall be semi-rigid, 1½-inch thick with a minimum R value of 6.5. Maximum water absorption shall be less than 0.1% by volume of insulation. Insulation shall be bonded to door and factory installed. Vault insulation shall be covered with 18-gauge aluminum sheet for mechanical protection.

2.05 ACCESS LADDERS

A. Provide aluminum vault ladders with fully-welded construction and tread-grip rungs, in accordance with Fairfax Water's Approved Products List.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products as indicated on the Approved Drawings and in accordance with manufacturer's instructions.

END OF SECTION 05500

SECTION 09900

SPECIAL COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Damp-proofing concrete vaults

B. Painting ferrous metals above grade

C. Painting ferrous metals in vaults

D. Coating aluminum surfaces in contact with cementitious materials

E. Interior vault piping

F. Safety striping for concrete vaults

1.02 SUBMITTALS

A. Submit all product information for each coating system, in accordance with the requirements of Section 01330.

1.03 COLORS

A. Fairfax Water shall select colors to be used, unless denoted otherwise herein.

1.04 SURFACES TO RECEIVE COATINGS

A. Ferrous metal at or above the ground

B. Ferrous metal inside vaults below the ground

C. Aluminum in contact with cementitious materials

D. Interior vault piping

E. Interior vault entryways, as shown on Shop Drawings

F. The following items shall not be field coated, but shop coated by the manufacturer as specified for each item.

1. Buried Butterfly and Gate Valves

2. Buried Ductile Iron Pipe and Fittings

3. Fire Hydrants

1.05 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise required by the Approved Drawings.

1. ASTM D3276-00 Standard Guide for Painting Inspectors (Metal Substrates)

2. ASTM D4285-83 Standard Test Method for Indicating Oil or Water in Compressed Air

3. ASTM D4417-14 Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel

4. ASTM 7091-13 Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals

5. AWWA C600 Installation of Ductile-Iron Water Mains and Appurtenances

6. 29 CFR 1910.134 Respiratory Protection.

7. 29 CFR 1910.1000 Air Contaminants

8. 29 CFR 1910.1200 Hazard Communication
9. STANDARD RP0287 Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape
10. SSPC-SP COM Commentary on Paint Application
11. SSPC-SP 1 Solvent Cleaning
12. SSPC-SP 2 Hand Tool Cleaning
13. SSPC-SP 3 Power Tool Cleaning
14. SSPC-PA 1 Paint Application Specification No.1, Shop, Field and Maintenance Painting
15. SSPC-PA 2 Measurement of Dry Paint Thickness with Magnetic Gauges
16. SSPC-VIS 1 Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
17. NACE No.1/SSPC-SP 5 White Metal Blast Cleaning
18. NACE No. 2/SSPC-SP 10 Near-White Metal Blast Cleaning
19. NACE No. 3/SSPC-SP 6 Commercial Blast Cleaning
20. NACE No. 4/SSPC-SP 7 Brush-Off Blast Cleaning
21. NACE No. 8/SSPC-SP 14 Industrial Blast Cleaning

B. Air Quality Regulations: All paint shall conform to the applicable air quality regulations at the point of application. Any paint material that cannot be guaranteed by the manufacturer to comply, whether specified by product designation or not, shall not be used.

C. Compatibility: It shall be the responsibility of the Contractor to ensure the compatibility of the field painting products that will be in contact with each other or that will be applied over shop painted or previously painted surfaces. Paint used in successive field coats shall be produced by the same manufacturer and be system compatible per manufacturer. Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to underlying paint.

D. Field Priming: In general, surfaces of equipment, steel, and cast iron are specified to be shop primed. Any such surfaces which have not been shop primed shall be field primed. Shop coatings that are damaged or have failed, and have been determined unsuitable by the Inspector, shall be removed and the surfaces field primed. Galvanized, stainless steel, and insulated surfaces shall be field primed. Primers used for field priming, unless otherwise required for repair of shop primers, shall be as specified in Part 2 below.

PART 2 PRODUCTS

2.01 PAINTS

A. All coatings shall be of the type as manufactured for the purpose intended and shall be applied in accordance with the manufacturer's Product Data Sheet.

B. All coatings shall be brought to the job-site in the manufacturer's originally sealed containers bearing the manufacturer's labels identifying the paint type, color and batch number.

C. All materials used on the project shall be from the same manufacturer. For 3 multi-coat systems, each coat shall be of a contrasting color. The color of the final top-coat shall be chosen to ensure that the last coat achieves adequate hiding power and provides a solid and consistent visual appearance.

D. Materials shall be stored in a designated space with temperatures of no less than 40 degrees F (4.5 degrees C) and no more than 110 degrees F (43 degrees C).

E. No adulterant, unauthorized paint thinner/reducer or other material not included in the paint formulation shall be added to the paint for any reason.

F. Air Quality Regulations: All paint shall conform to the applicable air quality regulations at the point of application. Any paint material which cannot be guaranteed by the manufacturer to comply, whether specified by product designation or not, shall not be used.

G. Hydrants

1. Primer: Hydrant Manufacturer's Shop Primer
2. Finish (Barrel): Kennedy Safety Red or Mueller Red No. 10, shop-applied by hydrant manufacturer
3. Finish (Top and Caps): Kennedy Silver or Mueller Silver No. 18, shop-applied by hydrant manufacturer

H. Interior Vault Piping

If surface temperature is equal to or greater than 40 degrees F:

1. Base Coat: Sherwin-Williams Macropoxy 646 Fast Cure Epoxy – Meadow Green (Item# B58W610) (#52300049563)
2. Intermediate Coat: Sherwin-Williams Macropoxy 646 Fast Cure Epoxy – Mill White (Item# B58W610)
3. Top Coat: Sherwin-Williams Macropoxy Fast Cure Epoxy 646 – Meadow Green (Item# B58W610) (#52300049563)

If surface temperature is less than 40 degrees F:

1. Base Coat: Sherwin-Williams Duraplate 235 Multi-Purpose Epoxy – Haze Gray (Item# B67A235)
2. Intermediate Coat: Sherwin-Williams Duraplate 235 Multi-Purpose Epoxy – Mill White (Item# B67W235)
3. Top Coat: Sherwin-Williams Duraplate 235 Multi-Purpose Epoxy – Haze Gray (Item# B67A235)

I. Guard Posts (Bollards)

1. Primer: Sherwin-Williams DTM Wash Primer
2. Top Coat (2 coats are required): Sherwin-Williams Sher-Cryl High Performance Acrylic – Robotic Blue (SW 4063)

J. Safety Striping for Concrete Vaults

1. Primer: Sherwin-Williams Loxon Concrete & Masonry Primer (#A24W8300)
2. Finish: Sherwin-Williams Industrial Enamel (B54 Series) – Safety Yellow (#B54Y37)

2.02 ASPHALTIC COATINGS AND DAMP-PROOFING OF VAULTS

A. Carboline Bitumastic 50 or functional equal approved by Fairfax Water.

PART 3 EXECUTION

3.01 GENERAL

A. Pre-Job Conference: Prior to the coating portion of any project, there will be a Pre-Job Conference in which representatives from Fairfax Water, General Contractor, and Subcontractors shall be present to discuss the following:

1. Job specific health, environment, safety requirements and emergency procedures
2. Scope of work
3. Chain of command, points of contact, communication
4. Any areas of concern in the project's specification

5. Critical hold points for inspections
6. Method of conflict resolution between the inspector and applicators
7. Procedures for change orders
8. Work schedule, site access/accommodations
9. Work access for inspection (scaffolding, ladders, etc.)
10. The Pre-Job Conference shall be held at a time to be mutually agreed upon

B. All Coatings shall be applied in strict accordance with the paint manufacturer's Product Data Sheet. All work shall be performed by skilled workmen in a safe and workmanlike manner that is satisfactory to Fairfax Water.

C. Environmental Testing: Immediately prior to, during, and after (when applicable) any coating application, environmental testing shall be performed by the Inspector to ensure that the surface temperature of the substrate is at least 5 degrees F greater than the dew point in the immediate area where coating is to take place in accordance to ASTM D3276-00 Standard Guide for Paint Inspectors (Metal Substrates).

D. Environmental Controls/Enclosures: In the event that any environmental controls (heaters, dehumidifiers, enclosures, etc.) are needed in order to obtain acceptable conditions for coating, acceptable environmental conditions shall be maintained during the coating's drying time.

E. Paint Mixing: All Coatings should be mixed and thinned/reduced in strict accordance with the manufacturer's Product Data Sheet and all sweat-in/induction and pot-life times should be strictly adhered to. All paint containers shall be tightly closed except when paint is being withdrawn.

F. Stripe Coating: A "Stripe Coat" is a brushed coat of paint that is applied prior to a full coat of paint being applied to an entire surface. A "Stripe Coat" application must be applied prior to the Prime Coat, Intermediate Coat and Top Coat. Areas that must have a "Stripe Coat" application prior to each coat:

1. Edges
2. Weld Seams
3. Outside Corners
4. Nuts and Bolts (heads and threads)
5. Crevices

G. Dry Film Thickness (DFT): The application of each coat shall be at the rate required to achieve at least the minimum, but not more than the maximum, dry film thickness specified in the manufacturer's Product Data Sheet and inspected in accordance to SSPC-PA 2 Measurement of Dry Paint Thickness with Magnetic Gauges and/or DT 7091-13 Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.

H. Drying Time: No subsequent coating shall be applied until the previous coat has dried according to the drying schedule on the manufacturer's Product Data Sheet. Certain conditions such as temperature, humidity, etc. can increase drying times. Adequate ventilation shall be maintained at all times.

I. Apply coating to all exposed ferrous metal whether below ground within vaults, or above ground. Items to be painted include cast or ductile iron piping, fasteners, valves, valve operators, cover, guard posts, etc.

J. All coatings shall be brought to the job site in originally sealed and labeled containers of the paint manufacturer and shall be subject to inspection by Fairfax Water.

1. Store paint inside, protect against freezing.

2. No adulterant, unauthorized paint thinner or other material not included in the paint formulation shall be added to the paint for any reason.

K. Prior to applying coatings, surfaces shall be cured, dry, and clean, free of grease or foreign material, and properly sandblasted, ground, pores filled and sanded, in accordance with Paragraph 3.02 below.

L. Coatings shall be applied in accordance with the manufacturer's Product Data Sheet. If dew or moisture conditions are prevalent, delay application until the temperature of the surface to be painted is 5 degrees F above the dew point and the surfaces are dry. The Contractor shall provide dehumidifying or heating equipment if needed to prevent sweating.

M. Thoroughly mix paint each time any is withdrawn from the container. Keep paint containers tightly closed except when paint is being withdrawn.

N. Coatings shall be applied in strict accordance with the manufacturer's Product Data Sheet and shall be performed in a manner satisfactory to the Inspector. The application of each coat shall be at the rate required to achieve at least the minimum, but not more than the maximum, dry film thickness specified in the manufacturer's Product Data Sheet.

O. No new coat shall be applied until the previous coat has dried. Under no condition shall additional coats be applied until the preceding coat has dried at least the minimum time called for. Drying time shall be construed to mean "under normal conditions" and within the range of application stated by the manufacturer. Where conditions other than normal exist because of the weather, such as with high humidity, or when damp-proofing and painting is done in confined spaces, a longer drying time will be necessary. Adequate ventilation shall be maintained at all times.

P. It shall be the Contractor's responsibility to ensure that all surfaces are properly prepared, the proper primer applied to the correct film thickness, and the finish coat is compatible with the primer coat and applied to the correct film thickness. This applies to all material, whether the total process is done in the shop or in the field, or partially in shop and partially in the field.

3.02 SURFACE PREPARATION

A. PRE-CLEANING

1. Contaminants such as oil, grease, dirt, etc., on the substrate shall be removed in accordance with SSPC-SP 1 Solvent Cleaning.

2. All weld seams shall be cleaned of rust, slag and adherent mill scale, and all weld spatter shall be removed in accordance with SSPC-SP 2 Hand Tool Cleaning and/or SSPC-SP 3 Power Tool Cleaning.

B. DRY ABRASIVE BLASTING

1. All surfaces to be painted or coated shall be prepared in a workmanlike manner and in accordance with the manufacturer's Product Data Sheet, with the objective of obtaining a clean and dry surface that is properly prepared for coating.

2. Prepare the clean, dry substrate by dry-abrasive blasting in accordance with surface preparation standard NACE No.2/SSPC-SP 10 Near-White Metal Blast Cleaning.

3. Any material specified to be painted that has an existing Bitumastic coating or a priming system coating that is not specified shall have the existing coating removed by dry-abrasive sand blasting in accordance with surface preparation standard NACE No.2/SSPC-SP 10 Near-White Metal Blast Cleaning. Any material that is properly shop-primed does not need to be field primed or sandblasted unless the shop primer is damaged, in which case, the damaged area shall be properly cleaned and the indicated field primer applied.

4. After dry-abrasive blasting, all grit, dust and other surface contaminants shall be removed and the prime-coat shall be applied within 4 hours of completion of blasting or before any detrimental corrosion or recontamination occurs.

5. No coating shall be applied prior to the approval by the Inspector.

3.03 DAMP-PROOFING

A. Exterior walls of all concrete vaults from finished grade down to the top of the bottom slabs shall be damp-proofed on the exterior surface with 2 coats of a Bitumastic/Asphaltic/Coal Tar coating in accordance with the manufacturer’s Product Data Sheet.

B. All structural joints of all concrete vaults shall be coated in the field after installation of the precast concrete structure with damp-proofing as specified above. Any damage to the damp-proofing coating as a result of shipping, installation, or any other reason shall receive two (2) touch-up coats of damp-proofing coating as specified above.

3.04 ASPHALTIC COATINGS

A. All aluminum/metal surfaces that are to be embedded in or fastened to cementitious materials shall receive 2 coats of a Bitumastic/Asphaltic/Coal Tar coating.

B. Apply in accordance with the manufacturer's Product Data Sheet.

3.05 PAINTING

A. Apply paint to exposed ferrous metals whether below ground within vaults, or above ground. Items to be painted include cast or ductile iron piping, fasteners, valves, valve operators, covers, guard posts, fire hydrants, etc.

B. Paint shall be of the type as manufactured for the purpose intended and shall be applied in accordance with the manufacturer's instructions in such a manner as indicated on the manufacturer’s Product Data Sheet. Any material that is properly shop primed does not need to be field primed unless the shop primer is damaged, in which case the damaged area shall be properly cleaned and the indicated field primer applied.

PART 4 REPAIR AND REMEDIAL WORK

A. Upon inspection, all damaged coatings shall be feathered around the damaged area for a minimum distance that is deemed acceptable to the Inspector and accordance with SSPC-SP 2 Hand Tool Cleaning.

B. All coatings found to be of an unacceptable dry-film thickness, shall be repaired to an acceptable dry-film thickness.

C. All areas to be repaired shall use the same coating materials and system as were used in the original coating application.

END OF SECTION 09900

SECTION 13110

CATHODIC PROTECTION

PART 1 GENERAL

1.01 DESCRIPTION

A. These specifications define materials and installation practices to minimize corrosion and to provide facilities for long-term corrosion monitoring of the proposed pipelines.

B. Installation of corrosion control components shall be in accordance with the following specifications, Approved Drawings, and Fairfax Water's Standard Details. All installation practices and components shall be approved by Fairfax Water.

C. The corrosion control system shall include electrical continuity (joint bonding), insulated flanges, insulated unions, and corrosion control test facilities.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer catalog cuts or other descriptive information for the specific materials required on this project for approval.

1. Packaged Magnesium Anodes
2. Test Stations and Terminal Boards
3. Shunt
4. Shorting Bars (Grounding Mats)
5. Wire and Cable
6. Thermite Welding Equipment
7. Coating for Thermite Welds
8. Insulated Flanges
9. Insulated Unions
10. External Coating for Insulated Flanges and Buried Mechanical Joints
11. Insulated Flange Internal Coating
12. Mastic Coating
13. Wire Connectors and Terminations
14. Electrical Tape
15. Field Test Equipment and Calibration Sheets
16. Warning Tape
17. Survey Markers
18. Steel Hand Stamp
19. Test Station Concrete
20. Guard Post
21. Solder
22. Separator Mesh
23. Zinc Anode Ribbon (Grounding Mats)
24. Polyethylene Encasement

25. PVC Insert

B. Quality Assurance: Submit in conjunction with product data:

1. Installation and Test Personnel Qualifications for Pipe Joint Bonding and Corrosion Control Hardware
2. Qualifications of NACE International Certified Corrosion Specialist
3. Proposed Test Data Forms

C. Close-Out: Submit prior to placing the water main in-service:

1. Letter of Compliance
2. Record Drawings
3. Test Report

1.03 QUALITY ASSURANCE

A. Qualifications: Installation, quality assurance, and testing personnel must have demonstrated experience with similar work.

1. Must be specifically named in qualification submittal and have completed at least three successful corrosion control systems within last three years for underground pipelines of similar type, similar size and equal complexity.
2. Must be full-time contractor or subcontractor employees. Part-time or contract personnel hired only for this work will not be permitted.
3. Only personnel approved by Fairfax Water are permitted. Personnel changes during course of project must be minimized and submitted to Fairfax Water at least two weeks prior to planned implementation.

B. Supervision: Employ a Corrosion Specialist certified by NACE International to perform the following:

1. Oversee and certify installation and related testing. Including pipe joint bonding, magnesium anodes groundbeds, and corrosion control equipment. Individual must participate in field activities to extent required by work.
2. Issue letter of compliance indicating all corrosion control measures are satisfactorily installed and comply with Approved Drawings. The letter of compliance shall be signed by the NACE International Corrosion Specialist.
3. Provide results from Acceptance Testing and pictures of test stations, concrete pads, and terminal board connections to Fairfax Water in the Test Report.

1.04 RECORD DRAWINGS:

A. General: Document installed location and configuration of each test station and each insulating device using Fairfax Water as-built sketch plate, including:

1. Test station number per schedule and installed pipeline station number.
2. Measurements (ties) between test station and three (3) or more existing physical objects.
3. Distance from test station to guard post, where installed.
4. Wire routing, size, insulation color and termination configuration on terminal board.
5. Pipeline station numbers for wire attachments to pipe.
6. Anode locations, where installed, including pipeline station number, depth and distance from pipe.
7. Pipeline station number and arrangement of interconnecting fittings for each insulating device, including insulated flanges and insulated mechanical couplings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Approved Manufacturers: Fairfax Water publishes an “Approved Products List” which lists, by category, manufacturer’s products approved for use in Fairfax Water’s system. Manufacturers’ products covered by the categories included in this document which are not specifically listed are not approved for use. The Approved Products List is available from Fairfax Water’s internet website - www.fairfaxwater.org/developers-engineers.

2.02 MAGNESIUM ANODES

A. Approved Manufacturers: See Fairfax Water’s Approved Products List.

2.03 TEST STATIONS AND TERMINAL BOARDS

A. Flush Mount Valve Box Type

1. Approved Manufacturers: See Fairfax Water’s Approved Products List.

B. Materials (Terminal Boards):

1. The terminal board shall be 4 inch by 6 inch by 0.25 inch thick phenolic board, 7 terminals, with 0.25 inch diameter nickel plated brass hardware. Terminal numbers to be engraved on terminal board. One 0.01 ohm (8 ampere) shunt and two copper shorting bars to be provided as indicated on details.

2.04 CURRENT MEASURING SHUNT

A. Materials:

1. Test station shunts shall be constructed to fit the terminal posts for the specified test station. The resistance shall be 0.01 ohm with a current capacity of 8 amperes. The shunt shall be as manufactured by Cott Manufacturing Company Model "Yellow" or approved equal.

2.05 SHORTING BARS (GROUNDING MATS)

A. Materials:

1. Shorting bars shall be constructed of copper to fit terminal posts for the specified test station. The shorting bars shall be 0.5 inch wide by 0.03 inch thick by 1.5 inches long, with 2 holes predrilled for mounting, as manufactured by CP Test & Valve Products, Inc. or approved equal.

2.06 WIRE AND CABLE

A. Materials:

1. All wiring shall be stranded copper wire of the AWG wire size and color shown on the Approved Drawings and details.

2. Wire for bonded joints shall be AWG No. 4 single conductor stranded copper wire with high molecular weight polyethylene (HMWPE) insulation (Black).

3. Wire for test stations shall be single conductor, stranded copper wire with 600-volt THWN or HMWPE insulation (colors, size and insulation as shown on details).

4. Wire for anode header cable shall be AWG No. 8 single conductor stranded copper wire with HMWPE insulation (Black).

2.07 THERMITE WELDING EQUIPMENT

A. Approved Manufacturers: See Fairfax Water’s Approved Products List.

2.08 THERMITE WELD COATING MATERIALS

A. Approved Manufacturers: See Fairfax Water’s Approved Products List.

B. Materials:

1. Thermite welds shall be coated with a prefabricated assembly specially designed for covering cathodic protection wire connections to piping and fittings. The prefabricated assembly shall consist of the following components: 1) top plastic sheet formed with an igloo shaped dome and entry tunnel for the lead wire; 2) a special elastomeric compound in the plastic dome firm enough to resist flow at normally encountered application and operating temperatures, but soft enough to mold itself around and completely cover the irregular welded profile; 3) a double row of parallel, flexible serrations on either side of the dome to assist with conforming around small diameter pipe; 4) a base of black unbacked elastomeric tape with exceptional adhesive properties for bonding firmly to a surface when used with the appropriate primer.

2.09 INSULATED FLANGES

A. Approved Manufacturers: See Fairfax Water's Approved Products List.

2.10 INSULATED UNIONS

A. Approved Manufacturers: See Fairfax Water's Approved Products List.

B. Material: Nylon insulator skirt.

2.11 EXTERNAL COATING FOR INSULATED FLANGES AND BURIED MECHANICAL JOINTS

A. General Requirements:

1. All coatings used on project shall be from same manufacturer and as specified herein. All products comprising completed coating system shall be compatible and the same products shall be used throughout the project. Pipe surfaces that will come in contact with potable water inside the pipeline (e.g. spigot ends of bell and spigot joints) shall be coated with materials having NSF-61 certification.

B. Field Applied Petrolatum Tape:

1. Approved Manufacturers: See Fairfax Water's Approved Products List.

2.12 INTERNAL PIPE COATING FOR INSULATED FLANGES

A. Approved Manufacturers: See Fairfax Water's Approved Products List.

2.13 MASTIC COATING

A. General Requirements:

1. The external coating shall be applied only where noted on:

a. Buried mechanical joints, buried bolts, nuts, coupling harness tie rods, saddles, iron and steel anchors, and other connecting hardware.
b. Service clamps other transition fittings between copper services and ductile iron pipe.

B. Approved Manufacturers: See Fairfax Water's Approved Products List.

2.14 WIRE CONNECTORS AND TERMINATIONS

A. Butt Splices

1. Approved Manufacturers: See Fairfax Water's Approved Products List.

B. Terminal Lugs

1. Approved Manufacturers: See Fairfax Water's Approved Products List.

2.15 ELECTRICAL TAPE

A. Approved Manufacturers: See Fairfax Water's Approved Products List.

2.16 FIELD TEST EQUIPMENT

A. As determined by Contractor to meet specific requirements. All electrical instruments must bear evidence of calibration within 1 year of testing.

2.17 UTILITY WARNING TAPE

A. Approved Manufacturers: See Fairfax Water's Approved Products List.

2.18 SURVEY MARKERS

A. Materials: 2-inch diameter flat head brass or bronze disk survey marker with ribbed shank.

2.19 STEEL HAND STAMP

A. Materials: Steel hand stamp with 3/8-inch letter/numeral height.

2.20 TEST STATION CONCRETE

A. Materials: Class D Concrete in accordance with Section 03300.

2.21 GUARD POST

A. Steel pipe (4 inches in diameter) with welded cap on top in accordance with details.

2.22 SOLDER

A. Materials: 0.062 inch diameter 60/40 Solder with 3.5 percent type RMA rosin core.

2.23 SEPARATOR MESH/UTILITY CROSSINGS

A. Approved Manufacturers: See Fairfax Water's Approved Products List.

B. Materials

1. The separator mesh shall be a medium density flexible polyethylene webbing pad (mesh pattern), nominal thickness 0.156 inch.

2.24 ZINC ANODE RIBBON (GROUNDING MATS)

A. Approved Manufacturers
1. Platt Brothers and Co. – Plattline Zinc Ribbon Anodes
2. American Carbon Co. – Badgercord Zinc Ribbon

B. Materials
1. Cross Section ½" X $^{9}/_{16}$"
2. Diameter of Wire Core 0.130 Inches
3. Standard Coil Length 500-Feet

2.25 POLYETHYLENE ENCASEMENT

A. Approved Manufacturers: See Fairfax Water's Approved Products List.

B. Materials: in accordance with Section 02510.

2.26 PVC INSERT

A. Approved Manufacturers: See Fairfax Water's Approved Products List.

B. Materials: In accordance with Section 02510.

PART 3 EXECUTION

3.01 INSTALLATION

A. Handling of Pipe

1. At the project site, the pipe shall not be handled with metal chains, cables, unpadded tongs, forklifts or other equipment likely to cause damage to the pipe shop coating or score the pipe surface.

2. Storing of the pipe shall be on padded 12-inch wide (minimum) skids or select loamy or sand dirt berms, where possible. In urban areas, pipe should be suspended on padded skids. Where skid chucks are used in contact with the pipe, they should be padded with several layers of padding material. Padded chucks should be placed such that pipe is

nested on the skid rather than the chuck. The coated pipe shall not be laid on pavement without benefit of padding at contact points.

3. If cables or chains are used during transportation, they must be properly padded with approved, suitable material as required to protect the pipe surface from damage while in transit. Use of a padded horizontal separator strip between successive rows of pipe is necessary to prevent damage to the pipe surface.

4. At all times during construction of the pipeline, the Contractor shall take every precaution to prevent damage to the protective shop coating and scoring of the pipe surface. No metal tools or heavy objects shall be permitted to come into contact unnecessarily with the pipe surface.

B. Thermite Welding: Attach test wires and bond cables to the piping by thermite welding.

1. General: All thermite welds shall be made as shown on the Approved Drawings, Standard Details, and in accordance with the manufacturer's recommendations using the proper combination of equipment for the pipe and wire size being welded. All welding materials and equipment shall be the product of a single manufacturer.

2. Area Preparation: Assure that the area where the attachment is to be made is absolutely dry. Remove mill coating, dirt, grime and grease from the pipe or fitting surface at the weld location by wire brushing or by the use of suitable safety solvents. Clean an area (two inches square) of the pipe or fitting surface at the weld location to a bright shiny surface, free of all serious pits and flaws by use of a mechanical grinder.

3. Cable Preparation: Prepare the wire for welding by assuring that the cable is absolutely dry. The cable shall be free of dirt, grease and other foreign products. Cut the cable in such a way as to avoid flattening or forcing out of round. To prevent deformation of the cable, cut the cable with cable cutters. Remove the insulation in a manner that will avoid damage to strands. Install adapter sleeves for all bonds and test wires in accordance with the manufacturer's recommendations prior to welding. Either prefabricated factory sleeved joint bonds or bond wire with formed sleeves made in the field is acceptable. Hold the cable at an approximate 30 degree angle to the pipe surface when welding.

4. Installation: Install thermite welds in accordance with the manufacturer's written instructions. Deliver packaged weld charges to job site in new, unopened dry containers. Replace completed welds having burnt wire strands and wire strands not completely covered with weldment.

5. Testing: When the weld has cooled, remove the weld slag and test the weldment for strength by striking a sharp blow with a two-pound hammer while pulling firmly on the wire in direction parallel to pipe. Replace unsound welds and retest weldments.

    a. Documentation: Record adequacy of each bond cable and test wire weld based on the above procedure and visual inspection before and after coating welds area. Data recorded for each bond cable and test wire to include date of inspection, name of inspection personnel, pipeline station number, quantity and gauge of wire installed, and simple statement (e.g. "satisfactory") regarding proper installation. Provide field sketches where tabular data alone is not sufficient to document pipe alignment and bonding configuration.

6. Cleaning and Replacing Molds: Thoroughly clean mold and mold covers after completion of each weld to assure that no slag will penetrate into the next weld. Replace molds periodically and where there is pitting or other wear conditions.

7. Coating Thermite Welds: After soundness of the weld has been verified, thoroughly clean with a stiff wire brush and coat with an elastomeric cap. The elastomeric cap shall extend on all four sides beyond the cleaned area onto the pipe surface. Apply primer over the entire weld area and over the entire area where the elastomeric cap will be placed. Allow primer to dry. Push the dome of the prefabricated cap containing elastomeric material firmly into weld area. Lift the wire away from the pipe and apply the elastomeric material completely around and underneath the wire. Push the wire back

down on the pipe.

C. Bonded Joints: Install bond cables across each joint in accordance with the limits indicated in the Approved Drawings using the thermite weld process.

1. All new pipeline joints, including those on pipe, fittings, valves and branch connections including hydrants. Do not bond across insulating devices including PVC inserts. Do not bond between new ductile iron and prestressed concrete pipe.

D. Test Stations: Includes terminal box, concrete pad, guard post, survey marker, wire leads, PVC conduit, utility warning tape and monitoring equipment.

1. General: Type of test station; number, size and color of wires; and wire routing are shown on the Approved Drawings. Unless otherwise noted or approved by Fairfax Water, test stations for pipelines buried under pavement shall be located outside paving limits. Test stations shall be sufficiently set back from vehicle traffic lanes so that they can be accessed for maintenance without extensive traffic control or other special safety precautions.

2. Wire Routing: Install test and monitoring equipment wires in a wiring harness arrangement routed along the bottom of the pipe trench where practical. Form harness by taping wires together at intervals of 10 feet. Install wires leaving the pipe trench in PVC conduit when terminal box is not installed over water main.

3. Utility Warning Tape: Install 1 foot above PVC conduit.

4. Guard Post and Concrete Pad:

   a. Guard Post: Provide with concrete anchor at locations required by test station schedule. Coat portion not buried in accordance with Section 09900.

   b. Concrete Pad: Provide for each flush mount test station. Non-reinforced concrete pad formed around test station shall be 24 inches by 24 inches by 8 inches sloped away from terminal box.

   c. Survey Marker: Mount flush with concrete during pad construction. Stamp test station number in accordance with Fairfax Water’s standards.

E. Insulated Flanges: Unless noted otherwise, install with a test station and two test wires attached to pipe on each side of flange.

1. Preparation: Clean mud, dirt, grease, oil and other contaminants from flange surfaces. Check flange face and bolt hole tolerances and verify clearances prior to installing insulating materials.

2. Internal Coating: Two coats dielectric internal pipe coating, minimum dry film thickness per coat - 10 Mils. Surface preparation, coating application and cure times per manufacturer. Unless noted otherwise, apply internal coating three feet or to nearest fitting from flange face in both directions.

3. Installation: Install insulated flange gasket, sleeves and washers under clean and dry conditions in accordance with manufacturer's written instructions. Two insulating washers required for each bolt (one for each side of flange). Properly torque bolts per insulating material manufacturer's instructions to avoid damage to insulating components and otherwise ensure electrical separation between flange faces and between each bolt and each flange. Do not use conductive grease or other material to facilitate flange assembly that could compromise electrical integrity of insulating materials.

4. Initial Testing: After assembly, directly measure electrical resistance between each bolt and one flange using an ohm meter or other approved low voltage resistance meter. Resistances less than 10 megohm are not acceptable and require insulator replacement, cleaning and drying of insulator surfaces, and/or other corrective action. If any bolt fails the 10 megohm minimum resistance requirements, all bolts must be retested after corrections are made. Tests shall also be performed across the insulating flange to assure that the central gasket is providing effective insulation between the flanged faces

prior to coating.

5. External Coating: Coat buried insulated flanges with approved petrolatum tape coating. Surface preparation and coating application shall be as specified by manufacturer, including use of filler material to provide smooth contour around bolts and from transition between pipe and flange.

6. Final Testing before Backfilling: A final test of the insulated flange shall be made from the attached test wires prior to backfilling. Tests shall be repeated from the insulated flange test wires after backfilling and after the test wires have been brought to grade.

F. Insulated Unions:

1. General: Insulated unions shall be installed to isolate all metallic pipe connections to the ductile iron water main that are 2 inches or smaller in diameter. Plastic pipe connections do not require the installation of an insulated union.

2. Preparation: Clean mud, dirt, grease, oil and other contaminants from piping surfaces. Check union, condition of insulator and verify clearances prior to installing insulating materials.

3. Installation: Install insulated union under clean and dry conditions in accordance with manufacturer's written instructions. Properly torque union per insulating material manufacturer's instructions to avoid damage to insulating components and otherwise ensure electrical separation between pipe faces. Do not use conductive grease or other material to facilitate union assembly which could compromise electrical integrity of insulating materials.

4. Testing: After assembly the insulator shall be tested for effectiveness with an approved insulator test instrument. If the insulator is found to be defective corrective action should be taken which may include replacement of the insulated union.

5. After the union is tested to be properly isolated, the insulator and adjacent piping shall be coated. Clean all dirt, moisture, oil, grease, and other contaminants from the pipe and union surfaces. Thoroughly mix the mastic coating and apply a coat of approximately 12 mils of coating to the pipe and union surfaces. The coating shall extend a minimum of 12 inches on either side of the insulator. Allow the coating to dry to touch (approximately 20 minutes) and apply a second coat of mastic of approximately 12 mils in thickness. The total thickness of the final dry coating shall be a minimum of 20 mils. Allow to dry before backfilling.

G. Clearance of Piping to Other Structures

1. 12 inches of natural clearance shall be maintained between the piping and other metallic structures, where possible. When 12 inches of clearance cannot be maintained, install a medium density flexible polyethylene mesh pattern webbing pad, nominal thickness 0.156 inch, around piping and secure with non-metallic tape.

H. Concrete Buttresses, Support Blocks, Anchor Blocks

1. Position reinforcing rods used in the construction of support blocks, anchor blocks and other concrete structures so that they are not in contact with the piping. Maintain a minimum 2 inches of spacing between all reinforcing steel and the pipe and any pipe anchors.

2. When placing concrete in direct contact with ductile iron piping, apply the mastic coating to the external surface of the ductile iron piping prior to placing the concrete. Clean all dirt, moisture, oil, grease, and other contaminants from the piping surface. Thoroughly mix the mastic coating and apply a coat of approximately 12 mils of coating to the piping surface. Allow the coating to dry to touch (approximately 20 minutes) and apply a second coat of mastic of approximately 12 mils in thickness. Allow to dry before placing the concrete.

I. Polyethylene Encasement: Install in accordance with Section 02510.

J. PVC Inserts: Install in accordance with Section 02510.

3.02 TESTS

A. General: The Inspector will witness test to ensure proper operation and compliance of test stations installation in accordance with Fairfax Water requirements and plan details of the Cathodic Protection system. The Contractor shall coordinate with Fairfax Water to schedule field test with the Inspector, at least two weeks in advance. Note: In the event field tests indicate deficiencies in the system, the Contractor will be responsible for correcting deficiencies and re-testing the Cathodic Protection system.

1. Test Data Forms: Record test data in a uniform format pre-approved by the Inspector. Include test data, personnel, and instrumentation used on each sheet.
2. Testing Summary:
    a. Pre-Backfill Tests:
        1) Bonded joint and test wire integrity
        2) Insulated joint effectiveness
    b. Post-Backfill Tests:
        1) Pipe continuity test
        2) Pipe-to-soil AC and DC potential measurements
        3) Anode potential and current measurements
        4) Insulated joint effectiveness
    c. Improper materials or installation determined by Contractor performed tests, and/or tests performed by the Fairfax Water, shall be corrected by the Contractor.
3. Schedule:
    a. Pre-Backfill Tests: Complete as work progresses.
    b. Post-Backfill Tests: Complete prior to Final Acceptance approval.
    c. Test Report: Letter of Compliance; Record Drawings: Submit no later than 10 working days before application for Beneficial Use.
4. Test Report:
    a. Raw test data for all pre-backfill and post-backfill tests.
    b. Test set-ups and schematics.
    c. Summary tabulations and theoretical calculations.
    d. Letter of Compliance.
    e. Record Drawings.

B. Pre-Backfill Test Procedures:

1. Bonded joint and test wire integrity tests:
    a. Conduct visual inspection and hammer test including required documentation per installation section of this Specification.
2. Insulated joint effectiveness tests:
    a. Test electrical effectiveness of each buried dielectric insulating joint after installation into pipe system and no sooner than two days before backfilling.
    b. Perform initial resistance tests between each bolt and flange in accordance with installation section of this Specification.
    c. Perform tests for completed insulators by a) use of a high-frequency isolation tester

manufactured specifically for this purpose, and by b) measuring electrical potential between mating flanges before, during and immediately after application of a direct test current to the pipe on one side of the flange of no less than 1 ampere. Documented data for test b) shall include all potentials and applied test current.

d. Acceptance Criteria:

1) High frequency isolation tester: "Acceptable", "Satisfactory" or other similar direct meter reading, and

2) Electrical potential/applied current: Apply test current to one side of the flange insulator; a positive potential shift on the side of the flange where current is applied, and a negative potential shift on the side of the flange opposite of where current is applied indicates that the insulator is effective.

C. Post-Backfill Test Procedures:

1. Pipe Continuity Tests:

a. Measure and record longitudinal resistance of pipe between consecutive test stations, and between test stations and intermediate hydrant laterals. Determine resistance using Ohm's Law by impressing a direct test current across pipe span and measuring resultant voltage drop across same span. Use of temporary test points at locations other than test stations and hydrants require approval by the Inspector.

b. Documentation: Include applied test current, measured voltage before application of current, with current applied and immediately after interrupting test current, calculated resistance and corresponding theoretical resistance (Paragraph C below) in test report.

c. Acceptance Criteria: Maximum acceptable span resistance - 110% of the sum of:

1) Number of pipe joints multiplied by theoretical resistance of a joint bond, determined by number of bond wires per joint and wire gauge.

2) Length of pipe multiplied by theoretical resistance per unit length, determined by pipe diameter, wall thickness and resistivity.

2. Pipe-to-Soil Potential Measurements:

a. Record at all test stations and hydrants used for post-backfill continuity measurements, and on both sides of all insulating devices.

b. Collect using a temporary copper/copper sulfate reference electrode placed on grade within one foot of test station.

c. Collect at all locations prior to connecting anodes at test stations, and then after anodes have been connected at all test stations for a minimum of 2 hours.

3. Anode Potential and Current Measurements:

a. Measure and record open-circuit potential between each anode cable at each test station and a temporary copper/copper sulfate reference electrode placed on grade within one foot of test station. Collect open circuit potential data with no other influencing anodes connected to main.

b. Measure and record anode current at each test station using permanently installed current measuring shunt. Document shunt voltage drop, shunt resistance, and calculated current.

c. Acceptance Criteria:

1) Open-Circuit Potential: Magnitude 1.6 volts or greater.

2) Anode Current: Minimum 0.02 ampere per anode, adjusted to account for number of anodes included in circuit at any given location (e.g. 15 anodes - minimum 0.30 ampere).

4. Insulated Joint Effectiveness Tests: Test each joint. Procedures and acceptance criteria in accordance with pre-backfill insulated joint effectiveness tests.

END OF SECTION 13110

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APPENDIX A

FAIRFAX WATER - STANDARD DETAILS

Refer to Standard Details found at:
www.fairfaxwater.org/developers-engineers

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APPENDIX B

FAIRFAX WATER – APPROVED WET TAP CONTRACTOR LIST

Only approved personnel working for Approved Contractors will be allowed to perform wet taps. Fairfax Water maintains a list of Approved Wet Tap Contractors, which may be found online at: www.fairfaxwater.org/developers-engineers.

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APPENDIX C

FAIRFAX WATER – APPROVED PRODUCTS LIST

Refer to Approved Product List found at:
www.fairfaxwater.org/developers-engineers

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