

**STANDARD SPECIFICATIONS  
FOR CONSTRUCTION OF  
WATER MAIN EXTENSIONS  
FOR  
DEVELOPMENTS SERVED BY THE  
EAST DONEGAL TOWNSHIP MUNICIPAL AUTHORITY  
LANCASTER COUNTY, PENNSYLVANIA**

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**STANDARD SPECIFICATIONS  
WATER SYSTEM EXPANSION  
FOR  
SUBDIVISION DEVELOPMENTS  
SERVED BY THE  
EAST DONEGAL TOWNSHIP MUNICIPAL AUTHORITY  
LANCASTER COUNTY, PENNSYLVANIA**

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**DIVISION 1  
GENERAL REQUIREMENTS**

**DIVISION 1**

**GENERAL REQUIREMENTS**

**DIVISION INDEX**

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**SECTION 01010  
SPECIAL CONDITIONS**

**PART 1 - GENERAL**

**1.01 PROJECT DOCUMENTS**

- A. All Special Conditions, Technical Specifications and applicable requirements of the Project Plans apply to the Work.

**1.02 SCOPE**

- A. Provide labor, materials, equipment, and services and perform all operations required for completion of Work as specified and/or indicated on the Project Drawings.

**1.03 SUMMARY OF WORK**

- A. The Work comprises the general installation and construction of:

Water main extensions within subdivision developments served by the East Donegal Township Municipal Authority (Authority) in Lancaster County, Pennsylvania, as indicated on drawings prepared by a Developer (Owner) and these specifications.

**1.04 REFERENCE CODES AND SPECIFICATIONS**

- A. Standards and other publications referenced in the Specifications shall be of the issues in effect at the time of bidding and form a part of this Project.
- B. References are made to the Pennsylvania Department of Transportation specifications. Unless otherwise noted, the specifications referred to are Form 408, Department of Transportation Specifications, latest edition, and related supplements.
- C. Reference in the State Specifications to "State", "Chief Engineer", or "Department" shall be interpreted as the Authority's Engineer. When particular articles or sections are referred to, all paragraphs other than those relating to payment shall apply.

**1.05 PROJECT IDENTIFICATION SIGNS**

- A. A Project Identification Sign will not be required.

**1.06 FIELD OFFICES AND SHEDS**

**SECTION 01010  
SPECIAL CONDITIONS**

- A. Furnish, install and maintain storage and work sheds needed for construction.
- B. Office for the Engineer:
  - 1. A separate space for the sole use of Engineer will not be required.

**1.07 CONTRACTOR'S USE OF PREMISES**

- A. Confine construction equipment, the storage of materials and equipment, and operations of workmen to within the property limits of the Owner and at areas authorized by the Owner.
- B. Materials may be stored appropriately on site provided such stored materials do not unduly restrict public use or infringe on private property. Contractor's activities shall be in compliance with Section 01650 – Equipment Installation and Startups, and with detailed requirements contained in the technical specifications.
- C. The Contractor shall assume full responsibility for materials stored on site including materials for which the Owner has made payment. Purchase and maintain such additional amounts of insurance as is necessary to provide coverage against loss or damage to the materials.
- D. Transport materials remaining at the completion of the project for which the Owner has made payment to a storage area designated by the Owner.

**1.08 CLEANING UP**

- A. Throughout the duration of the project, Contractor shall continuously keep site, storage areas, streets, roads, highways and adjacent properties free from accumulations of waste materials, excess excavation, rubbish and windblown debris resulting from construction operations.
- B. At completion of project work or portions thereof, Contractor shall remove all excess accumulated materials as stated above, and shall remove all dirt, foreign materials, stains, fingerprints, etc. from all piping and equipment, and from the project work area in general.

**1.09 PROTECTION OF EXISTING FACILITIES**

- A. All existing facilities in the area of the Work shall be maintained in good condition and protected by the Contractor from any damages caused as part of this project work, other than modifications to existing facilities that are specifically required by

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the Project Documents.

- B. Any facilities that are damaged or destroyed as a result of work under this Contract shall be replaced or repaired to the satisfaction of the Authority, at no additional cost to the Authority.

**1.10 CLASSIFICATION OF EXCAVATION**

- A. All excavation performed under this contract is considered UNCLASSIFIED and includes excavation and removal of all soils, shale, rock, boulders, fill and all other materials encountered of whatever nature. This shall include excavation of all materials, including that meeting the description of both common and rock excavation, as defined under Section 02201 – Trench Excavation, Backfilling and Compacting.

**PART 2 - SPECIFIC REQUIREMENTS**

**2.01 CONCRETE**

- A. Where concrete is required for backing up hydrants and fittings, it shall have a minimum allowable 28-day compressive strength (f'c) of 3000 psi.

**2.02 GRADES AND EXTRA DEPTH EXCAVATION**

- A. It is the intent of these Plans and Specifications to follow the existing or proposed finished grades, and provide a minimum of four (4) feet of cover over the crown of the water main and service lines. Provide a minimum of eighteen (18) inches of vertical separation between the crown and the bottom of each pipe where storm drains and/or box culverts or other utilities cross the proposed water main or service line. Deeper installations of water mains may be acceptable so as to maintain the specified vertical separation upon approval of the Authority's representative at the site.
- B. Generally, for water lines, no bends or fittings will be permitted to accomplish this grade separation. The trench shall be excavated an additional depth on each side of the storm drain or other utility pipe a sufficient distance to permit deflection of the water main at the pipe joints to accomplish the required grade separation. Sewer lines shall be constructed to the line and grade indicated.
- C. In the event special conditions exist which will not permit the installation as indicated in paragraph B. above, the Contractor shall notify the Authority's Engineer of such conditions and the method which the Contractor proposes to obtain the required

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SPECIAL CONDITIONS**

grade separation. Under no circumstances will the installation of additional fittings be permitted without the prior written approval of the Authority's Engineer.

**2.03 WATER MAINS AND FITTINGS**

- A. Provide Cement Lined Ductile-Iron water mains and fittings, either class 50 or 52 conforming to AWWA/ANSI C104/A21.4 and C151/A21.51.
- B. Provide push-on joints with rubber gaskets conforming to AWWA/ANSI C111/A21.11.
- C. Provide Ductile-Iron fittings conforming to AWWA/ANSI C110/A21.10 or C153/A21.53 with either push-on or mechanical joints.

**2.04 FIRE HYDRANTS**

- A. Provide Mueller Centurion hydrants for conformity with existing hydrants in the system. Furnish with a five and one-quarter (5-1/4) inch valve opening and National Standard threads. Provide traffic type with no excavation needed during repair.
- B. Provide hydrants that open counter-clockwise (left). Demonstrate that the new hydrants conform in all respects with the existing hydrants prior to installation.
- C. Paint hydrants upon completion of installation in accordance with Section 02641. Use Tenemec hydrant paint or approved equal, color to match existing hydrants.

**2.05 VALVES**

- A. Provide Mueller, American Darling or approved equal valves to conform with the existing valves in the system.
- B. Provide Resilient Seat type valve conforming to AWWA C-509 or C-515.
- C. Provide valves that open to the left only

**2.06 CONNECTIONS TO EXISTING MAINS**

- A. The Contractor's attention is called to the fact that proposed water mains may connect to the existing water distribution system as shown on the drawings. In some cases the existing mains are old asbestos-cement mains with outside diameters that vary from present standards. Provide appropriate adaptors for connecting the old mains

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SPECIAL CONDITIONS**

to the new mains or fittings. **Mechanical** couplings, **Dresser Style 38, Rockwell 411 or equal**, may be used in lieu of direct connections where necessary.

**2.07 SERVICE LINES**

- A. Provide Type K, seamless copper tubing service lines conforming to ASTM B88 *or Polyethylene (PE) Pressure Tubing, 200psi rated, conforming to ASTM D-2737*.
- B. *Service line larger than 3” diameter shall be cement lined ductile Iron pipe.*
- C. Install service lines in a *PVC sleeve having the smallest inside diameter possible to receive the service line* where shown or indicated on the drawings. *Seal both ends of the sleeve with a neoprene reducing coupling or bushing.*

**2.08 CORPORATION STOPS**

- A. Provide Corporation Stop Assemblies conforming in all respects to the equipment listed in the following table for conformity with the existing *corporation* stops:

| <u>Manufacturer</u>              | <u>Inlet End AWWA Taper<br/>Outlet End Compression</u> |
|----------------------------------|--|
| Mueller<br><i>Ford Meter Box</i> | B-25008N<br><i>F-1000</i>                              |

- B. *Manufactured of no-lead (NL) brass conforming to the latest requirements of the Federal Safe Drinking Water Act.*

**2.09 CURB STOPS**

- A. Provide Curb Stop Assemblies conforming in all respects to the equipment listed in the following table for conformity with the existing *Curb* stops:

| <u>Manufacturer</u>              | <u>End Connection Type<br/>Compression</u> |
|----------------------------------|--|
| Mueller<br><i>Ford meter Box</i> | B-25209N<br><i>B-44</i>                    |

- B. *Manufactured of no-lead (NL) brass conforming to the latest requirements of the Federal Safe Drinking Water Act.*

**SECTION 01010  
SPECIAL CONDITIONS**

**2.10 CURB BOXES AND COVERS**

- A. Provide curb boxes of Cast Iron, extension type with *stainless steel* stationary rod, Arch pattern base and lid marked as "Water".
  
- B. Provide Mueller model *H-10334* ~~H-10314~~ *cast iron* curb boxes with *cast iron* ~~one-piece, two-hole lid~~ *having a pentagon brass plug*. ~~except where the Authority's field representative approves placement of the curb box in concrete or paved areas. Provide a plug style lid with pentagon bolt for placement in concrete or paved areas.~~

**END OF SECTION**

**SECTION 01300**  
**SUBMITTALS**

**PART 1 - GENERAL**

**1.01 SCOPE**

- A. Submittals as referenced in the detailed Technical Specifications shall be made by the Contractor as indicated therein and as more specifically described in this Section. The purpose of this Section is to more clearly define the nature and quantity of certain submittals but is not intended to be all inclusive. Submittals required elsewhere in the Specifications, but not referred to herein shall be made as required by the Section or Paragraph requiring them.

**PART 2 - SPECIFIC REQUIREMENTS**

**2.01 PROGRESS SCHEDULE**

- A. Contractor shall submit five (5) copies of his estimated progress schedule to Engineer within ten (10) days of the effective date of the Owner's notice to proceed. The progress schedule shall be complete and shall indicate that all phases of work will be completed within the time period indicated.
- B. If, during the course of the work, Contractor determines that any phase or stage of the work will not be performed or completed as indicated on the progress schedule, or that the time frame for starting and/or completing the phase or stage will be substantially different from the time frame indicated thereon, Contractor shall submit five (5) copies of a revised progress schedule showing when the phase or stage will be started and/or completed. This revised schedule shall show the relationship of this work to other stages or phases of work, and shall clearly show how all work items will be completed within the revised schedule.

**2.02 SCHEDULE OF VALUES**

(Reserved)

**2.03 SHOP DRAWINGS**

- A. Contractor shall submit five (5) copies of a schedule of shop drawings submissions to Engineer within ten (10) days after receipt of the Owner's notice to proceed. To the extent practicable, the submission of shop drawings to Engineer shall be made in a continuous and orderly manner and as early in the contract period as possible to avoid delays and lack of continuity in the review by Engineer.

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**SECTION 01300  
SUBMITTALS**

B. Contractor shall submit the number of copies of shop drawings as indicated in the following schedule:

|  |   |
|--|---|
| 1. Structural Shop Drawings                      | 7 |
| 2. Electrical & Instrumentation<br>Shop Drawings | 7 |
| 3. All Other Shop Drawings                       | 6 |

C. The indicated schedule provides for three (3) copies to be returned to Contractor. In the event Contractor requires additional copies, the number of required additional copies shall be added to the minimum number indicated.

**2.04 OPERATION AND MAINTENANCE MANUALS**

A. Where Operation and Maintenance manuals are required for specific items of equipment by the Technical Specifications, the Contractor shall furnish three (3) copies of each.

B. No copies of the Operation and Maintenance manuals will be returned to the Contractor. In the event Contractor requires returned copies, the number of required additional copies shall be added to the minimum number indicated.

**2.05 TEST REPORTS**

A. When tests are specified, Contractor shall submit three (3) copies of all test reports unless a different number of reports is required in the Technical Specifications.

B. No copies of the Test Reports will be returned to the Contractor. In the event Contractor requires returned copies, the number of required additional copies shall be added to the minimum number indicated.

**END OF SECTION**

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**SECTION 01650  
EQUIPMENT INSTALLATION AND STARTUP**

**PART 1 - GENERAL**

**1.01 SCOPE**

- A. All systems and equipment furnished under this Project shall be installed in accordance with manufacturers' recommendations and in line with generally accepted construction standards and methods, as further qualified by the Technical Specifications. It is the intent to secure, for every part of the work, complete and functioning systems and equipment which serve all of the intended purposes of those systems and equipment, including any minor related equipment and appurtenances required for proper system operation but not specifically detailed in the Technical Specifications or drawings.
- B. All systems and equipment furnished shall be properly anchored, checked for alignment, and lubricated and all electrical circuitry shall be properly tested for voltage, amperage and direction of rotation of motors prior to starting. Where services of a factory representative are indicated or required during the installation, the Contractor shall obtain verification from the representative that the system or equipment is ready for operation prior to starting; however, such verification shall not relieve the Contractor of responsibility for proper installation or preparation of any system or equipment. Specific requirements for services of manufacturer's engineering and service departments, if any, are detailed in the Special Conditions Section - 01010.
- C. When work has progressed to the point where all components of a system or all elements of a portion thereof which are intended to operate as a complete unit have been installed and are ready to be tested or, where no test is required, are ready to be placed in operation whether for the benefit of the Authority, Owner or for the Contractor, Contractor shall notify Engineer in writing of his request for "startup" establishing the time therefor. At least 48 hours notice shall be given the Engineer prior to such an equipment startup, with startup to be at a convenient time for all parties involved.
- D. Prior to a request for "start-up", the Contractor may operate each component of the system or each piece of equipment to be started or tested and shall satisfy himself that the unit is ready to operate as designed.
- E. When the presence of the factory representative is indicated or required in the

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**SECTION 01650**  
**EQUIPMENT INSTALLATION AND STARTUP**

Specifications, the representative shall be available to witness the "startup", check the system for proper operation and to instruct the Authority's operating personnel on the proper operation of the system or equipment.

- F. When testing of a system or item of equipment is required by the Specifications, Contractor shall arrange to have all instruments, gauges and other appurtenances necessary to perform the required tests available at the site and in proper working order. Tests shall be conducted in the presence of Engineer and for the duration specified or directed to prove that the system or equipment does, in fact, perform as specified. Tests shall be conducted by the Contractor or, when required, a trained factory representative.
- G. Upon completion of the testing, Contractor, or the trained factory representative as directed by Contractor, shall submit a report to Engineer. The report shall contain the raw data obtained during the test, results, calculations showing how results were obtained, conclusions arrived at from the test and recommendations as to how the system or equipment should be operated to obtain the most efficient performance and best operation.
- H. When the results of any tests or operation during "startup" fail to demonstrate that the system or equipment being started will operate in strict accordance with the Specifications, Contractor shall make all repairs, adjustments or replacements necessary to bring the unit into compliance and the testing will be performed again until it is demonstrated that the unit will perform as specified.

**1.02 OPERATION BY CONTRACTOR**

- A. Contractor may be permitted to place certain equipment, systems or portions thereof which are designed to operate as a separate unit in operation after "startup" if Contractor can demonstrate that such operation (1) is necessary for proper performance of the work; (2) is necessary to meet project staging requirements; (3) will result in cost savings to Authority in the form of energy costs or operational costs; (4) is necessary to maintain operation of an existing system; or (5) is for the Contractor's own convenience.
- B. Request for permission to operate shall be submitted in writing by Contractor to Engineer; however, no request to do so shall be submitted prior to "startup" and prior to demonstration of satisfactory performance.

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**SECTION 01650**  
**EQUIPMENT INSTALLATION AND STARTUP**

- C. When the request for operation by Contractor is for any reason other than for the benefit of Authority, Contractor shall bear all costs related to such operation and assume all responsibility related thereto.
- D. When the request for operation by Contractor is for the benefit of Authority, permission to operate will be issued only after the “start-up” testing has been completed to the satisfaction of the Authority’s Engineer and written approval to do so has been issued by the Engineer.

**PART 2 - SPECIFIC REQUIREMENTS**

**2.01 DELIVERY AND STORAGE**

- A. All materials and equipment delivered to the construction site shall be packaged and handled with care at all times to protect from any possible damage. Until items of material or equipment are installed, they shall be stored using the same care expressed above, and shall be stored at a location which does not interfere with normal plant operations, damage the existing plant facilities, or cause a health or safety hazard.
- B. If additional requirements for delivery and storage are listed elsewhere in the specifications, the most stringent requirements shall apply in all cases, and shall be used in a complimentary manner with all other requirements.

**2.02 REMOVAL OF EXISTING FACILITIES AND EQUIPMENT**

- A. If the Project drawings call for removal of any facilities or equipment, the Contractor shall exercise care at all times in the handling of this equipment and shall place these items at an on-site location as directed by Authority’s representative and in a manner acceptable to Authority.

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**SECTION 01650**  
**EQUIPMENT INSTALLATION AND STARTUP**

- B. All equipment, facilities, and other items which are removed by the Contractor from their place of origin during the progress of construction under this Contract, and which the Authority does not choose to retain on-site, shall be removed from the site by the Contractor and disposed of in an environmentally acceptable manner, at no cost to the Authority.

**2.03 INSTALLATION AND STARTUP**

- A. The Contractor shall conform to the intent of Part 1 of this Specification regarding installation and startup.
- B. Where a conflict exists between the intent of this Specification and details included in the Technical Specifications and Drawings, Contractor shall immediately notify Engineer of this conflict and request a determination for resolving said conflict.
- C. In conjunction with the startup requirements detailed under Part 1, the Contractor shall successfully demonstrate that all equipment, accessories, monitoring systems, and appurtenances perform as a functional system as shown and specified.
- D. Any additional startup and testing requirements for applicable facilities and equipment shall be performed as required under the Technical Specifications for those specific items.
- E. Any project equipment, materials, and systems which are damaged prior to final project completion and acceptance shall be removed and replaced by the Contractor to the Authority's satisfaction, at no cost to the Authority.

**END OF SECTION**

**DIVISION 2  
SITEWORK**

**DIVISION INDEX**

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**SECTION 02101  
SITE PREPARATION**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

A. The Work of this Section includes, but is not limited to:

1. Clearing
2. Grubbing
3. Stripping and Stockpiling Topsoil
4. Debris Disposal
5. Bonds and Insurance
6. Permit Fees
7. Field Offices & Sheds
8. Soil Erosion Control Measures

B. Definitions:

1. Clearing is defined as the removal of trees, brush, down timber, rotten wood, rubbish, any other vegetation, and objectionable material at or above original ground elevation not designated to be saved. Clearing also includes removal of fences, walls, guard posts, guard rails, signs, and other obstructions interfering with the proposed work.
2. Grubbing is defined as the removal from below the surface of the natural ground of stumps, roots and stubs, brush, organic materials and debris.

**1.02 JOB CONDITIONS**

A. The Contractor may clear all obstructions within the limits of work shown on the drawings except those specifically designated to be saved or restored on the Project Drawings or Special Conditions. Obstructions specifically designated to be saved or restored will be marked by the Authority's representative.

**1.03 SUBMITTALS**

A. Burning Permits:

1. Submit two (2) copies of each on-site burning permit, if such permits are required by local jurisdictional authorities.

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**SECTION 02101  
SITE PREPARATION**

- B. Permits for Disposal of Debris:
  - 1. Arrange for disposal of debris resulting from clearing and grubbing to locations outside the Authority's right-of-way and obtain written agreements with the owners of the property where the debris will be deposited.
  - 2. Submit two (2) copies of the agreement with each property owner releasing the Authority from responsibility in connection with the disposal of the debris.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Temporary Fencing:
  - 1. Undamaged picket snow fence, 4' high, formed of wooden slats, tightly woven with wire cable.
  - 2. Soil-set fence posts, studded "T" type, 6' high.
- B. Tree Wound Dressing:
  - 1. Antiseptic and waterproof, asphalt base.
- C. Soil Erosion and Sedimentation Control
  - 1. Provide materials as shown on the drawings and as required by the Lancaster County Conservation District.

**PART 3 - EXECUTION**

**3.01 PREPARATION**

- A. Protect benchmarks, utilities, existing trees, shrubs and other landscape features designated for preservation with temporary fencing or barricades satisfactory to the Engineer. No material shall be stored or construction operation carried on within 4-feet of any tree to be saved or within the tree protection fence.

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**SECTION 02101  
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- B. When a private enclosure fence encroaches on the work area notify the property owner at least 5 days in advance of the clearing/grubbing operations to permit the property owner to remove it, construct a supplemental fence, or make such other arrangements as may be necessary for security purposes.

Upon failure of the property owner to reasonably proceed with the work required to secure his property, carefully remove the fence, in whole or in part, and neatly pile the materials onto the owner's property.

**3.02 UTILITY RELOCATIONS**

- A. Inform all companies, individuals and others owning a controlling facilities or structures within the limits of the work which have to be relocated, adjusted or reconstructed in sufficient time for the utility to organize and perform such work in conjunction with or in advance of the Contractor's operations.
- B. Comply with the provisions of Act 287, as amended by Act 187.

**3.03 CLEARING**

- A. Confine clearing to within the limits of work shown on the drawings.
- B. Fell trees in a manner that will avoid damage to trees, shrubs, and other installation which are to be retained.
- C. Where stumps are not required to be grubbed, flushcut with ground elevation.

**3.04 GRUBBING**

- A. Grub areas within the construction limits to remove roots and other objectional material to a minimum depth of 8".
- B. Remove all stumps within the cleared areas unless otherwise authorized by the Engineer.

**3.05 STRIPPING AND STOCKPILING TOPSOIL**

- A. Strip topsoil to whatever depth it may occur from areas to be excavated, filled, or graded and stockpile at a location approved by the Lancaster County Conservation District for use in finish grading.

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SITE PREPARATION**

- B. The topsoil is the property of the Owner and shall not be used as backfill or removed from the site, unless authorized by the Owner.

**3.06 DEBRIS DISPOSAL**

- A. Trees, logs, branches, brush, stumps, and other debris resulting from clearing and grubbing operations shall become the property of the Contractor and shall be legally disposed of.
- B. Do not deposit or bury on the site debris resulting from the clearing and grubbing work.
- C. Debris may be burned on-site if local ordinances allow open-air burning, if required permits are obtained, and if burning operations are conducted in compliance with local ordinances and regulations.

**3.07 SOIL EROSION AND SEDIMENTATION CONTROL**

- A. Install soil erosion and sedimentation control measures in accordance with the plan approved by the Lancaster County Conservation District.
- B. Maintain the soil erosion and sedimentation control measures throughout the course of the project.
- C. Remove the soil erosion and sedimentation control measures at the completion of the project in accordance with the approved plan.

**3.08 RESTORATION**

- A. Repair all injuries to bark, trunk, limbs, and roots of remaining plants by properly dressing, cutting, tracing and painting, using approved arboricultural practices and materials.
- B. Replace trees, shrubs and plants designated to be saved which are permanently injured or die during the life of the Contract (including guaranty period) as a result of construction operations with like species acceptable to the project Owner.
- C. Remove protective fences, enclosures and guards upon the completion of the project.

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**SECTION 02101  
SITE PREPARATION**

- D. Restore guard posts, guard rail, signs and other interferences to the condition equal to that existing before construction operations.

**END OF SECTION**

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**SECTION 02201**  
**TRENCH EXCAVATION, BACKFILLING AND COMPACTING**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

A. The Work of this Section includes, but is not limited to:

1. Cutting paved surfaces
2. Blasting
3. Trench excavation, backfill and compaction
4. Support of excavation
5. Pipe protection requirements
6. Control of excavated material
7. Rough grading
8. Restoration of unpaved surfaces
9. Pavement restoration

B. Applicable Standard Details:

1. See trench details shown on Drawings.

**1.02 QUALITY ASSURANCE**

A. Testing Agency:

1. Compaction testing shall be performed by a Soils Testing Laboratory engaged and paid for by the Contractor and approved by the Engineer.

B. Reference Standards:

1. Pennsylvania Department of Transportation (PennDOT):

Form 408 Specifications, Latest Edition  
Pennsylvania Test Method, PRM 106  
Pennsylvania Test Method, PTM 402  
Publication 203, "Work Zone Traffic Control"

2. American Society for Testing and Materials (ASTM):

ASTM C33, Standard Specification for Concrete Aggregates.  
ASTM D698, Standard Test Methods for Laboratory Compaction

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**SECTION 02201**  
**TRENCH EXCAVATION, BACKFILLING AND COMPACTING**

Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).

ASTM D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

ASTM D2216, Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

ASTM D2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

ASTM D3017, Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. Compaction Testing:

1. Conduct one test for each 1,000 linear feet of pipeline.
2. Conduct in-place compaction tests at locations as directed by the Engineer during backfilling operations.
3. Determine compaction in state highways and shoulders by the testing procedure contained in Pennsylvania Test Methods, PTM 106, Method B or PTM 402.
4. Determine compaction in areas other than state highways and shoulders by the testing procedure contained in ASTM D698, and in-place density and moisture tests.

**1.03 SUBMITTALS**

A. Certificates:

1. Submit certification attesting that the composition analysis of pipe protection and select material stone backfill materials meet Specification requirements.
2. Submit certified test results of compaction tests.

B. Compaction Equipment List:

1. Include all equipment to be utilized for compacting, including

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**TRENCH EXCAVATION, BACKFILLING AND COMPACTING**

manufacturers' lift thickness limitations.

C. Soils Testing Laboratory:

1. Submit name of Soils Testing Laboratory to Engineer for approval.

**1.04 JOB CONDITIONS**

A. Classification of Excavation:

1. All excavation work performed under this contract is UNCLASSIFIED, and includes excavation and removal of all soil, shale, rock, boulders, fill, and all other materials encountered of whatever nature.

B. Compaction of Backfill:

1. The degree of compaction shall be at least 95% of the maximum dry density obtained by the ASTM D698 test, or that required by PennDOT, whichever is higher.

C. Control of Traffic:

1. Employ traffic control measures in accordance with Pennsylvania Department of Transportation, 67 PA Code Chapter 203, "Work Zone Traffic Control".

D. Protection of Existing Utilities and Structures:

1. Take all precautions and utilize all facilities required to protect existing utilities and structures. In compliance with Act 287 as amended by Act 187 of the General Assembly of Pennsylvania, advise each Utility Company at least 3 working days in advance of intent to excavate, do demolition work or use explosives and give the location of the job site. Request cooperative steps of the Utility Company and suggestions for procedures to avoid damage to its lines.
2. Advise each person in physical control of powered equipment or explosive used in excavation or demolition work of the type and location of utility lines at the job site, the Utility Company assistance to expect, and

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**SECTION 02201**  
**TRENCH EXCAVATION, BACKFILLING AND COMPACTING**

procedures to follow to prevent damage.

3. Immediately report to the Utility Company any break, leak or other damage to the lines or protective coatings made or discovered during the work and immediately alert the occupants of premises of any emergency created or discovered.
4. Allow free access to Utility Company personnel at all times for purposes of maintenance, repair and inspection.

**PART 2 - PRODUCTS**

**2.01 PIPE PROTECTION MATERIAL**

- A. Type II and Type III Pipe Protection Material:
  1. ASTM C33, Size 7, crushed stone or gravel aggregate or AASHTO Number 7, Section 703.2 of the PennDOT Specifications. ½" maximum size. Do not use slag or cinders.
- B. Type IV Pipe Protection Material:
  1. ASTM C33, Size 8, crushed stone or gravel aggregate or AASHTO Number 8, Section 703.2 of the PennDOT Specifications. 3/8" maximum size. Do not use slag or cinders.

**2.02 BACKFILL MATERIAL**

- A. Select Material Stone Backfill:
  1. Select Granular Material (PA No. 2RC) conforming to Section 703.3 of the PennDOT Specifications.
- B. Suitable Backfill Material (State highways and shoulders):
  1. From top of pipe protection material to subgrade elevation:
    - a. Material conforming to Section 703.3 of the PennDOT Specifications.
- C. Suitable Backfill Material (Other than state highways and shoulders):

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**TRENCH EXCAVATION, BACKFILLING AND COMPACTING**

1. From top of pipe protection material to 24" over top of pipe:
    - a. Material excavated from the trench if free of stones larger than 2" in size and free of wet, frozen, or organic material.
  2. From 24" above pipe to subgrade elevation:
    - a. Material excavated from the trench if free of stones larger than 4" in size and free of wet, frozen, or organic materials.
- D. Suitable Foreign Backfill Material:
1. Material meeting the requirements of Paragraphs B and C above, which has to be re-handled or hauled further to the point of use than it would be to haul it to the dump site.

**PART 3 - EXECUTION**

**3.01 MAINTENANCE AND PROTECTION OF TRAFFIC**

- A. Coordinate the work to insure the least inconvenience to traffic and maintain traffic in one or more unobstructed lanes unless closing the street is authorized.
- B. Maintain access to all streets and private drives.
- C. Provide and maintain signs, flashing warning lights, barricades, markers, and other protective devices as required to conform with construction operations and to keep traffic flowing with minimum restrictions.
- D. Comply with state and local codes, permits and regulations.

**3.02 CUTTING PAVED SURFACES**

- A. Where installation of pipelines, miscellaneous structures, and appurtenances necessitate breaking a paved surface, make cuts in a neat uniform fashion forming straight lines parallel with the centerline of the trench. Cut offsets at right angles to the centerline of the trench.
- B. Protect edges of the cut pavement during excavation to prevent raveling or breaking; square edges prior to pavement replacement.

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**SECTION 02201**  
**TRENCH EXCAVATION, BACKFILLING AND COMPACTING**

- C. The requirement for neat line cuts, in other than state highways, may be waived if the final paving restoration indicates overlay beyond the trench width.

**3.03 BLASTING**

- A. Blasting will be permitted except in areas where the proximity of structures, underground facilities, or public safety preclude the use of explosives. Nothing in this section shall relieve the Contractor of his responsibilities for damages, nor shall it result in any responsibility to the Authority or the Authority's Engineer.
- B. Blasting work shall be supervised by licensed and experienced personnel and performed in conformance with applicable Federal, State and Local Codes.

**3.04 TRENCH EXCAVATION**

- A. Depth of Excavation:
  - 1. Gravity Pipelines:
    - a. Excavate trenches to the depth and grade shown on the drawings for the invert of the pipe plus that excavation necessary for placement of pipe protection material.
    - b. Excavation for laterals shall provide a straight uniform grade from the main pipeline or riser stack to the elevation at the right-of-way line, plus that excavation necessary for placement of pipe protection material.
  - 2. Pressure Pipelines:
    - a. Excavate trenches to the minimum depth necessary to place required pipe protection material and to provide 4' cover from the top of the pipe to the finish ground elevation, except where specific depths are otherwise shown on the drawings.
  - 3. Where unsuitable bearing material is encountered in the trench bottom, continue excavation until the unsuitable material is removed, solid bearing is obtained or can be established, or concrete cradle can be placed. If no cradle is to be installed, refill the trench to required pipeline grade with Type

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**TRENCH EXCAVATION, BACKFILLING AND COMPACTING**

II pipe protection material.

4. Where Type I pipe protection is being utilized and rock is encountered in the trench bottom, remove the rock to a depth of 5" plus 0.1 O.D. of the pipe below design trench bottom and place Type II pipe protection material. See trench details on Drawings.
5. Where the Contractor, by error or intent, excavates beyond the minimum required depth, backfill the trench to the required pipeline grade with Type II pipe protection material.

**B. Width of Excavation:**

1. Excavate trenches, including laterals, to a width necessary for placement and jointing of the pipe. Minimum trench width shall be 24" or 12" plus pipe bell outside diameter, whichever is greater. See trench details on Drawings for trench width payment limits.
2. Shape trench walls completely vertical from trench bottom to at least 2 feet above the top of the pipe.

**C. Length of Open Trench:**

1. Do not advance trenching operations more than 400 feet ahead of completed pipeline.

**3.05 SUPPORT OF EXCAVATION**

- A. Support excavation with sheathing, shoring, bracing, or by use of a "trench box", as required to comply with Federal and State laws and codes.
- B. Install adequate excavation supports to prevent ground movement or settlement of adjacent structures, pipelines or utilities. Damage due to settlement because of failure to provide support or through negligence or fault of the Contractor in an other manner, shall be repaired at the Contractor's expense.
- C. Withdraw shoring, bracing, and sheathing as backfilling proceeds unless otherwise directed by the Engineer.

**3.06 CONTROL OF EXCAVATED MATERIAL**

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**TRENCH EXCAVATION, BACKFILLING AND COMPACTING**

- A. Keep the ground surface, within a minimum of 2 feet of both sides of the excavation, free of excavated material.
- B. Provide temporary barricades to prevent excavated material from encroaching on private property, walks, gutters, and storm drains.
- C. Maintain accessibility to all fire hydrants, valve pit covers, valve boxes, curb boxes, fire and police call boxes, and other utility controls at all times. Keep gutters clear or provide other satisfactory facilities for street drainage. Do not obstruct natural water courses. Where necessary, provide temporary channels to allow the flow of water either along or across the site of the work. Erosion damage or sedimentation caused by water diversion shall be repaired, removed and corrected to the satisfaction of the property owner at the Contractor's expense.
- D. In areas where pipelines parallel or cross streams, ensure that no material slides, is washed, or dumped into the stream course. Remove cofferdams immediately upon completion of pipeline construction.

**3.07 DEWATERING**

- A. Keep excavations dry and free of water. Dispose of precipitation and subsurface water clear of the work.
- B. Maintain pipe trenches dry until pipe has been jointed, inspected, and backfilled, and concrete work has been completed. Preclude trench water from entering pipelines under construction.
- C. Intercept and divert surface drainage away from excavations. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water.
- D. Comply with Federal and State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

**3.08 PIPE PROTECTION REQUIREMENTS**

- A. Type I Pipe Protection:
  - 1. Prepared trench bottom as shown on the trench details.

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**TRENCH EXCAVATION, BACKFILLING AND COMPACTING**

2. Use with DI and RC pressure pipe.
  3. Use with CMP, CI and DI, and RC gravity pipe ONLY when authorized by the Engineer.
- B. Type II Pipe Protection:
1. Depth of pipe protection material aggregate as shown on the trench details.
  2. Provide Type II protection as minimum for all pipe materials except plastic pipe, unless otherwise authorized by the Engineer, except where trench conditions are suitable for Type I protection when installing pressure pipe.
  3. When using AC, VCPX and RC pipe, Type II protection material is limited to the depths as indicated on the drawings.
- C. Type III Pipe Protection:
1. Depth of pipe protection material aggregate as shown on the trench details.
  2. When using AC, VCPX and RC pipe, Type III protection material is limited to the depths as indicated on the drawings.
- D. Type IV Pipe Protection:
1. Depth of pipe protection material aggregate as shown on the trench details.
  2. Provide Type IV protection when using ABS, PE, and PVC pipe.
  3. Modify the Type II and Type III pipe protection material portion to all Type IV protection material.
- E. Shape recesses for the joints or bell of the pipe by hand. Assure that the pipe is supported on the lower quadrant for the entire length of the barrel.

**3.09 PIPE LAYING**

- A. Provide required pipe protection material, placed in accordance with the trench details shown on the drawings.
- B. Lay pipe as specified in the appropriate section for pipe line construction.

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**3.10 THRUST RESTRAINT**

- A. Provide pressure pipe with concrete thrust blocks or use restrained joint fittings at all bends, tees, and changes in direction, in accordance with the Project Drawings.

**3.11 BACKFILLING TRENCHES**

- A. After pipe installation and inspection, backfill trenches in accordance with trench details, and these Specifications.
- B. Lift Thickness Limitations:
  - 1. Submit a list of the compaction equipment to be utilized on the project, the recommendations of the equipment manufacturer as to the maximum lift thickness which can be placed, and the method of compaction to be used with this equipment to achieve the required compaction. In no case shall maximum lift thickness placed exceed the maximum limits specified by the manufacturer's recommendations. However, if the equipment manufacturer's lift thickness recommendation is followed and the specified compaction is not obtained, the Contractor shall, at his own expense, remove, replace, and retest as many times as is required to obtain the specified compaction.
  - 2. Lift thickness limitations specified for state highways, shoulders, or embankments govern over the compaction equipment manufacturer's recommendations.
- C. Jetting:
  - 1. When approved by the Engineer in writing, jetting methods may be used to consolidate backfill into a firm compact mass.
- D. Uncompacted Backfill:
  - 1. Where uncompacted backfill is indicated on the Project Drawings, backfill the trench from one foot above the pipe to the top of the trench with material excavated from the trench, crowned over the trench to a sufficient height to allow for settlement to grade after consolidation.

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**TRENCH EXCAVATION, BACKFILLING AND COMPACTING**

E. Unsuitable Backfill Material:

1. Where the Engineer deems backfill material to be unsuitable and rejects all or part thereof due to conditions prevailing at the time of construction, remove the unsuitable material and replace with suitable backfill material or select material stone backfill.

**3.12 DISPOSAL OF EXCAVATED MATERIAL**

- A. Excavated material remaining after completion of backfilling shall remain the property of the Contractor, and shall be removed from the construction area and legally disposed of, unless the Owner authorizes the Contractor's placement of this material elsewhere on-site.

**3.13 ROUGH GRADING**

- A. Rough grade areas disturbed by construction to a uniform finish. Form the bases for terraces, banks, lawns and paved areas.
- B. Grade areas to be paved to depths required for placing subbase and paving materials.
- C. Rough grade areas to be seeded 3" below indicated finish contours.

**3.14 RESTORATION OF UNPAVED SURFACES**

- A. Restore unpaved surfaces disturbed by construction to equal the surface condition prior to construction.
- B. Restore grassed areas in accordance with Section 02901, Finish Grading, Seeding and Sodding.

**END OF SECTION**

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**SECTION 02301**  
**BORING, JACKING AND TUNNELING**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. The work of this section includes, but is not limited to:
  - 1. Approach trench excavation
  - 2. Installation of casing pipe or liner
  - 3. Installation of carrier pipe
  
- B. Related Work:
  - 1. Work under this item shall be coordinated with that specified under Section 02201 - Trench Excavation, Backfilling and Compacting.

**1.02 QUALITY ASSURANCE**

- A. Contractor Qualifications:
  - 1. Construction operations shall be undertaken only by a contractor well experienced in operations of similar magnitude and condition under transportation arteries and surface areas which cannot be disturbed.
  
- B. Design Criteria:
  - 1. Pipe and joints of leakproof construction, designed for the earth and/or other pressures present, plus highway H20 loading or railway E80 loading with the associated recommended impact loading.
  - 2. Design bracing, backstops, and use of jacks of sufficient rating so that the jacking can proceed without stoppage, except for adding pipe sections and as conditions permit, to minimize the tendency of the ground material to "freeze" around the casing pipe.
  
- C. Allowable Tolerances:
  - 1. Do not overcut excavation by more than 1" greater than the outside diameter of the casing pipe.
  - 2. Install casing pipe with the determined vertical and horizontal alignment prior to installation of the carrier pipe.

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**SECTION 02301**  
**BORING, JACKING AND TUNNELING**

- D. Reference Codes and Specifications:
1. Comply with applicable federal, state and local ordinances, codes, statutes, rules and regulation, and affected jurisdictional bodies.
  2. Pennsylvania Department of Transportation (PennDOT): Form 408 Specifications, latest edition.

**1.03 SUBMITTALS**

- A. Submit history of previous work completed of equivalent nature and scope. Include qualification and experience of key personnel.
- B. Submit description of proposed construction methods, including methods to establish and maintain vertical and horizontal alignment.
- C. Submit tunnel liner design calculations and manufacturer's data on tunnel liner plate showing sizes, shapes, methods of attachment and connection details, and details of grout holes.
1. Highway Crossings: Design tunnel for earth and/or other pressure loads present, plus AASHTO H20 live loading.
  2. Railroad Crossings: Design tunnel for earth and/or other pressure loads present, plus Cooper's Railroad E80 live loading with 50-percent added for impact.

**1.04 JOB CONDITIONS**

- A. Conduct operations so as not to interfere with, interrupt, damage, destroy, or endanger the integrity of surface or subsurface structures or utilities, and landscape in the immediate or adjacent areas.
- B. When boring, jacking or tunneling under state highways and railroads, comply with applicable right-of-way occupancy permits.
- C. If boring is obstructed, relocate or jack or tunnel crossing as approved by the Engineer.

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**SECTION 02301**  
**BORING, JACKING AND TUNNELING**

**PART 2 - PRODUCTS**

**2.01 STEEL CASING PIPE**

- A. Steel casing pipe shall have 35,000 psi minimum yield strength, be asphalt coated and conform to "Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless," ASTM A 53.
- B. Full circumference welded joint.
- C. Diameter and wall thickness as shown on the drawings.

**2.02 REINFORCED CONCRETE CASING PIPE**

- A. Reinforced concrete casing pipe shall conform to "Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe," ASTM C 76.
- B. Determine pipe class from "Concrete Pipe Design Manual" prepared by the American Concrete Pipe Association.
- C. Tongue and groove joints. To avoid concentrated loads at the joints insert strips of plywood, asphalt roofing paper or similar resilient materials around the circumference in the joints.

**2.03 TUNNELING LINER PLATE**

- A. Tunnel liner plate steel shall be galvanized, have minimum yield strength 28,000 psi and conform to "Standard Specification for Commercial Steel (CS), Sheet and Strip, Carbon (0.16 Maximum to 0.25 Maximum Percent), Hot-Rolled," ASTM A659.
- B. Bolts and nuts shall be galvanized and in conformance with "Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength," ASTM A 307.

**2.04 CARRIER PIPE**

- A. Ductile iron carrier pipe shall be in conformance with ANSI/AWWA C 151/A21.51 and Class as shown on the drawings.

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- B. Prestressed concrete carrier pipe shall be steel cylinder type in conformance with pressure rating as shown on the drawings.

**2.05 TIMBER SKIDS**

- A. Pressure treated, cut to a cross-sectional size to allow placement of the carrier pipe in the casing and to support the barrel of the carrier pipe.
  - 1. Provided with notches to accommodate fastening. Treat notches at time of pipe installation.
- B. Creosoting shall be in conformance with "Standard Specification for Preservatives and Pressure Treatment Process for Timber," AASHTO M 133.

**2.06 STEEL STRAPPING**

- A. Steel strapping shall be in conformance with "Standard Specification for Carbon Structural Steel," ASTM A 36.

**2.07 SAND (Fine Aggregate)**

- A. Fine aggregate shall be Type A per Section 703.1 of the Form 408 Specifications.

**2.08 GROUT**

- A. One part portland cement (conforming to "Standard Specification for Portland Cement," ASTM C 150) and 6 parts mortar sand mixed with water to a consistency applicable for pressure grouting.

**PART 3 - EXECUTION**

**3.01 APPROACH TRENCH**

- A. Excavate approach trench using methods as site conditions require.
- B. Ensure pipe entrance face as near perpendicular to alignment as conditions permit.
- C. Establish a vertical entrance face at least 1 foot above top of casing or tunnel lining.
- D. Install adequate excavation supports as specified in Section 02201 - Trench

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**SECTION 02301**  
**BORING, JACKING AND TUNNELING**

Excavation, Backfilling and Compacting.

**3.02 CASING PIPE INSTALLATION METHODS**

A. Boring:

1. Push the pipe into the ground with a boring auger rotating within the pipe to remove the spoil. Do not advance the cutting head ahead of the casing pipe except for that distance necessary to permit the cutting teeth to cut clearance for the pipe. The machine bore and cutting head arrangement shall be removable from within the pipe. Arrange the face of the cutting head to provide a barrier to the free flow of soft material.
2. If unstable soil is encountered during boring, retract the cutting head into the casing to permit a balance between the pushing pressure and the ratio of pipe advancement to quantity of soil.
3. If voids should develop greater than the outside diameter of the pipe by approximately one inch, grout to fill voids. Grouting to fill voids will be at the expense of the Contractor.

B. Jacking:

1. Construct adequate thrust wall normal to the proposed line of thrust.
2. Impart thrust load to the pipe through a suitable thrust ring that is sufficiently rigid to ensure distribution of the thrust load on the pipe.

C. Drilling and Jacking:

1. Use an oil field type rock roller bit or plate bit made up of individual roller cutter units solidly welded to the pipe which is turned and pushed for its entire length by the drilling machine to give the bit the necessary cutting action.
2. Inject a high density slurry (oil field drilling mud) to the head as a cutter lubricant. Inject slurry at the rear of the cutter units to prevent jetting action ahead of the pipe.

D. Mining and Jacking:

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1. Utilize manual hand-mining excavation from within the casing pipe as it is advanced with jacks, allowing minimum ground standup time ahead of the casing pipe.

**3.03 TUNNELING**

- A. Advance excavation for the tunnel liner in increments sufficient for the erection of one ring of liners and install liner plates immediately after each increment of excavation. Carry on excavation in such a manner that voids behind the liner plates are held to a minimum. Completely fill such voids with grout followed immediately by grout placed under pressure.
- B. Excavate to the lines, grades, dimensions and tolerances as specified and shown, to accommodate the initial support and permanent lining.
- C. Installation of Tunnel Linings:
  1. Install the tunnel lining in a manner that will not damage the lining or coating.
  2. Ensure that the edges are clean and free from material that could interfere with proper bearing.
  3. Install bolts for liner plates in accordance with liner plate manufacturer's recommendations and retension or replace, if necessary, any bolt which does not meet the requirements.
- D. Place concrete invert as shown on the drawings.

**3.04 DEWATERING**

- A. Intercept and divert surface drainage precipitation and groundwater away from excavation through the use of dikes, curb walls, ditches, pipes, sumps or other means.
- B. Develop a substantially dry subgrade for the prosecution of subsequent operations.

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**BORING, JACKING AND TUNNELING**

- C. Comply with Federal and State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sedimentation control.

**3.05 PRESSURE GROUTING**

- A. Pressure grout the annular space between the casing pipe and surrounding earth.

**3.06 CARRIER PIPE INSTALLATION**

- A. All provisions regarding cleaning, inspection and handling specified under pipe material sections apply to this work.
- B. Place the carrier as shown on the drawings. Exercise care to prevent damage to pipe joints when carrier pipe is placed in casing.
- C. Support pipeline within casing so that no external loads are transmitted to carrier pipe. Attach wooden skids to barrel of carrier pipe; do not rest carrier pipe on bells.
- D. Fill the annular space between the carrier and casing pipe with sand or provide other positive means to prevent flotation.
- E. Close/seal ends of casing.

**END OF SECTION**

**SECTION 02501  
PAVING AND RESTORATION**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. The work of this section includes, but is not limited to:
  - 1. Temporary paving
  - 2. Permanent paving
  - 3. Shoulder restoration
  - 4. Curb and sidewalk restoration
  
- B. See the Special Conditions and/or the drawings for specific paving and resurfacing requirements for this project.

**1.02 QUALITY ASSURANCE**

- A. Referenced standards:
  - 1. Pennsylvania Department of Transportation
    - a. Chapter 459 (67 PA Code), Occupancy of Highways by Utilities
    - b. Form 408 Specifications, Latest Edition
    - c. Publication 27, Specification for Bituminous Mixtures (Bulletin 27)
    - d. Publication 37, Specification for Bituminous Materials (Bulletin 25)
    - e. Publication 203, Work Zone Traffic Control

**1.03 SUBMITTALS**

- A. Certificates:
  - 1. Submit certification from bituminous and aggregate suppliers attesting that materials conform to the State specifications.

**1.04 JOB CONDITIONS**

- A. Control of Traffic:
  - 1. Take measures to control traffic during paving operations. Do not allow traffic on newly paved areas until authorized by the Engineer.
  - 2. Employ traffic control measures in accordance with Pennsylvania

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Department of Transportation Publication No. 203, "Work Zone Traffic Control."

- B. Restore existing paving outside the limits of the work that is damaged by the Contractor's operations to its original condition at the expense of the Contractor.

**PART 2 - PRODUCTS**

**2.01 CONCRETE**

- A. See Section 03310 - Cast-In-Place Concrete

**2.02 BITUMINOUS PAVING MATERIALS AND AGGREGATES**

- A. Refer to State Specifications, Form 408. All bituminous materials and aggregates used in paving and resurfacing shall conform to the applicable portions of the State Specifications.

**PART 3 - EXECUTION**

**3.01 TEMPORARY PAVING OVER TRENCHES**

- A. Place temporary paving immediately upon completion of trench backfilling. Unpaved trenches shall not remain unpaved longer than ten working days after backfilling.
- B. Shape and compact subgrade, then place and compact subbase and/or base course material to the required thickness.
- C. Place temporary paving material. Compact to required minimum thickness with trench roller having minimum 300 pounds per inch-width of compaction roll.
- D. Continuously maintain temporary paving to the satisfaction of the Engineer and the State and local road departments. Temporary paving on state roads must remain in place for a minimum of 90 days.

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**3.02 PERMANENT PAVING**

- A. For restoration of existing pavement, trim existing paving to remove damaged areas. Cut straight joint lines and right angle offsets. Remove temporary paving material. Construct permanent base and surface courses to the required compacted thicknesses shown on the drawings and/or as identified in the Special Conditions, and in accordance with Form 408 Specifications.
- B. For new pavement, shape and compact subgrade, then place and compact base and surface courses and base drainage facilities as shown on the drawings and/or as identified in the Special Conditions, and in accordance with Form 408 Specifications.
- C. Maintain permanent paving to the satisfaction of the Engineer and the local and State road departments throughout the contract maintenance period.

**3.03 BITUMINOUS OVERLAY**

- A. Where indicated on the drawings, in the Special Conditions, or where directed by the Engineer, place a bituminous overlay.
- B. Construct in accordance with Section 401.3 Form 408 Specifications.

**3.04 SHOULDER RESTORATION**

- A. Restore shoulders in accordance with drawings, Special Conditions, and Form 408 Specifications.

**3.05 DRIVEWAY RESTORATION**

- A. Trim concrete and bituminous driveway surfaces to remove damaged areas. Saw cut straight joint lines parallel to the centerline of the trench. Cut offsets at right angles to the trench centerline.
- B. Restore existing concrete driveways trenched through with a 6" layer of concrete reinforced with 6 x 6 x 10/10 wire mesh.
- C. Restore existing blacktop driveways trenched through in-kind, or with minimum 1-1/2" layer wearing course over 6" layer of 2 RC aggregate.
- D. Restore earth driveways with a 6" layer of 2 RC stone backfill.
- E. Restore stone or gravel driveways in-kind.
- F. Restore brick driveways with like bricks placed on a 4" thick wet sand bed. Place

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bricks in like pattern and spacing.

**3.06 CONCRETE CURB AND SIDEWALK REPAIRS**

- A. Replace curbs and sidewalks damaged by construction to match existing.
- B. Reconstruct curbs and sidewalks to the first expansion joint on either side of the damaged portion. Install expansion joint material.
- C. Reconstruct sidewalks to 4" thickness of concrete placed on a 4" base of compacted 2 RC crushed aggregate.

**END OF SECTION**

**SECTION 02603  
VALVE VAULTS AND METER BOXES**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. This section includes labor, materials, equipment and related services necessary for furnishing and installing valve vaults and meter boxes as shown on the plans or as specified.

**1.02 RELATED WORK**

- A. Work under this item shall be coordinated with that specified under the following sections:
  - 1. Section 02201 - Trench Excavation, Backfilling and Compacting
  - 2. Section 02615 - Water Distribution Pipe
  - 3. Section 02641 - Valves, Hydrants and Meters
  - 4. Section 02645 - Water Service Connections
  - 5. Section 03310 - Cast-In-Place Concrete

**1.03 QUALITY ASSURANCE**

- A. Materials and work shall conform to the requirements of the drawings, applicable codes, these specifications and standards referenced within these specifications. In case of conflicts between requirements, the more stringent requirements shall govern.

**1.04 SUBMITTALS**

- A. Manufacturer's Literature
  - 1. Submit manufacturer's latest published literature for valve vaults, meter boxes, and frames and covers.
- B. Shop Drawings
  - 1. Submit detailed Shop Drawings for each product specified herein for prior approval of the Engineer.

**1.05 PRODUCT DELIVERY, HANDLING AND STORAGE**

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- A. Exercise care in handling to avoid chipping, cracking and breakage.
- B. Remove defective products from the site immediately.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Crushed Stone Subbase
  - 1. Crushed stone subbase shall be size 2A and Type C in conformance with Section 703 of the PennDOT Form 408 Specifications.
- B. Masonry Mortar
  - 1. Masonry mortar shall be Type S in conformance with "Specification for Mortar for Unit Masonry," ASTM C 270, latest edition.
- C. Concrete Block
  - 1. Concrete block shall be in conformance with "Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes," ASTM C 139, latest edition.
- D. Joint Sealant Compound
  - 1. Joint sealant compound shall be FS SS-S-00210, preformed, flexible, self-adhering and cold-applied.
- E. Cast Iron
  - 1. Cast iron shall be manufactured in accordance with "Specification for Gray Iron Castings," ASTM A 48, latest edition, Class 30 or better and be free of bubbles, sand and air holes and other imperfections.

**2.02 MANUFACTURED PRODUCTS**

- A. Precast Reinforced Concrete Vaults
  - 1. Precast vaults shall conform to Section 713.2(e) of the PennDOT Form 408

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**VALVE VAULTS AND METER BOXES**

Specifications.

2. Vaults shall meet the loading conditions of AASHTO HS-20.
3. Vaults shall include manhole steps and pipe openings as indicated on the drawings.

**B. Precast Concrete Manholes**

1. Precast concrete manholes shall conform to the drawings and to "Specification for Precast Reinforced Concrete Manhole Sections," ASTM C 478, latest edition.

**C. Precast Concrete Water Meter Boxes**

1. Precast concrete water meter boxes shall have minimum 4000 psi concrete and minimum 2" wall thickness.
2. Reinforcement shall be 6 x 6 10/10 wire mesh.
3. Water meter boxes shall be suitable for use in sidewalks, lawns, or other areas not subject to vehicular traffic.

**D. Cast Iron Meter Boxes**

1. Domestic cast iron meter boxes shall be three-piece, comprised of a base, an upper body and a separate lid, or a two-piece, comprised of an integral body casting and a separate lid.
2. Integrally cast anchor lugs and inlet and outlet connections.
3. All hardware shall be included.
4. Meter Box Covers:
  - a. Meter box covers shall be single or double lid with minimum 11" lid opening.
  - b. Words "Water Meter" shall be cast into the lid.

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**VALVE VAULTS AND METER BOXES**

- c. Bronze worm lock shall have standard waterworks pentagon bolt head.
  - d. Lid with a recess shall engage a lug on the key, permitting the key to become a handle for lifting the lid.
- E. Cast Iron Manhole and Vault Frames and Covers
- 1. Contact surfaces shall be domestic cast iron, machined and matched.
  - 2. The pipeline service shall be cast on the cover as shown on the drawings.
- F. Fabricated Steel Hatch or Vault Cover
- 1. Fabricated steel hatch or vault covers shall be commercially manufactured to meet the loading requirements of AASHTO HS-20 or as specified otherwise.
  - 2. Frames shall be formed steel channel frames with anchor flange and drainage coupling of sizes as designated on drawings.
  - 3. Doors shall have steel diamond pattern plate, reinforced with structural steel framing.
  - 4. Hinges shall be forged brass hinges with stainless steel pins.
  - 5. Lifting mechanisms shall be stainless steel, compression spring type, balancing door leaf through entire arch and acting as a check in retarding downward movement.
  - 6. Hold-open device shall be automatic, 90-degree, hold-open arm with vinyl-covered release handle.
  - 7. Locking device shall be snap lock with handle on the underside and removable key handle on the top side. Include removable plug for concealing key hole.
  - 8. Cadmium plate or galvanize all hardware.
  - 9. Factory prime cost of red oxide and finish coat of color and kind designated shall be applied to all steel surfaces.

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**VALVE VAULTS AND METER BOXES**

G. Keys and Wrenches

1. Supply keys and wrenches of the type and number specified.

**PART 3 - EXECUTION**

**3.01 GENERAL**

- A. Refer to drawings for location, grade and depth of vaults and boxes.

**3.02 EXCAVATION**

- A. Excavate to the line and grade shown on the drawings and as specified in Section 02201.
- B. Location and depth of structures as shown on the drawings.

**SECTION 02603**  
**VALVE VAULTS AND METER BOXES**

**3.03 FOUNDATION**

- A. Provide 6" compacted crushed stone subbase foundation for precast structures and all meter boxes.
- B. Place cast-in-place concrete foundation on undisturbed earth.

**3.04 CONSTRUCTION**

- A. Vaults
  - 1. Construct valve vaults of precast sections, masonry, and cast-in-place concrete as shown on the drawings.
  - 2. Seal vault joints watertight with preformed plastic joint sealant compound.
  - 3. Seal annular space between pipe and vault with mechanical seal consisting of interlocking synthetic rubber links shaped to fill the space and assembled with bolts and a pressure plate under each bolt head and nut.
  - 4. Do not erect masonry when ambient temperature is below 45 Degrees F., unless it is rising and at no time when the temperature is below 40 Degrees F., except by written permission of the Engineer.
  - 5. Install vault frames and covers and adjust to finished grade elevation.
- B. Meter Boxes
  - 1. Install meter boxes as shown on the drawings.
  - 2. Adjust meter box covers to finished grade elevation.

**3.05 BACKFILLING**

- A. Backfill only after inspection of the vault or meter box.
- B. Backfill as specified in Section 02201.

**SECTION 02615  
WATER MAINS**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. This Section includes all labor, materials, equipment and related services for furnishing and installing water transmission and distribution lines and fittings, as shown on the drawings or as specified.

**1.02 RELATED WORK**

- A. Work under this section shall be coordinated with that specified under the following sections, whenever applicable:
1. Section 02201 - Trench Excavation, Backfilling and Compacting
  2. Section 02301 - Boring, Jacking and Tunneling
  3. Section 02603 - Valve Vaults and Meter Boxes
  4. Section 02641 - Valves and Fire Hydrants
  5. Section 02645 - Water Service Connections
  6. Section 02655 - Testing and Disinfecting Water Mains
  7. Section 03310 - Cast-In-Place Concrete

**1.03 QUALITY ASSURANCE**

- A. Materials and work shall conform to the requirements of the drawings, applicable codes, these specifications and standards referenced within these specifications. In case of conflicts between requirements, the more stringent requirements shall govern.
- B. The latest edition of the following standards are referenced within the specification:
1. American National Standards Institute (ANSI)/American Water Works Association (AWWA):
    - a. ANSI/AWWA
      - C104/A21.4 Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water
      - C105/A21.5 Polyethylene Encasement for Ductile-Iron Pipe Systems

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**SECTION 02615  
WATER MAINS**

- C110/A21.10 Ductile-Iron and Gray-Iron Fittings, 3-In. Through 48-In., for Water.
- C111/A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- C115/A21.15 Flanged Ductile-Iron Pipe with Ductile Iron or Gray-Iron Threaded Flanges
- C150/A21.50 Thickness Design of Ductile Iron Pipe
- C151/A21.51 Ductile-Iron Pipe, Centrifugally Cast, for Water
- C153/A21.53 Ductile-Iron Compact Fittings 3-Inch through 24-Inch, and 54-Inch through 64-Inch for Water Service

b. AWWA

- C200 Steel Water Pipe 6 Inches and Larger
- C203 Coal Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied
- C205 Cement Mortar Protective Lining and Coating for Steel Water Pipe 4-Inch and Larger - Shop Applied
- C206 Field Welding of Steel Water Pipe
- C207 Steel Pipe Flanges for Waterworks Service – Sizes 4 in. Through 144 in.
- C600 Installation of Ductile Iron Water Mains and Their Appurtenances
- C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4-Inches Through 12-Inches, for Water Distribution

2. American Society for Testing and Materials (ASTM):

- D1785 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, 120
- D2241 Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series)
- D2466 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
- D2855 Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

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**SECTION 02615**  
**WATER MAINS**

D3139                      Standard Specification for Joints for Plastic Pressure  
Pipes Using Flexible Elastomeric Seals

- C.     Reject materials contaminated with gasoline, lubricating oil, liquid or gaseous fuel, aromatic compounds, paint solvent, paint thinner, or acid solder.

**1.04 SUBMITTALS**

- A.     Submit manufacturer's catalog information for each type of pipe, fittings, couplings, adapters, gaskets and assembly of joints for approval of the Engineer. Include manufacturers' recommendations for deflection in pipe joints.
- B.     Certificates:
  - 1.     Submit certifications for each type of pipe, fittings, gaskets, lubricants or other joint materials from the manufacturers attesting that each of these meets or exceeds specifications requirements.
- C.     Samples or Shop Drawings:
  - 1.     Submit shop drawings for joint assemblies and one sample each type of jointing materials.

**1.05 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A.     Delivery and Handling:
  - 1.     Do not place materials on private property without written permission from the property owner.
  - 2.     During loading, transporting and unloading, exercise care to prevent damage to materials.
  - 3.     Do not drop pipe or fittings. Avoid shock or damage at all times.
  - 4.     Use padded slings, hooks and tongs to prevent damage to the exterior surface or internal lining of the pipe.
- B.     Storage:
  - 1.     Pipe may be strung along alignment where approved by the Engineer.

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WATER MAINS**

2. Do not stack higher than Maximum Stacking Heights shown in AWWA C600 or as recommended by the pipe manufacturer.
3. Keep interior of pipe and fittings free from dirt or other foreign matter.
4. Store gaskets for mechanical and push-on joints in cool location out of direct sunlight and not in contact with petroleum products.

**PART 2 - PRODUCTS**

**2.01 PIPE, FITTINGS AND JOINTS**

A. Ductile Iron (DI)

1. Ductile Iron Pipe: ANSI/AWWA C150/A21.50 and C151/A21.51
  - a. Cement Mortar Lined in accordance with ANSI/AWWA C104/A21.4
  - b. Class as shown
2. Ductile Iron and Cast Iron Fittings: ANSI/AWWA C110/A21.10 or C153/A21.53
  - a. Cement Mortar Lined in accordance with ANSI/AWWA C104/A21.4
  - b. Pressure Rating: As shown
3. Joints:
  - a. Mechanical or Push-on Joints conforming with ANSI/AWWA C111/A21.11 for underground installations
  - b. Flanged Joints conforming with ANSI/AWWA C153-A21.53 and ANSI/AWWA C115/A21.15 for interior installations

B. Polyvinyl Chloride (PVC) Plastic Pipe

1. Pipe:
  - a. Schedule Rated: ASTM D1785, Schedule 40
  - b. Pressure Rated: ASTM D2241, Pressure Class as shown



**SECTION 02615**  
**WATER MAINS**

- c. Outside Diameter Dimension Pipe: AWWA C900, Pressure Class and Dimension Ratio as shown
  - 2. Manufactured from Polyvinyl Chloride 1120 or 1220
  - 3. National Sanitation Foundation Seal of Approval for use with potable water required
  - 4. Joints:
    - a. Push-on: ASTM D3139
    - b. Solvent Cement: ASTM D2855
  - 5. Fittings:
    - a. Push-on: Class suitable for use with pipe specified
    - b. Solvent Welded: ASTM D2466
    - c. Cast or Ductile Iron Fittings for PVC Pressure Pipe: ANSI/AWWA C110/A21.10
- C. Steel
  - 1. Pipe: AWWA C200
    - a. Cement Mortar Lined in accordance with AWWA C205
    - b. Coal Tar Coated in accordance with AWWA C203
    - c. Internal pressure and minimum wall thickness as shown.
    - d. Design stress at specified pressure: 50-percent of yield point.
  - 2. Fittings: AWWA C200
  - 3. Joints:
    - a. Welded: AWWA C206
    - b. Flanged: AWWA C207

**SECTION 02615  
WATER MAINS**

- c. Mechanically Coupled: Dresser Style 38, Rockwell 411, or equal.

**PART 3 - EXECUTION**

**3.01 EXECUTION**

- A. Excavate trenches as specified in Section 02201.
- B. Provide at least 4 ft. of cover from the top of the pipe to the finished grade elevation.

**3.02 PIPE PROTECTION**

- A. Provide Type I pipe protection for ductile iron pipelines as shown on detail on drawings. Type II pipe protection may be provided as an alternate to digging out for bells.
  - 1. Shape recesses for the joints or bell of the pipe by hand. Assure that the pipe is supported on the lower quadrant for the entire length of the barrel.
- B. Provide Type II pipe protection for steel pipelines as shown on detail on drawings.
- C. Provide Type IV pipe protection for PVC pipelines as shown on detail on drawings.

**3.03 PIPE LAYING**

- A. Clean and inspect each length of pipe or fitting before lowering into the trench. Do not lower pipe into the trench except that which is to be immediately installed.
- B. Lay pipe to a uniform line with the barrel of the pipe resting solidly in pipe protection material throughout its length. Excavate recesses in pipe protection material to accommodate joints, fittings, and appurtenances. Do not subject pipe to a blow or shock to achieve solid bearing or grade.
- C. Lay each section of pipe in such a manner as to form a close concentric joint with adjoining section and to avoid offsets.
- D. Lubricate pipe and gaskets as recommended by the manufacturer. Assemble to provide tight, flexible joints that permit movement caused by expansion, contraction, and ground movement.
- E. Check each pipe installed as to line and grade in place. Correct deviations immediately. Deflection of pipe joints in excess of maximum recommended by manufacturer will be cause for rejections.

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**WATER MAINS**

- F. Install fittings and valves as pipe laying progresses. Do not support weight of fittings and valves from pipe.
- G. When the work is not in progress, and at the end of each work day, securely plug the ends of pipe and fittings to prevent trench water, earth, or other substances from entering the pipes or fittings.
- H. Backfill concurrently with pipelaying to hold installed pipe in place. When pipe laying is terminated for any reason, provide at least 2 feet of backfill over all pipe except the last piece laid.
- I. Joint Assembly
  - 1. Push-on Joints:
    - a. Clean the inside of the bell and the outside of the spigot. Insert rubber gasket into the bell recess.
    - b. Apply a thin film of gasket lubricant to either the inside of the gasket or the spigot end of the pipe, or both.
    - c. Insert the spigot end of the pipe into the socket using care to keep the joint from contacting the ground. Complete the joint by forcing the plain end to the bottom of the socket. Mark pipe that is not furnished with a depth mark before assembly to assure that the spigot is fully inserted.
  - 2. Mechanical Joints:
    - a. Wash the socket and plain end. Apply a thin film of lubricant. Slip the gland and gasket over the plain end of the pipe. Apply lubricant to gasket.
    - b. Insert the plain end of the pipe into the socket and seat the gasket evenly in the socket.
    - c. Slide the gland into position, insert bolts, and finger-tighten nuts.
    - d. Bring bolts to uniform tightness. Tighten bolts 180-degrees apart alternately in conformance with Appendix A of ANSI/AWWA C111/A21.11.
    - e. Coat all bolts and nuts with bitumastic paint after installation.

## **SECTION 02615 WATER MAINS**

3. Solvent Cemented Joints:
  - a. Chamfer and deburr pipe. Clean socket and plain end. Measure and mark the socket depth on the outside of the pipe.
  - b. Apply primer to inside socket surface using a scrubbing motion to ensure penetration. Repeated applications may be necessary. Soften surface of male end of pipe to depth of fitting socket by applying a liberal brush coat of primer. Do not pour primer on. Assure entire surface is well softened.
  - c. Repeat application of primer to inside socket surface then apply cement to pipe while surfaces are still wet with primer. Apply cement uniformly taking care to keep excess cement out of socket.
  - d. Immediately after applying the last coat of cement to the pipe and while both the inside socket surface and outside pipe surface are soft and wet, forcefully seat the pipe in the socket. Turn the pipe 1/4 turn during assembly to distribute cement evenly. Assembly should be completed within 20-seconds after the last application of cement. Insert pipe with a steady, even motion. Do not use hammer blows.
  - e. Hold joint in place until the cement has set. Wipe excess cement from the pipe.
4. Coupled Joints: In accordance with manufacturer's recommendations.
- J. Install service connections as specified in Section 02645.

### **3.04 CUTTING**

- A. Cut pipe without damaging pipe or lining.
- B. Grind cut ends and rough edges smooth. Bevel end for push-on joints.

### **3.05 DEFLECTION**

- A. When it is necessary to deflect water mains from a straight alignment horizontally or vertically, do not exceed limits as follows:
  1. Ductile Iron Pipe: AWWA C600

**SECTION 02615  
WATER MAINS**

2. PVC Pipe: Per manufacturers' recommendations.

**3.06 THRUST RESTRAINT**

- A. Provide all valves, tees, bends, caps, and plugs with concrete thrust blocks as indicated on the drawings. Pour concrete thrust blocks against undisturbed earth. Locate thrust blocks to contain the resultant force and so pipe and fitting joints will be accessible for repair.
- B. Furnish and install tie rods, clamps, set screw, retainer glands or restrained joints as indicated on the drawings. Protect metal restrained joint components against corrosion by applying a bituminous coating or encasing the entire assembly with an 8-mil thick polyethylene wrap in accordance with ANSI/AWWA C105/A21.5.
- C. If restrained joints are proposed for use, contact Authority's Engineer for approval of method and minimum restrained lengths.

**3.07 BLOWOFFS**

- A. Install a blow-off on the dead ends of all water mains where shown on the drawings.
- B. Construct blow-offs as shown on detail on drawings.

**3.08 AIR RELEASE VALVES**

- A. Install air release valves at the high points of water mains where shown on the drawings.
- B. Construct air release valves including valve vault as shown on detail on drawings.

**3.09 SPECIAL CONDITIONS**

- A. Connections
  1. Wherever an existing water main is to be cut and closed, or extended or connected to the proposed new lines, construct connections as shown on the drawings.
  2. For connecting pipe of different materials, use transition fittings as recommended by the manufacturer and approved by the Engineer.
- B. Stream Crossings
  1. Install water mains crossing streams as shown on detail on drawings.

**SECTION 02615  
WATER MAINS**

2. Provide valves, valve vaults, and sampling tap on each side of the stream as shown on the drawings.
- C. Highway and Railroad Crossings
1. Install water mains crossing highways and railroads as shown on drawings. Comply with Railroad Company, State Department of Transportation, and municipal permits provided by Owner.
  2. When casing pipe is indicated, install it as specified in Section-2301 - Boring, Jacking and Tunneling.
- D. Bridge or Aerial Crossings
1. For above the ground water mains attached to a bridge or other structural supports, furnish and install all supports, hangars and fastenings as shown on the drawings.
  2. Provide insulation and jacket as shown.
- E. Wall Sleeves
1. Provide pipes passing through concrete or masonry construction with sleeve or wall pipe fittings of type and size indicated.
  2. Provide sleeves two pipe sizes larger than the water mains, unless otherwise specified or shown.

**3.10 COMPLETION**

- A. Test and disinfect water mains as specified in Section 02655.

**END OF SECTION**

**SECTION 02641  
VALVES AND FIRE HYDRANTS**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. This Section includes all labor, materials, equipment, and related services necessary for furnishing and installing valves, valve boxes and fire hydrants, as shown on the plans or as specified.

**1.02 RELATED WORK**

- A. Work under this item shall be coordinated with that specified under the following sections, when included in these Specifications:
1. Section 02201-Trench Excavation, Backfilling and Compacting
  2. Section 02603-Valve Vaults and Meter Boxes
  3. Section 02615-Water Mains
  4. Section 02645-Water Service Connections
  5. Section 03310-Cast-in-Place Concrete

**1.03 QUALITY ASSURANCE**

- A. Materials and work shall conform to the requirements of the Drawings, these Specifications, referenced standards of the American Water Works Association (AWWA), and applicable codes. In case of conflicts between requirements, the more stringent requirements shall govern.

**1.04 SUBMITTALS**

- A. Certificates:
1. Submit manufacturer's certification attesting that valves, hydrants, and accessories meet or exceed AWWA Standards and Specification requirements.
- B. Product Data:
1. Submit manufacturer's latest published literature including illustrations, installation instructions, maintenance instructions and parts lists.

**1.05 PRODUCT DELIVERY, STORAGE AND HANDLING**

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**SECTION 02641  
VALVES AND FIRE HYDRANTS**

- A. Prepare valves, hydrants and accessories for shipment according to AWWA Standards and:
  - 1. Seal valve, hydrants and meter ends to prevent entry of foreign matter into product body.
  - 2. Box, crate, completely enclose, and protect products from accumulations of foreign matter.
- B. Store products in areas protected from weather, moisture, or possible damage.
- C. Do not store products directly on ground.
- D. Handle products to prevent damage to interior or exterior surfaces.

**PART 2 - PRODUCTS**

**2.01 GATE VALVES**

- A. Valve body shall be iron with bronze trim conforming to "Standard for Gate Valves, 3 Through 48 In. NPS, for Water and Sewer Systems," AWWA C509 or C515, latest edition.
  - 1. Valves shall be resilient-seated gate valves, 250 psi pressure rated.
  - 2. Valves shall have non-rising stems with O-ring stem seals.
  - 3. The operating nut shall be 2" square and open counterclockwise unless otherwise indicated.
  - 4. Valve ends shall be flanged, mechanical joint or bell end. Use flanged valves for above ground service only.
  - 5. Provide valves 16" and larger with bypass valves and gear operators.

**2.02 BUTTERFLY VALVES**

- A. Butterfly valves shall be Class 150B and in accordance with "Standard for Rubber-Sealed Butterfly Valves," AWWA C504, latest edition.
- B. Valve body shall be iron with stainless steel shaft and nylon bearings.

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**SECTION 02641**  
**VALVES AND FIRE HYDRANTS**

1. Sizes 2" thru 20" shall be 200 psi rated.
  2. Sizes 24" thru 48" shall be 150 psi rated.
- C. Valve ends shall be flanged, wafer, or mechanical joint.
- D. Valves shall have worm gear manual actuators, sealed and permanently lubricated with position indicator.
1. Vertical, right angle, or buried type valves shall have hand-wheel, crank handle, or square nut as indicated.
  2. Buried valves shall have stem extension and valve box.
  3. Valve operators shall open counterclockwise unless otherwise indicated.

**2.03 VALVE BOXES**

- A. Valve boxes shall be domestic cast iron screw type with "WATER" cast on lid.
1. Valves 12" and smaller shall have two-piece box.
  2. Valves larger than 12" shall have three-piece box with round base.
  3. Provide lids as indicated in the Special Conditions, Section 01010.

**2.04 AIR RELEASE VALVES**

- A. Valve body and cover shall be cast iron with stainless steel float, orifice seat, linkage mechanism, mountings and trim, in accordance with AWWA C512, latest edition.
- B. Orifice valve shall be Buna-N.
1. Valve orifice shall be designated for maximum venting capacity under normal main pressure.
  2. Valve shall have 150 psi minimum rated working pressure and be hydrostatically tested to 2 times rated working pressure.

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VALVES AND FIRE HYDRANTS**

**2.05 PRESSURE REDUCING VALVES**

- A. Valve body and cover shall be cast iron with stainless steel trim, external pilot operated, with free floating piston, single seat with seat bore equal to size of valve.
- B. The pilot valve shall be easily accessible, so arranged to allow for its removal from the main valve while the main valve is under pressure, and easily adjustable without removal of springs, weights, or use of special tools.
  - 1. Valve shall maintain a pre-adjusted downstream pressure for varying rates of flow through the positioning of the piston by the pilot without causing water hammer or waste of water.
  - 2. Valve shall have 200 psi minimum rated working pressure and be hydrostatically tested to 2 times rated working pressure.

**2.06 FIRE HYDRANTS**

- A. Fire hydrants shall be dry-barrel break-away type conforming to "Standard for Dry-Barrel Fire Hydrants," AWWA C502, latest edition.
  - 1. Bury depth shall be 5'-0", or as indicated on the Drawings.
  - 2. Inlet Connection shall be 6".
  - 3. Valve openings shall be 5-1/4".
  - 4. Valve ends shall be mechanical joint or bell end.
  - 5. Bolts and nuts shall be corrosion resistant.
  - 6. Hydrants shall have one pumper and two 2-1/2" nozzles, with nozzle caps attached by separate chains.
  - 7. Refer to Special Conditions, Section 01010 for additional requirements.

**PART 3 - EXECUTION**

**3.01 GENERAL**

- A. Determine the exact location and size of valves and hydrants from the drawings.

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VALVES AND FIRE HYDRANTS**

The Standard Details represent typical details only. Obtain all necessary clarification and directions from the Authority's representative prior to the execution of work.

- B. Perform trench excavation, backfilling and compaction in accordance with Section 02201.
- C. Install pipe and tubing in accordance with Sections 02615 and 02645 and the applicable details.

**3.02 GATE AND BUTTERFLY VALVES**

- A. Install valves in conjunction with pipe laying. Set valves plumb.
- B. Provide buried valves with valve boxes installed flush with finished grade.
- C. Furnish one tee wrench to the Authority.

**3.03 AIR RELEASE VALVES**

- A. Install air release valves in valve vault.
- B. Provide clamp where needed.
- C. Set air release valves plumb.

**3.04 PRESSURE REDUCING VALVES**

- A. Install pressure reducing valves in valve vault.
- B. Provide thrust restraint, supports, and clamps where needed.

**3.05 FIRE HYDRANTS**

- A. Install fire hydrants as shown on the Standard Detail Sheet. Provide support blocking and drainage gravel as shown.
  - 1. Set hydrants plumb with pumper nozzle facing the curb or street.
  - 2. Set hydrants with nozzles at least 18 inches above the ground and the safety flange not more than 6 inches nor less than 2 inches above grade.

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**SECTION 02641**  
**VALVES AND FIRE HYDRANTS**

3. Do not block the drain hole.

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4. Paint hydrants in accordance with local color scheme.
  5. One spanner wrench shall be provided for each ten (10) fire hydrants furnished, or a minimum of one (1) wrench per project unless otherwise directed by the Authority's representative.
- B. After hydrostatic testing flush hydrants and check for proper drainage.
- C. Upon completion of installation, hydrants shall be painted.
1. Thoroughly clean entire hydrant above ground surface and wire brush any areas where factory coating has been damaged.
  2. Apply one (1) spot coat and one (1) full coat of primer at 1-1/2 - 2 mils each.
  3. Apply two (2) full coats of the finish coating at 1-1/2 - 2 mils each.
  4. Completed coatings shall have a minimum dry-mil thickness of 6 mils.
  5. Coatings shall be the following as manufactured by M.A.B./Pennsbury Coatings Corporation or approved equal:  
  
Primer - Reinforced Alkyd, "Flash-Dry"  
Primer, 1 - G-16 (Gray)  
Finish - Phenolic Modified Urethane,  
"Hydrant-Hide", 9032 (color to match existing hydrants)
  6. Apply coatings by brush only.

**END OF SECTION**

**SECTION 02645  
WATER SERVICE CONNECTIONS**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. This section includes, but is not limited to, all labor, materials, equipment and related services for furnishing and installing corporation stops, service pipe, curb stops, meter boxes and meter setting equipment, as shown on the drawings or as specified.

**1.02 RELATED WORK**

- A. Work under this section shall be coordinated with that specified under the following sections, whenever applicable:
1. Section 02201 - Trench Excavation, Backfilling and Compacting
  2. Section 02603 - Valve Vaults and Meter Boxes
  3. Section 02615 - Water Mains

**1.03 QUALITY ASSURANCE**

- A. Regulatory Requirements:
1. Comply with requirements of the East Donegal Township Municipal Authority. Include tapping of water mains and backflow prevention.
  2. Comply with standards of authorities having jurisdiction for potable-water-service-piping, including materials, installation, testing, and disinfection.
  3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Materials and work shall conform to the requirements of the drawings, applicable codes, these specifications and standards referenced within these specifications. In case of conflicts between requirements, the more stringent requirements shall govern.
- C. The latest edition of the following standards are referenced within the specification:
1. American National Standards Institute (ANSI):

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B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class  
25, 125, 250 and 800

B16.3 Malleable-Iron Screwed Fittings, 150 and 300 lb.

2. American Society for Testing and Materials (ASTM):

A240 Standard Specification for Chromium and  
chromium-Nickel Stainless steel Plate, Sheet, and Strip for  
Pressure Vessels and for General Applications

A351 Standard Specification for Castings, Austenitic, for  
Pressure-Containing Parts

B62 Standard Specification for Composition Bronze or  
Ounce Metal Castings

B88 Standard Specification for  
Seamless Copper Water Tube

**D2237 Standard Specification for  
Polyethylene (PE) Plastic Tubing (only covers tubing with  
Outside Controlled Diameters).**

3. American Water Works Association (AWWA):

C500 Metal-Seated Gate Valves for Water Supply Service  
**C509 Resilient-Seated Gate Valves for Water Supply  
Service**

C700 Cold-Water Meters -  
Displacement Type, Bronze Main Case

C701 Cold-Water Meters - Turbine  
Type for Customer Service

C703 Cold-Water Meters - Fire  
Service Type

**C710 Cold Water Meters -  
Displacement Type, Plastic Main Case**

C800 Underground Service Line  
Valves and Fittings

C901 Polyethylene (PE) Pressure  
Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm) for  
Water Service

4. ANSI/AWWA:

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|             |   |
|-------------|---|
| C104/A21.4  | Cement-Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fittings for Water   |
|             | C110/A21.10 Gray-Iron and Ductile-Iron Fittings, 3-inch through 48-inch for Water |
|             | C111/A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings      |
| C115/A21.15 | Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges         |
| C151/A21.51 | Ductile-Iron Pipe, Centrifugally Cast for Water                                   |

- D. Comply with FMG's "Approval guide" or UL's Fire Protection Equipment Directory" for fire-service-main products.
- E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- F. NSF compliance:
1. Comply with ANSI/NSF 14 for plastic potable-water-service piping, including marking "pw" on piping.
  2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

**1.03 SUBMITTALS**

- A. Manufacturer's Literature
1. Submit 6 copies each of pages of manufacturer's catalog for each size and type of Corporation Stop, Curb Stop, Curb Box, Meter Setting and pipe, fitting or coupling.
- B. Shop Drawings or Samples: Submit for the Engineer's approval 6 copies of shop drawings or samples, if so directed, of all products to be assembled by the Contractor at site. Include the following:

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1. Wiring Diagrams: Power, signal, and control wiring for alarms, if any.

C. Certificates

1. Submit 6 copies each of certificate for pipe, pipe fittings, joints, joint gaskets and lubricants and base materials from each manufacturer attesting that each of these meets or exceeds specifications requirements.

D. Coordination Drawings: for piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty location, and elevations.

**1.04 PRODUCT DELIVERY, STORAGE AND HANDLING**

A. Product Delivery:

1. During loading, transporting and unloading of all materials and products, exercise care to prevent any damage.
2. Ensure that valves are dry and internally protected against rust and corrosion.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off ground or pavement in watertight enclosure when outdoor storage is necessary.

**1.05 PROJECT CONDITIONS**

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify the East Donegal Township Municipal Authority's Construction Representative no fewer than two (2) days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without the

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**WATER SERVICE CONNECTIONS**

East Donegal Township Municipal Authority Construction  
Representative's written permission.

**1.06 COORDINATION**

- A. Coordinate connection to water main with the East Donegal Township Municipal Authority's Construction Representative.

**PART 2 - PRODUCTS**

**2.01 PIPE OR TUBING AND FITTINGS**

- A. Copper Water Tubing
  - 1. ASTM B-88, Type K, Seamless
  - 2. Matching Fittings of Compression Type
- B. Ductile - Iron Pipe
  - 1. Pipe:
    - a. ANSI/AWWA C115/A21.15 or C151/A21.51
    - b. Thickness Class as indicated on the drawings
    - c. Cement-mortar lining: ANSI/AWWA C104/21.4
  - 2. Joints:
    - a. Mechanical or Push-on: ANSI/AWWA C111/A21.11
    - b. Flanged: ANSI/AWWA C115/A21.15
  - 3. Fittings: ANSI/AWWA C110/A21.10
- C. Polyethylene (PE) Plastic Pipe and Fittings
  - 1. Pipe:
    - a. PE, ASTM Pipe: ASTM D 2237, SDR No. 9 with PE compound number required to give pressure rating not less than 200 psig (1380 kPa)
    - b. PE, AWWA Pipe: AWWA C901, DR No. 9 with PE compound number

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required to give pressure ration not less than 200 psig (1380 kPa).

2. Joints:
  - a. Make joints with insert stiffeners conforming to the AWWA Standard 901 for PE Pipe and Tubing.
  - b. Provide solid 304 tubular stainless steel (ASTM A240) insert stiffeners, dimpled and flanged to retain placement within the service line.
  - c. Key lock construction with a minimum of two (2) key locks to maintain solid structural integrity.
  - d. Manufactured in the United States of America.
  
3. Fittings:
  - a. Provide *no-lead (NL) brass or* stainless steel fittings ASTM A351 for all *threaded* elbows and tees. *Provide brass corporation* stops and curb stops.
  - b. Provide CTS compression fittings *for all other fittings*
  - c. Refer to Section 01010 for corporation and curb stop specifications.

**2.02 CONNECTIONS**

A. General

1. Provide pipe joints and coupling materials suitable in size, design and material of pipe and service fittings with which it is used.

**B. Screwed Joints**

1. *Use sharp cut threads of standard gauge and length. After threading, ream all pipe ends to the size of bore and clean out all chips. Use a sufficient quantity of select pipe dope of graphite and oil for lubrication of assembly.*

**2.03 TAPPING ACCESSORIES**

A. Tapping Sleeves

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1. Mechanical Joint, or as indicated on the drawings.
2. 200 psi working pressure.
3. Outlet Flange: ANSI B16.1, Class 125

B. Tapping Valves

1. AWWA C500 *or* AWWA C509
2. Inlet Flange, Class 125

**2.04 CORPORATION STOP ASSEMBLY**

A. Corporation Stops

1. ***Brass AWWA C800 (UNS C89833) no-lead***
2. Inlet end threaded for tapping according to AWWA C800
3. Outlet end suitable for service pipe specified.
4. Ball Type Valve. (See Section 01010, Special Conditions)

B. Service Clamps

1. ***Stainless Steel or Ductile Iron*** body.
2. Neoprene, O-ring gasket.
3. ***Minimum body length 6 1/2" for PE and Asbestos Cement water***

***mains.***

**2.05 CURB STOP ASSEMBLY**

A. Curb Stops

1. Brass body conforming to ***AWWA C800 (UNS C89833) no-lead.***
2. Ball Type Valve.
3. Positive Pressure Sealing.
4. See Section 01010, Special Conditions.

B. Curb Boxes and Covers

1. Cast Iron body, Extension Type with ***Stainless Steel*** Stationary Rod.
2. Minneapolis or Arch Pattern Base.
  3. ***Cast Iron lid*** with inscription "Water", with ***pentagon brass plug.***

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4. See Section 01010, Special Conditions.

**2.06 METER SETTING EQUIPMENT**

A. Outside Meter Setting

1. *Provide Coil Pitsetter with flat cast iron cover, locking bracket, insulation disc, angle ball valve on inlet and dual check valve outlet.*
2. *Provide pit with 18” diameter, or larger, compatible with meter size, and 48” min. depth.*
3. *Provide 1” HDPE coil tubing per ASTM D 2737, SDR 9 CTS sized. Assure the following requirements are met:*
  - a. *Coil complies with AWWA C-901*
  - b. *Coil is NSF Standard 61 approved*
  - c. *Coil is rated at 200 PSIG working pressure*
  - d. *Coil allows meter to be raised for meter access and lowered below the frost line to prevent meter and service line freeze-up*
  - e. *Inlet and outlet valves are secured to a slotted, adjustable mounting plate*
  - f. *Upper and lower mounting brackets secure the position of the mounting plate*
4. *Provide pit manufactured by The Ford Meter Box Company, Inc. or approved equal.*
5. *Provide lightweight body made from 18” PVC tile, per ASTM D 2241.*
6. *Provide Angle ball valves rated at 150 PSI working pressure*
7. *Flat cast Iron traffic-rated locking cover (catalog No. A82H-T), per ASTM A48, Class 25. Provide traffic-rated cover when meter pit is located in sidewalk or traffic area.*
8. *Provide closed-cell polyethylene foam disc for freezing protection.*

B. Inside Meter Setting

1. Meter Yokes, Copper or Iron.
2. *Provide products with “NL” (no lead) cast into body for proper identification. Inlet and Outlet horizontal setting with matching couplings, fittings.*
3. *Provide ball valve on inlet and approved dual check valve followed by a 150 psi rated ball valve on outlet.*

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4. *Provide Brass components that do not come in contact with potable water conforming to AWWA Standard C-800 (ASTM B-62 and ASTM B584, UNS C83600-85-5-5-5)*

**2.07 METERS**

- A. Displacement Type: AWWA C700 **or C710**
- B. Turbine Type: AWWA C701
- C. Compound Type: AWWA C702
- D. Fire Service Type: AWWA C703

**PART 3 - EXECUTION**

**3.01 PREPARATION**

- A. Establish location of curb stops and *boxes, and meter or meter pit* for each service connection.
- B. Excavate trench to the line and grade shown on the drawings and as specified. Jack or bore service lines underneath paved highways where approved by the Engineer.
- C. When requested by Engineer, prepare sample service mock-up for the inspection and approval of the Engineer.

**3.02 TAPPING WATER MAINS**

- A. Each connection for different kind of water mains shall be tapped using suitable materials, equipment and methods approved by the Engineer.
- B. Provide service clamps *or saddle* for PVC, *PE and asbestos-cement* water mains.
- C. Screw Corporation Stops directly into a tapped and threaded *ductile* iron main at 10 and 2 o'clock positions on the main's circumference. Locate corporation stops at least 12" apart longitudinally and staggered.

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- D. In case of plastic pipe water mains, provide full support for the service clamp all around the circumference of the pipe, with minimum **6-1/2"** width of bearing area. Exercise care against crushing or any other damage to the water mains at the time of tapping or installing the service clamp or Corporation Stop.
- E. Use proper seals or other devices to ensure that no leaks are left in the water mains at the points of tapping. Do not backfill and cover the service connection until approved by the East Donegal Township Municipal Authority's Construction Representative.

**3.03 SERVICE LINE AND FITTINGS**

- A. Copper Service Lines
  - 1. Bend tubing to connect the service pipe or tubing to the tapping fitting or corporation stops to provide flexibility to counteract the effects of settlement or expansion/contraction in the line.
  - 2. Lay service line in a continuous section with no joints from ***the main to the curb stop and from*** the curb stop to the shutoff valve inside the building being served. If the distance from the curb stop to the building exceeds the length of a single roll of tubing (***100 feet***), install a meter pit at the right-of-way line of the water main to which the service line is being connected.
  - 3. When more than one section of tubing is necessary ***after the meter pit***, lay each section of the service line in a manner to form a tight joint with the adjoining section. Avoid offsets, kinks or awkward bends to ensure a smooth flow line.
  - 4. Clean and inspect each pipe and part of the fitting before installing and assemble to provide a flexible joint. Use joints or lubricants recommended by the manufacturers and as specified by the Engineer.
  - 5. Install service fittings and appurtenances on suitable brick or concrete supports as shown on the drawings and Standard Details. Do not use earth, rocks, wood or other organic materials as supports.
  - 6. Flared connections will not be permitted.
  - 7. Bed and cover copper service line with masonry sand. Do not use limestone material for bedding or cover. In cases where the service line crosses other underground utilities (gas, electric, telephone, etc.) install the service line in a PVC sleeve ***having an inside diameter as small as possible to accommodate the service line*** of sufficient length to extend at least five (5') feet beyond the utility trench(s) being crossed. ***Seal both ends of the sleeve with a neoprene reducing coupling or bushing.***

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B. Polyethylene (PE) Plastic Service Lines

1. Install PE water service line in accordance with the manufacturer's recommendations. Provide suitable bedding and cover material ***consisting of masonry sand 6" below the pipe and 18" above the pipe*** as shown on the drawing and standard details.
2. Store pipe on firm and flat surfaces.
3. Keep pipe and fittings away from sharp objects, heat, and toxic and aggressive materials.
3. Take care not to cut, kink, abrade, or otherwise damage the pipe during handling. Take care when handling pipe under wet or frosty conditions, as pipe may become slippery.
4. Keep protective packaging intact until pipe and fittings are required for use.
5. Release coils carefully, keeping in mind they may be coiled under tension. Uncoil pipe and allow it to warm in the sun before burial for ease of installation.
6. Temporarily cap cut pipe ends to prevent dirt or other material from entering the pipe.
7. Lay pipe in as straight a line as possible. If pipe must be deflected, do not exceed the minimum bending radius recommended by the manufacturer. To minimize bending stresses at the point the pipe enters the connection; allow a minimum of ten (10) pipe diameters from fittings or valves for bends.
8. Lay pipe with moderate slack or snaking to accommodate any contraction resulting from cooling prior to backfilling. Allow pipe to cool in the trench before backfilling.
9. Trim pipe to required length and connect to rigidly held fittings such as ***corporation stops, curb stops or shut-off valves in building*** and meter ***pits*** after it has cooled substantially close to the trench temperature to minimize the development of pull-out stresses at the connection.
10. Assure that the service pipe is properly supported at the connection to corporation stop or other rigid structure to prevent localized shear, bending and pull-out resulting from differential soil settlement.
11. ***Place a length of #12 AWG cable adjacent to the service line for the entire length to serve as a means for locating the underground pipe. Terminate cable inside of basement wall (or other interior location if meter is not located in a basement) and extend cable to surface at the curb box. An additional curb box may be required to accomplish this.. Cable must be installed with no splices and the end at the main must be grounded.***

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**WATER SERVICE CONNECTIONS**

12. Perform pressure testing prior to final backfilling.

C. General Requirements

1. *The total length of a service line may not exceed 100 feet unless a meter pit is installed at the curb line or property line nearest the water main.*
2. Prevent displacement of pipes and fittings at the time of placing concrete for thrust blocks or for any structures until initial setting of concrete is assured.
3. Operate each corporation and curb stop before and after installation.
4. When the work is not in progress and at the end of each day, securely plug the ends of pipe and fittings to prevent any dirt or foreign substances from entering the lines.
5. Provide concrete thrust blocking at all bends, tees and changes in direction. *In lieu of concrete thrust blocks, the contractor may elect to install threaded rods, “Meg-a-Lug” flanges or locking gaskets as a restraint provided they are installed in accordance with the manufacturer’s recommendations as it relates to “Meg-a-Lug” flanges and locking gaskets.*
6. Provide all pipes passing through concrete or masonry construction with Wall Sleeves of the type and size indicated.
7. Test and disinfect mains and service lines as specified in Section 02655.

**END OF SECTION**

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**SECTION 02655**  
**TESTING AND DISINFECTING WATER MAINS**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. This Section includes all labor, materials, equipment and related services necessary for testing and disinfecting water mains, as shown on the plans or as specified.

**1.02 RELATED WORK**

- A. Work under this section shall be coordinated with that specified under the following sections:
1. Section 02615 - Water Mains
  2. Section 02641 - Valves and Fire Hydrants
  3. Section 02645 - Water Service Connections

**1.03 QUALITY ASSURANCE**

- A. Testing Agency
1. Bacteriological testing shall be performed by a testing laboratory engaged and paid for by the Contractor and approved by the Engineer.
- B. Assure that testing and chemicals conform to the following standards of the American Water Works Association (AWWA), latest edition:
- |      |   |
|------|---|
| B300 | Standard for Hypochlorites  |
| B301 | Standard for Liquid Chlorine  |
| C600 | Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances |
| C651 | Standard for Disinfecting Water Mains   |
- C. Test Acceptance
1. No test will be accepted until the results are below the specified maximum limits.
  2. The Contractor shall, at his own expense, determine and correct the sources of leakage and retest until successful test results are achieved.

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**SECTION 02655**  
**TESTING AND DISINFECTING WATER MAINS**

**1.04 SUBMITTALS**

A. Test Procedures

1. List of test equipment
2. Testing Sequence Schedule

B. Certificates

1. Submit, prior to starting testing, certification attesting that the pressure gauges to be used have been calibrated and are accurate to the degree specified in Part 2, Products.
2. Submit certification attesting that the chlorine form composition is as specified.

C. Test Reports

1. Submit two copies of laboratory test reports of each bacteriological test.

**PART 2 - PRODUCTS**

**2.01 HYDROSTATIC TEST EQUIPMENT**

- A. Hydro Pump
- B. Pressure Hose
- C. Test Connections
- D. Water Meter
- E. Pressure Gauge, calibrated to 0.1 lbs./sq.in.
- F. Pressure Relief Valve

**2.02 DISINFECTING CHEMICALS**

- A. Liquid chlorine, calcium hypochlorite, or sodium hypochlorite conforming to AWWA Standards B300 and B301.

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**TESTING AND DISINFECTING WATER MAINS**

**PART 3 - EXECUTION**

**3.01 PREPARATION**

- A. Backfill trenches in accordance with Section 02201.
- B. Provide the water line under test with reaction thrust blocking. Hydrostatic testing shall not begin until the concrete thrust blocking has set. Allow 2,000 psi 28-day strength concrete to set (cure) for a minimum of 7 days prior to testing. If (H.E.S.)3,000 psi 3-day strength concrete is used, hydrostatic testing may not begin until the concrete has set a minimum of 2 days.
- C. Provide pumps, piping, tanks, connections, polyurethane plugs, and appurtenances at no additional expense to the Owner. The Authority will provide the necessary water.

**3.02 TESTING WATER LINES**

A. Hydrostatic Testing

- 1. Test each newly installed section of water line by hydrostatic test procedure in accordance with the recommended practice established by AWWA, Standard C600, Section 4. Provide taps as necessary to perform the test.
- 2. Conduct pressure tests for a period of not less than 30 minutes at a pressure of 200 psig or 1.5 times the average working pressure, whichever is greater. This pressure shall be attained at the elevation of the lowest point in line under test corrected to the elevation of the test gauge. Obtain pressure from the Engineer.
- 3. Slowly fill the section to be tested with water, expelling air from the pipeline at the high points. Install corporation cocks at high points if necessary. After all air is expelled, close air vents and corporation cocks and raise the pressure to the specified test pressure.
- 4. Observe joints, fittings and valves under test. Remove and replace cracked pipe, joints, fittings, and valves showing visible leakage. Retest.

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**B. Leakage Tests**

1. After completion of successful pressure testing, conduct the leakage test for a 2-hour period at a test pressure of 150 psig.
2. Expel air from the line under test, close the air vents, curb stops and/or corporation stops and raise pressure to the specified test pressure. The leakage in the section under test is defined as the quantity of water supplied to maintain pressure within 5 psig of the specified test pressure during the entire testing period.

Water pipe installation is deemed to have failed the leakage test if the leakage obtained is greater than that determined by the formula:

$$L = \frac{N \times D \times P^{1/2}}{7400}$$

Where:

L is allowable leakage in gallons/hour

N is number of joints in the section tested

D is nominal diameter of pipe in inches

P is average test pressure in pounds per square inch gauge

If the line under test contains sections of various diameters, the allowable leakage shall be the sum of the computed leakage for each size.

3. If test results indicate that the pipe laid has leakage greater than specified, locate and repair the defective joints, fittings, pipe or valves and retest until leakage is within allowable limits. Repair visible leaks regardless of the amount of leakage.

**3.03 DISINFECTION**

**A. General**

1. After completion of satisfactory pressure and leakage testing, disinfect the water lines in accordance with the recommended practice established in AWWA Standard C601. Conduct water line disinfection in the following steps:

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- a. Preliminary flushing
- b. Chlorine application
- c. Final flushing
- d. Bacteriologic tests

**B. Preliminary Flushing**

- 1. Prior to disinfection, except when the tablet method is used, flush the line at a rate of flow of at least 2.5 feet per second for a period of 15 minutes.
- 2. Dispose of flushing water.

**C. Chlorine Form**

- 1. The chlorine form to be applied to the system shall be either chlorine gas solution, calcium hypochlorite or sodium hypochlorite. The Engineer's written approval of the chlorine form to be used is required.

**D. Chlorine Application**

- 1. Continuous Feed Method:
  - a. Feed water and chlorine to the line at a constant rate so that the chlorine concentration is a minimum of 50 mg/1 available chlorine.
  - b. During chlorine application, take precautionary measures to prevent the concentrated treatment solution from flowing back into the existing distribution system and/or supply source.
  - c. Continue chlorine applications until the entire main is filled with chlorine solution.
- 2. Tablet Method:
  - a. **CAUTION:** Since the preliminary flushing step must be eliminated, this method may be used only when scrupulous cleanliness has been exercised and with approval of the Engineer. It shall not be used if trench water or foreign material has entered the main, or if the water temperature is below 41 degrees F.

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- b. Place sufficient number of tablets in each section of pipe, in hydrants, hydrant branches, and other appurtenances to obtain a minimum of 50 mg/1 available chlorine. Attach tablets to the crown of pipe sections with adhesive. Apply adhesive only to the broad side of the tablet next to the pipe surface. Place crushed tablets in the inside annular space of joints, or rub like chalk on the butt ends of pipe.
    - c. When pipeline installation is completed, fill the main with water at a maximum velocity of one foot per second. Manipulate valves so that the chlorine solution does not flow back into the line supplying the water.
  3. During the 24-hour treatment, operate all valves, curb stops, and hydrants in the section treated.
  4. At the completion of the 24-hour treatment, the water shall contain a minimum of 25 mg/1 chlorine throughout the pipeline.
  5. Repeat the disinfection process until the minimum available chlorine is present at the end of the treatment sequence. The tablet method cannot be used in these subsequent disinfections. No additional compensation will be provided the Contractor for repeat treatment or testing.
- E. Final Flushing
  1. Flush the heavily chlorinated water from the system under treatment until the chlorine concentration in the water leaving the system is less than 1 mg/1.
  2. Comply with Federal, State and local laws when discharging the flushed chlorine solution.
- F. Bacteriological Testing
  1. After final flushing is completed and before the water main is placed in service, test the line for bacteriologic quality. Perform two tests 24-hours apart.
  2. Collect a minimum of two samples at the end of each line for each test, and

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one sample of the incoming water from the existing water system for comparison. Collect the first sample upon completion of flushing. Collect the second sample 24 hours after the first sample is collected.

3. Collect samples in sterile bottles treated with sodium thiosulfate.
4. Sampling tap shall consist of corporation stop installed in the main with copper tube gooseneck assembly. Do not sample from hose or fire hydrant.
5. Provide bacteriological test reports to the Owner and the Authority's Engineer. Failure to meet State health standard requirements will be cause for the Contractor to rechlorinate and retest the system, at no additional cost to the Authority.

**END OF SECTION**

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**SECTION 02901**  
**FINISH GRADING, SEEDING AND SODDING**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. The Work of this Section includes, but is not limited to:
  - 1. Placing topsoil
  - 2. Soil conditioning
  - 3. Finish grading
  - 4. Seeding
  - 5. Sodding
  - 6. Maintenance
- B. Restore unpaved surfaces to a condition similar to that prior to excavation as specified and indicated on the Drawings.
- C. Construct unpaved finished surfaces to the lines and grades indicated on the Drawings.
- D. The "Seeding Tables" at the end of this section list specific seeding requirements. Refer to Drawings for seeding requirements at each specific location of Work.

**1.02 QUALITY ASSURANCE**

- A. Testing Agency:
  - 1. The Contractor has the option to use soil testing to justify decreasing lime and fertilizer rates. When soil testing is selected by the Contractor, the soil and soil supplement testing shall be performed by a Soils Testing Laboratory engaged and paid for by the Contractor and approved by the Engineer.
    - a. Collect soil samples under the direction of the Engineer.
- B. Reference Standards:
  - 1. Pennsylvania Department of Transportation Specification, Form 408, Latest Edition.
  - 2. Pennsylvania Seed Act of 1965, Act 187, as amended.

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3. Pennsylvania Fertilizer Law of 1956, P.L. 1795, as amended.
4. Pennsylvania Agricultural Lime Act of 1961, P.L. 435, as amended.
5. Rules for Testing Seeds of the Association of Official Seed Analysts.
6. American Association of State Highway and Transportation Officials (AASHTO). AASHTO T194 - Determination of Organic Matter in Soils by Wet Combustion.

**1.03 SUBMITTALS**

A. Samples -SOD:

1. When directed, furnish three strips of sod, 4-1/2 feet long by 12" wide, laid on 3" of topsoil and tamped in place. The samples shall be representative of the sod and workmanship to be provided.
2. Advise the Engineer of the location of the field, and area within the field, from which the sod is to be taken for approval.

B. Certificates:

1. Prior to use or placement of material, submit certifications of material composition of the following for approval:
  - a. Topsoil analysis
  - b. Fertilizer
  - c. Lime
  - d. Seed mixture (s)
2. If soil tests are performed to justify decreased liming and fertilizer rates, submit certified soil sample analyses, including laboratory's recommended soil supplement formulation.

**1.04 PRODUCT DELIVERY, STORAGE AND HANDLING**

A. Seed:

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1. Deliver seed fully tagged and in separate packages according to species or seed mix. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.
- B. Sod:
1. Mow sod in the field to a height of not more than 2-1/2" within 5 days prior to lifting.
  2. Cut sod to a depth equal to the growth of the fibrous roots, but in no case less than 1-1/2", exclusive of grass and thatch. Do not cut sod when the ground temperature is below 32 degrees Fahrenheit.
  3. Deliver sod to the project site within 24 hours after being cut and place sod within 36 hours after being cut. Do not deliver small, irregular, or broken pieces of sod.
  4. During wet weather, allow sod to dry sufficiently to prevent tearing during handling and placing. During dry weather, moisten sod to ensure its vitality and to prevent dropping of the soil during handling. Sod that dries out will be rejected.

**PART 2 - PRODUCTS**

**2.01 TOPSOIL**

- A. Provide topsoil having a pH of between 6.0 and 7.0; containing not less than 2% nor more than 10% organic matter as determined by AASHTO T194.
- B. Fertile friable loam, sandy loam, or clay loam which will hold a ball when squeezed with the hand, but which will crumble shortly after being released.
- C. Free of clods, grass, roots, or other debris harmful to plant growth.
- D. Free of pests, pest larvae, and matter toxic to plants.

**2.03 FERTILIZER**

- A. Basic Dry Formulation Fertilizer:

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1. Analysis 0-20-20 and as defined by the Pennsylvania Fertilizer Law.

B. Starter Fertilizer:

1. Analysis 10-5-5 or 12-6-6 and as defined by the Pennsylvania Fertilizer Law.

**2.03 LIME**

A. Raw ground limestone conforming to Section 804.2 (a) of the PennDOT Specifications.

**2.04 SEED**

A. Fresh, clean, dated material from the last available crop and within the date period specified, with a date of test not more than 9 months prior to the date of sowing. Percentage of pure seed present shall represent freedom from inert matter and from other seeds distinguishable by their appearance. All seeds will be subject to analysis and testing.

**TABLE 1 - GRASS AND AGRICULTURAL SEEDS**

| Species  | Minimum<br>Guaranteed Purity<br>(Percent) | Maximum Weed<br>Seed<br>(Percent) | Minimum<br>Guaranteed<br>Germination<br>(Percent) |
|--|---|-----------------------------------|---|
| Kentucky Bluegrass<br>( <i>Poa pratensis</i> )<br>Domestic origin; min.<br>21 lb. per bushel | 90  | 0.20                              | 80  |
| Perennial Ryegrass<br>( <i>Lolium perenne</i> , var.<br>Pennfine)                            | 95  | 0.15                              | 90  |
| Kentucky 31 Fescue<br>( <i>Festuca elatior</i><br><i>arundinacea</i> )                       | 98  | 0.25                              | 85  |
| Pennlawn Red Fescue<br>( <i>Festuca rubra</i> , var.<br>Penn-lawn)                           | 98  | 0.25                              | 90  |
| Annual Rye Grass<br>( <i>Lolium multi-florum</i> )   | 95  | 0.15                              | 90  |

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|  |    |      |    |
|--|----|------|----|
| Crownvetch<br>( <i>Coronilla varia</i> , var.<br>Penngift) | 99 | 0.10 | 70 |
| Timothy ( <i>Phleum<br/>pretense</i> )                     | 98 | 0.25 | 95 |

**2.05 SEED MIXTURES**

A. See "Seeding Table" at end of this Section.

**2.06 INOCULANT**

- A. Inoculate leguminous seed before seeding with nitrogen fixing bacteria culture prepared specifically for the species.
- B. Do not use inoculant later than the date indicated by the manufacturer.
- C. Protect inoculated seed from prolonged exposure to sunlight prior to sowing.
- D. Reinoculate seed not sown within 24 hours following initial inoculation.

**2.07 MULCHING MATERIALS**

- A. Mulches for seeded areas shall be one, or a combination of, the following:
  - 1. Hay:
    - a. Cured to less than 20% moisture content by weight.
    - b. Contain no stems of tobacco, soybeans, or other coarse or woody material.
    - c. Timothy hay or mixed clover and timothy hay.
  - 2. Straw:
    - a. Cured to less than 20% moisture content by weight.
    - b. Contain no stems of tobacco, soybeans, or other coarse or woody material.

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c. Wheat or oat straw.

3. Wood Cellulose:

- a. No growth or germination inhibiting substances.
- b. Green, air dried. Packages not exceeding 100 pounds.
- c. Requirements:

Moisture Content: 12% ± 3%  
Organic Matter: 98% ± 0.2% on the oven dry basis.  
Ash Content: 1.4% ± 0.2%  
Minimum Water-Holding Capacity: 1,000%

4. Mushroom Manure:

- a. Organic origin, free of foreign material larger than 2" and substances toxic to plant growth.
- b. Organic Matter: 20 % minimum
- c. Water Holding Capacity: 120% minimum
- d. pH: 6.0

**2.08 SOD**

- A. At least three year old, well-rooted Kentucky Bluegrass (*Poa pratensis*) sod containing a growth of not more than 10% of other grasses and clovers.
- B. Free from noxious weeds such as bermuda grass, wild mustard, crab grass, and kindred grasses.

**PART 3 - EXECUTION**

**3.01 TIME OF OPERATIONS**

- A. Spring Seeding:
  - 1. Preliminary operations for seed bed preparation may commence as soon after February 15 as ground conditions permit.

**3.02 PREPARATION OF SUBGRADE**

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- A. "Hard pan" or heavy shale:
  - 1. Plow to a minimum depth of 6".
  - 2. Loosen and grade by harrowing, discing, or dragging.
  - 3. Handrake subgrade. Remove stones over 2" in diameter and other debris.
- B. Loose loam, sandy loam, or light clay:
  - 1. Loosen and grade by harrowing, discing, or dragging.
  - 2. Handrake subgrade. Remove rocks over 2" in diameter and other debris.

**3.03 PLACING TOPSOIL**

- A. Place topsoil and spread over the prepared subgrade to obtain the required depth and grade elevation. Final compacted thickness of topsoil not less than 3-1/2".
- B. Handrake topsoil and remove all materials unsuitable or harmful to plant growth.
- C. Do not place topsoil when the subgrade is frozen, excessively wet, or extremely dry.
- D. Do not handle topsoil when frozen or muddy.

**3.04 TILLAGE**

- A. After seed bed areas have been brought to proper compacted elevation, thoroughly loosen to a minimum depth 5" by discing, harrowing, or other approved methods. Do not work topsoiled areas when frozen or excessively wet.
- B. Liming:
  - 1. Distribute limestone uniformly at a rate of 100 pounds per 1,000 square feet.
  - 2. Thoroughly incorporate into the topsoil to a minimum depth of 4".
  - 3. Incorporate as a part of the tillage operation.

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- C. Basic Fertilizer:
  - 1. Distribute basic fertilizer uniformly at a rate of 50 pounds per 1,000 square feet.
  - 2. Incorporate into soil to depth of 4" by approved methods.
  - 3. Incorporate as part of tillage operation.
- D. Liming and Fertilizer rates may be decreased if lesser rates are indicated by soil tests provided by the Contractor.

**3.05 FINISH GRADING**

- A. Remove unsuitable material larger than 2" in any dimension.
- B. Uniformly grade surface to the required contours without the formation of water pockets.
- C. Rework areas which puddle by the addition of topsoil and fertilizer. Rerake.
- D. Distribute starter fertilizer at the following rates:
  - 10-5-5:50 pounds per 1,000 square feet.
  - 12-6-6:53 pounds per 1,000 square feet.
- E. Incorporate starter fertilizer into the upper 1" of soil.

**3.06 SEEDING**

- A. Uniformly sow specified seed mix by use of approved hydraulic seeder, power-drawn drill, power-operated seeder, or hand-operated seeder or by hand. Do not seed when winds are over 15 mph.
- B. Upon completion of sowing, cover seed to an average depth of 1/4" by hand raking or approved mechanical methods.
- C. Upon completion of seed covering, roll the area with a roller, exerting a maximum force of 65 pounds per foot width of roller.

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**3.07 MULCHING**

- A. Mulch within 48 hours of seeding.
- B. Place hay and straw mulch in a continuous blanket at a minimum rate of 1,200 pounds per 1,000 square yards.
  - 1. Anchor hay or straw mulch by use of twine, stakes, wire staples, paper, or plastic nets.
  - 2. Emulsified asphalt may be used for anchorage provided it is applied uniformly at a rate not less than 31 gallons per 1,000 square yards.
  - 3. Apply approved chemical mulch binders at the manufacturer's recommended rate.
- C. Chemical mulch binders or a light covering of topsoil may be used for anchorage when the size of the area precludes the use of mechanical equipment.
- D. Apply wood cellulose fiber hydraulically at a rate of 320 pounds per 1,000 square yards.
  - 1. Incorporate as an integral part of the slurry after seed and soil supplements have been thoroughly mixed.
- E. Spread mushroom manure uniformly to a minimum depth of 1/2" or to the depth indicated on the Drawings.
- F. When mulch is applied to grass areas by blowing equipment, the use of cutters in the equipment will be permitted to the extent that a minimum of 95% of the mulch is 6" or more in length. For cut mulches applied by the blowing method, achieve a loose depth in place of not less than 2".
- G. When mulching by the asphalt mix method, apply the mulch by blowing. Spray the asphalt binder material into the mulch as it leaves the blower. Apply the binder to the mulch in the proportion of 1.5 to 2.0 gallons per 45 pounds of mulch.
  - 1. Protect structures, pavements, curbs, and walls to prevent asphalt staining.

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2. Erect warning signs and barricades at intervals of 50 feet or less along the perimeter of the mulched area.
3. Do not spray asphalt and chemical mulch binders onto any area within 100 feet of a stream or other body of water.

**3.08 SODDING**

- A. Prior to sod placement, complete soil preparation or topsoiling.
- B. Apply lime and fertilizer as specified. Work into the soil a minimum of 2".
- C. Do not place sod when the temperature is lower than 32 degrees Fahrenheit.
- D. Place sod by hand with tight joints and no overlap. Transverse joints shall be broken or staggered.
- E. Place sod so that the top of the sod is flush with the surrounding grade.
- F. Use of tools which damage the sod or dumping of sod from vehicles will not be permitted.
- G. Water sod to the saturation point immediately after placement.
- H. After watering, tamp with an approved tamper to close all joints and insure close contact between sod and sod bed. After tamping, the sod shall present a smooth, even surface, free from bumps and depressions. If so directed, use a light roller, weighing not more than 65 pounds per foot of roller width to complete firming and smoothing the sod.
- I. When placing sod in ditches, place the strip with the long dimension at right angles to the flow of water. At any point where water will start flowing over a sodded area, the upper edge of the sod strips shall be turned into the soil below the adjacent area and a layer of compacted earth placed thereto, unless otherwise specified.
- J. In ditches and on slope areas, stake each strip of sod securely with at least 1 wood stake for each 2 square feet of sod. Stakes shall be 1/2" by 1" with a length of 8" to 12". Drive stakes flush with the top of the sod, with the long face parallel to the slope contour.

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**SECTION 02901  
FINISH GRADING, SEEDING AND SODDING**

**3.09 MAINTENANCE**

- A. Maintenance includes watering, weeding, mowing, cleanup, edging, and repair of washouts or gullies.
- B. Keep seeded areas wet, close to the saturation point, to a depth of 3" for a period of 10 days following seeding or sodding.
- C. Those areas which do not show a prompt catch or grass within 10 days following seeding or sodding shall be reseeded or resodded until complete grass catch occurs.
- D. When the grass reaches an average height of 2-1/2", cut to a height of 1-1/2". Irregularities or depressions which show up at this time shall be leveled and reseeded.

SEE SEEDING TABLE ON FOLLOWING PAGES

**SEEDING TABLE**

| CONDITION            | TOPSOIL | LIME*             | BASIC FERTILIZER | STARTER FERTILIZER   | SEED MIX & SOWING RATE (% BY WEIGHT)  |
|----------------------|---------|-------------------|------------------|--|---|
| Temporary Cover (**) | N/A     | N/A               | N/A              | N/A  | 100% Annual Ryegrass Sow 9# per 1,000 Sq. Yds. Mar thru May/ Aug. thru Sept.  |
| Roadside; Non-Mowed  | Yes     | 100# per 1,000 SF | No               | 10-5-5 @ 50# per 1,000 SF<br>Or<br>12-6-6 @ 33# per 1,000 SF | 50% Kentucky Bluegrass, 30% Pennlawn Red Fescue, 20% Perennial Ryegrass. Sow 21# per 1,000 Sq. Yds. Mar thru May/ Aug. thru Sept. |
| Roadside; Mowed      | Yes     | 100# per 1,000    | No               | 10-5-5 @ 50# per 1,000 SF<br>Or                              | 80% Kentucky 31 Fescue, 20% Pennlawn Red  |

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FINISH GRADING, SEEDING AND SODDING**

|  |     |                            |                                  |  |  |
|--|-----|----------------------------|----------------------------------|--|--|
|  |     | SF                         |                                  | 12-6-6 @ 33#<br>per 1,000 SF                                       | Fescue. Sow 21#<br>per 1,000 Sq. Yds.<br>Mar thru May/<br>Aug. thru Sept.  |
| Bank Areas                                     | Yes | 100#<br>per<br>1,000<br>SF | No                               | 10-5-5 @ 50#<br>per 1,000 SF<br>Or<br>12-6-6 @ 33#<br>per 1,000 SF | 45% Crownvetch,<br>55% Annual<br>Ryegrass. Sow 9#<br>per 1,000 Sq. Yds.<br>Anytime except<br>Sept. and Oct.  |
| Lawns  | Yes | 100#<br>per<br>1,000<br>SF | 0-20-20 @<br>50# per 1,000<br>SF | 10-5-5 @ 50#<br>per 1,000 SF<br>or 12-6-6 @<br>33# per 1,000<br>SF | 50% Kentucky<br>Bluegrass 30%<br>Pennlawn Red<br>Fescue 20%<br>Perennial Ryegrass<br>Sow 21# per 1,000<br>Sq. Yds.<br>Mar. thru May/<br>Aug thru Sept. |
| Open Fields;<br>Non-<br>Cultivated,<br>Pasture | No  | No                         | No                               | 10-5-5 @ 50#<br>per 1,000 SF<br>or 12-6-6 @<br>33# per 1,000<br>SF | 100% Timothy.<br>Sow 9# per 1,000<br>Sq. Yds. Mar thru<br>May/ Aug. thru<br>Sept.  |
| Open Fields;<br>Cultivated                     | No  | No                         | No                               | 10-5-5 @ 50#<br>per 1,000 SF<br>or 12-6-6 @<br>33# per 1,000<br>SF | 100% Annual<br>Ryegrass. Sow 9#<br>per 1,000 Sq. Yds.<br>Mar thru May/<br>Aug. thru Sept.  |
| Woods, Sparse                                  | No  | No                         | No                               | 10-5-5 @ 50#<br>per 1,000 SF<br>or 12-6-6 @<br>33# per 1,000<br>SF | 100% Red Fescue<br>Sow 36# per 1,000<br>Sq. Yds.<br>Mar. thru May/<br>Aug thru Sept.   |
| Woods, Dense                                   | No  | No                         | No                               | No   | Stabilize soil with<br>biodegradable<br>netting and paper<br>fabric material   |

\* Unless lesser rate indicated by soils tests.

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**SECTION 02901**  
**FINISH GRADING, SEEDING AND SODDING**

\*\* Unless otherwise specified in the E&S section

Note: Refer to Drawings and for seeding requirements at each specific location of Work.

**END OF SECTION**

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**SECTION 02910**  
**EROSION AND SEDIMENTATION CONTROL**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. The Work under this section includes, but is not limited to, the placing and maintenance of any soil erosion and sedimentation measures necessary to control water pollution and soil erosion as indicated on the Drawings, specified herein, or directed by the Engineer.

**1.02 RELATED WORK**

- A. Work under this item shall be coordinated with that specified under Section 02901 - Finish Grading, Seeding and Sodding.

**1.03 QUALITY ASSURANCE**

- A. Reference Standards:
1. Pennsylvania Department of Environmental Resources, Title 25-Rules and Regulations, Part I, Subpart C, Article II, Chapter 102.
  2. Pennsylvania Department of Environmental Resources, Soil Erosion and Sedimentation Control Manual, latest edition.
  3. Pennsylvania Department of Transportation Specification, Form 408, latest edition.

**PART 2 - PRODUCTS**

**2.01 MATERIAL**

- A. Seed - Temporary Cover Formula, Section 02901.
- B. Mulch - Section 02901; hay, straw, or wood cellulose.
- C. Jute Matting. Undyed jute yarn, woven into a uniform open plain weave mesh with approximately 1-inch square openings, weighing not less than 90 pounds per 100 square yards.
- D. Wood Excelsior Blanket. A machine-produced mat of curled and barbed wood excelsior, meeting the following requirements:

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1. A minimum of 80% of the fibers 8 inches or more in length.
  2. Consistent thickness, with the fiber evenly distributed over the entire area.
  3. Top side covered with a 2-inch x 1-inch, extruded plastic mesh, entwined with the excelsior mat for maximum strength and ease of handling.
  4. Average weight, 0.975 pounds per square yard,  $\pm 10\%$ .
  5. Smolder resistant.
  6. Nontoxic to vegetation and not inhibiting seed germination or growth.
  7. Not injurious to personnel placing the blanket.
  8. Subjected to leaching resistant tests made in accordance with Federal Specifications CCC-T 19 lb., Method 5830, except the continuous flow of water to the container bottom is required to be at a rate of about five changes in 24 hours.
- E. Erosion Control Netting. A uniformly extruded rectangular plastic mesh, meeting the following requirements:
1. Color - Black
  2. Weight - 2.6 pound/1,000 Square foot
  3. Mesh Opening - 1/2 inch x 1/2 inch
- F. Nylon Erosion Control Mat.
1. Mat. A bulky structure of entangled nylon monofilaments, bonded by melting at their intersections, forming a stable mat of suitable weight and configuration. Also, a mat that is resilient, permeable; highly resistant to environmental deteriorations and ultra-violet degradation, and meeting the following requirements:
    - a. Color - Black
    - b. Material Type - Nylon 6, plus a minimum content of 0.5% by weight of carbon black.

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- c. Filament diameter - 0.0157 inch, minimum
  - d. Weight - 3/4 pound per square yard
  - e. Thickness of mat - 0.7 inch, minimum
- 2. Mat Filler Material. PennDOT Form 408, Section 703.4, Anti-Skid Material, Type 2.
  - 3. Emulsified Asphalt. PennDOT Form 408, Section 805.2(b)1.
  - 4. Geotextiles, PennDOT Form 408, Section 735.
- G. Silt Barrier Fence. 18-inch height (above ground, installed), unless otherwise specified or indicated, meeting the following requirements:
- 1. Geotextiles. PennDOT Form 408, Section 735.
  - 2. Wire Mesh Support. Either galvanized or aluminized 14.5 gage wire mesh, arranged in a maximum grid of 6 inches x 6 inches. An alternate, acceptable, equivalent plastic mesh may be used.
  - 3. Posts. Of sufficient length for 18-inch embedment in the ground. Either wood, minimum 2.0 inches square; or steel, 1.25 inch x 1.00 inch T-section or equivalent; or acceptable plastic with an equivalent section.
  - 4. Fasteners. No. 9 staples, 1.5 inches long, or tie wires, 17 gage steel, of appropriate length, acceptably galvanized or aluminized.
- H. Staples. No. 8-gage steel wire staples for anchoring, bent U-shaped with a throat width of 1 or 2 inches, with an effective driving depth of not less than 6 inches.

**PART 3 - EXECUTION**

**3.01 EXECUTION**

- A. Provide erosion and sedimentation control measures as indicated on the Drawings.
- B. Provide additional measures to abate unforeseen conditions when necessary or as directed by the Engineer.
- C. After installation, satisfactorily maintain measures during construction. When

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directed, remove and replace measures not functioning, due to clogging, damage, or deterioration.

- D. Upon completion of the Work, when measures are no longer needed, remove and restore the area.

**3.02 CONSTRUCTION ON STEEP SLOPES**

- A. Where construction is progressing in areas with steep slopes, comply with the following:
1. Reduce by the greatest extent practicable the area and duration of exposure of readily erodible soils.
  2. Protect soils by use of temporary vegetation, or seeding and mulching, or by accelerating the establishment of permanent vegetation and completing protected segments of work as rapidly as is consistent with construction schedules.
  3. Retard the rate of runoff from the construction site and control disposal thereof.
  4. Trap sediment from construction sites in temporary or permanent silt basins to include pump discharges from dewatering operation.
  5. Sprinkle or apply dust suppressors to keep dust within tolerable limits on haul roads and at the construction site.
  6. Utilize temporary measures to control erosion on construction operations suspended for an appreciable length of time.

**3.03 STREAM CROSSING CONSTRUCTION**

- A. During construction at stream crossings, the Contractor shall be required to comply with the following, in addition to the above requirements:
1. All construction debris, excavated material, brush, rocks, and refuse incidental to this work shall be removed entirely from the stream channel and placed either on shore above the influence of flood waters, or at such dumping ground as may be approved by the Department of Environmental

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Resources.

2. Stream bed shall not be used as roadway for moving machinery from one site to another. Temporary stream crossings must be provided for equipment that must cross stream during construction. Structures are to be removed and stream bed returned to its original condition when project is completed.
3. Siltation control shall be provided for during construction, and bank stabilization shall be undertaken by planting of grasses, shrubbery, or trees immediately after completion of each phase of project.
4. Conduct operations in such manner to minimize turbidity at and below the construction site so as to meet the turbidity requirements established by the Bureau of Water Quality Management, PaDEP.
5. There shall be no unreasonable interference with the free discharge of a river or stream.

**3.04 INSTALLATION OF PROTECTIVE MEASURES**

- A. Install erosion and sedimentation control measures in accordance with the following:
  1. Jute Matting.
    - a. After the area has been graded and shaped and after seeding and soil supplements and mulching have been applied, unroll jute matting parallel to the flow direction and anchor, without stretching.
    - b. Spread the matting evenly and smoothly, in contact with the mulch at all points. Bury the up-channel end of each matt length in a vertical 6-inch slot, then backfill and tamp. Overlap subsequent upchannel sections 12 inches.
    - c. Where two or more widths are placed side by side, overlap the edges by not less than 4-inches, then staple along the overlap at 3-foot intervals. Staple the unlapped edge and center flowline at 6-foot intervals.
  2. Wood Excelsior Blanket. Construct, as required for jute matting, except do

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not mulch. Tightly butt adjoining sections at the ends and sides without overlapping, then staple at not less than 3-foot intervals.

3. Erosion Control Netting. Construct the same as jute matting, except anchor each square yard with two staples.
4. Nylon Erosion Control Mat. Grade, shape, and finish surfaces to be protected, so the surfaces are stable, firm, and free of rocks or obstructions which would prevent the mat from lying in direct contact with the soil surface. Prepare surfaces to receive permanent seeding and install mat in accordance with manufacturer's directions. After the mat has been placed, apply seeding and soil supplements, as specified in Section 02901. Mulch with wood cellulose fiber.
5. Silt Barrier Fence. Install posts and excavate the trench. Fasten the fabric securely, in accordance with the manufacturer's recommendations, to the posts, making sure that sag is kept to a minimum. Extend the fabric 8 to 12 inches into the excavated trench, backfill, and compact the trench with the excavated soil.

**3.05 MAINTENANCE**

- A. Check sedimentation barriers after each rainfall and daily during prolonged rainfall. Should the barrier become ineffective, replace immediately. Remove sediment deposits when they reach one-half the height of the barrier.
- B. Check all seeded area regularly to see that a good stand is maintained. Fertilize and reseed areas not showing adequate growth as necessary.
- C. Clean and/or replace the surface of rock construction entrance as necessary.

**END OF SECTION**

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CAST-IN-PLACE CONCRETE**

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**SECTION 03310  
CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. This section consists of furnishing and placing Portland Cement Concrete of the strength and to the dimensions shown on the plans, or as specified. This includes materials, mixing, proportioning, sampling, testing, placing, finishing, and curing of all plain and reinforced cast-in-place, normal-weight concrete.
- B. It is the intent of this Specification to secure, for every part of the work, concrete of homogenous composition which, when cured, will exhibit the required strength, durability, and resistance to weathering. Laboratory testing is required in order to determine compliance with specified strengths.
- C. Elements of the work are shown on the Drawings.

**1.02 QUALITY ASSURANCE**

- A. Materials and work shall conform to the requirements of the latest edition of all standards, codes and recommended practices listed below. In conflicts between standards, or required standards and this Specification, the more stringent requirements shall govern.
  - 1. "Specifications for Structural Concrete" ACI 301.
  - 2. "Metric Building Code Requirements for Structural Concrete & Commentary" ACI 318M.
  - 3. "Standard Specification for Ready-Mixed Concrete" ASTM C 94.
  - 4. "Standard Specification for Portland Cement" ASTM C 150.
  - 5. Field Reference Manual, ACI Publication SP-15.

The Contractor shall have available in the field office a copy of this manual containing "Specifications for Structural Concrete" (ACI 301) with Selected ACI and ASTM references.

**1.03 SUBMITTALS**

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- A. Submit samples of materials being used when requested by the Engineer including names, source and descriptions as required.
- B. Submit two copies of laboratory trial mix designs proposed in accordance with ACI 301, Chapter 3, or one copy each of 30 consecutive test results and the mix design used from a record of past performance in accordance with ACI 301, Chapter 3.
- C. Submit a sample ready-mixed concrete delivery ticket in accordance with the requirements of ASTM C 94.
- D. Reinforcing steel shop drawings showing type, grade, all fabrication dimensions and locations of placing reinforcing steel and accessories shall be submitted for review.
- E. Strength test results as called for in Paragraph 2.04, "Testing and Inspection" shall be submitted to the Engineer.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Portland Cement, conforming to ASTM C 150. Cement used in the work shall correspond to that on which the selection of concrete proportions was based. Only one brand and manufacturer of approved cement shall be used for exposed concrete. The type of cement shall be as shown on the Drawings.
- B. Aggregates, conforming to ASTM C 33. Local aggregates not complying with this standard may be used providing it can be shown by special test or a record or past performance that these aggregates produce concrete of adequate strength and durability.
  - 1. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances, within allowable standards.
  - 2. Coarse Aggregate: Clean, uncoated, graded aggregate containing no clay, mud, loam or foreign matter.
- C. Water shall be fresh, clean, and drinkable.
- D. Admixtures. An air-entraining admixture, conforming to ASTM C 260 shall be

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**SECTION 03310**  
**CAST-IN-PLACE CONCRETE**

used in all concrete. No other admixture shall be used regardless of the type of cement selected, unless the Engineer gives written acceptance for its use. If the Engineer permits or requires use of a chemical admixture, it shall meet the requirements of ASTM C 494, or if a pozzolan, it shall meet the requirements of ASTM C 618. Any admixture shall be used in accordance with the provisions of ACI 212.3R and ACI 212.4R. Calcium chloride or admixtures containing calcium chloride shall not be used.

- E. Metal reinforcement shall be provided in accordance with the drawings.
  - 1. Reinforcing steel, conforming to ASTM A 615 "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement".
  - 2. Welded wire fabric, conforming to ASTM A 185 "Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete".
  - 3. Metal accessories shall conform to the requirements of the CRSI "Manual of Standard Practice for Reinforcing Concrete Construction", latest edition.
- F. Joint material, conforming to ASTM D 1751, or ASTM D 1752.
- G. Curing materials shall exceed the moisture requirement of ASTM C 309 "Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete". Commercial curing compounds shall be "Masterseal" manufactured by Master Builders; "CS-309" manufactured by W.R. Meadows, Inc., "Horncure 50C" manufactured by Grace construction Materials, or accepted equal. Curing material shall provide water retention not exceeding loss of .035 gm/sq cm when used at a coverage of 200 square feet per gallon and tested in accordance with ASTM C 156.

**2.02 CONCRETE QUALITY REQUIRED**

- A. Where the concrete strength is listed as "fc" on the drawings, it shall be the specified compressive strength at 28 days. The average strength shall exceed specified compressive strength as required in accordance with ACI 318, and section 2.03 of this specification.
- B. When Type III Portland Cement, high early strength, is used, the specified strength at 7 days shall be the same as that required at 28 days for compressive strength.
- C. Concrete shall have a maximum water-cement ratio by weight of 0.45.

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**SECTION 03310**  
**CAST-IN-PLACE CONCRETE**

- D. Concrete shall be air-entrained. Total air content required (air-entrained and entrapped air) shall be  $6\% \pm 1\%$ . Air content shall be measured by ASTM C 231 "Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method".
- E. Concrete shall be proportioned and produced to have a slump, not to exceed 4 inches.
- F. Lightweight aggregate concrete shall not be used without prior approval of the Engineer.

**2.03 MIX PROPORTIONS**

- A. Concrete shall be composed of Portland Cement, fine aggregate, coarse aggregate, water and an air-entraining admixture. Proportions of ingredients shall produce concrete which will work readily into corners and angles of forms and bond to reinforcement without segregation or excessive bleed water forming on the surface. Proportioning of materials shall be in accordance with ACI 211 "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete". Proportions of ingredients shall be selected by past field experience or in-lieu of past performance by laboratory trial mixes to produce placeability, durability, strength and the additional properties specified.
- B. Required Average Compressive Strength Above Specified Strength. Determinations of required average strength above specified strength shall be in accordance with ACI 318 "Metric Building Code Requirements for Structural Concrete", and evaluations of compressive strength results of field concrete shall be in accordance with ACI 214.4R "Guide for Obtaining Cores and Interpreting Compressive Strength Results".

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**SECTION 03310  
CAST-IN-PLACE CONCRETE**

1. Past Field Experience: Proportions shall be established on the actual field experience of the ready-mix producer with the materials proposed for use. Standard deviation shall be determined by 30 consecutive tests (or two groups of tests totaling 30 or more). The average strength used for selecting proportions shall exceed the specified strength (f'c) by at least:

|          |   |  |
|----------|---|--|
| 400 psi  | - | standard deviation less than 300         |
| 550 psi  | - | standard deviation 300 to 399            |
| 700 psi  | - | standard deviation 400 to 499            |
| 900 psi  | - | standard deviation 500 to 600            |
| 1200 psi | - | standard deviation above 600, or unknown |
  
2. Trial Mixes: When the ready-mix producer does not have a record of past performance, the combination of materials and the proportions selected shall be selected from trial mixes having proportions and consistencies suitable for the work based on ACI 211, using at least three different water-cement ratios which will produce a range of strengths encompassing those required. the average strength required shall be 1200 psi above specified strength.

**2.04 TESTING AND INSPECTION**

- A. Materials and operations shall be tested and inspected as work progresses. Failure to detect defective work shall not prevent rejection when defect is discovered, nor shall it obligate the Engineer for final acceptance.
  
- B. Testing agencies shall meet the requirements of "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction" ASTM E 329.
  
- C. The following tests shall be performed by the Contractor or the designated agency and shall be paid for by the Contractor:
  1. Secure composite samples in accordance with "Standard Practice for Sampling Freshly Mixed Concrete" ASTM C 172.
  
  2. Mold and cure three specimens from each sample in accordance with "Standard Practic for Making and Curing Concrete Test Specimens in the Field" ASTM C 31.
  
  3. Compressive tests shall be in accordance with "Standard Test Method for

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Compressive Strength of Cylindrical Concrete Specimens" ASTM C 39. Two specimens shall be tested at 28 days for acceptance and one shall be tested at 7 days for information.

4. Make one strength test for each 100 cu. yd. or fraction thereof, of each mix design of concrete placed in any one day.
5. Determine slump for each strength test and whenever consistency of concrete appears to vary, using "Standard Test Method for Slump of Hydraulic Cement Concrete" ASTM C 143.
6. Determine total air content of normal-weight concrete sample for each strength test in accordance with "Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method" ASTM C 231.
7. Determine temperature of concrete sample for each strength test.
8. Determine unit weight, yield and air content for each strength test in accordance with "Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete" ASTM C 138.

**2.05 EVALUATION AND ACCEPTANCE**

- A. The strength level of the concrete will be considered satisfactory if the average of all sets of three consecutive strength test results equal or exceed specified strength and no individual test result is below specified strength by more than 500 psi for compressive tests. If the concrete fails to meet these criteria, remedial action shall be taken in accordance with ACI 318, Section 5.6.4 and the requirements of the Engineer.

**2.06 FORMWORK**

- A. Forms shall be used to confine and shape concrete to required dimensions. Forms shall have sufficient strength to withstand forces from placement and vibration of the concrete, and sufficient rigidity to maintain specified tolerances.
- B. Design, engineering, and construction of the formwork shall be the responsibility of the Contractor.
- C. Formwork shall be designed for loads, lateral pressure and allowable stresses in accordance with ACI 347 "Guide to Formwork For Concrete".

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- D. All tolerances, preparation of form surfaces, removal of forms, reshoring and removal strength shall be in accordance with ACI 301, "Specifications for Structural Concrete".

**2.07 REINFORCEMENT**

- A. Details of all reinforcement and accessories not covered in this section shall be in accordance with ACI SP-66 "ACI Detailing Manual", latest edition.
- B. All reinforcement shall be of the grade shown and shall conform to the following Specifications:
1. Deformed Bars: ASTM A 615 "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement", grade 40 or 60, as shown on the drawings.
  2. Welded Wire Fabric: ASTM A 185 "Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete". Size shall be shown on the Drawings.
- C. Fabricating, placing tolerances, and placing shall be in accordance with the requirements of ACI 301, "Specifications for Structural Concrete".
- D. No welding of any reinforcement is allowed without prior approval of the Engineer.

**2.08 JOINTS AND EMBEDDED ITEMS**

- A. Construction joints, when not shown on working drawings, shall be made and located to least impair the strength of the structure and shall be acceptable to the Engineer.
- B. Isolation and Expansion Joints: Premolded expansion joint filler shall conform to one of the following:
1. ASTM D 1751 "Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)".
  2. ASTM D 1752 "Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction".

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- C. Construction joints shall be as shown on the working drawings.
- D. Other Embedded Items: All water stops, sleeves, inserts, anchors and embedded items required for adjoining work or for its support shall be placed prior to concreting, positioned accurately, and supported against displacement.

**PART 3 - EXECUTION**

**3.01 MIXING AND TRANSPORTATION**

- A. Concrete shall be ready-mixed batched, mixed and transported in accordance with ASTM C 94 "Standard Specification for Ready-Mixed Concrete" plant equipment and facilities shall conform to the "Check-List for Certification of Ready-Mixed Concrete Production Facilities" of the National Ready-Mixed Concrete Association.

**3.02 PLACEMENT**

- A. Preparation: The Contractor shall provide access for delivery and provide sufficient equipment and manpower to rapidly place all concrete.
  - 1. All work shall be in accordance with ACI 304R "Guide for Measuring, Mixing, Transporting, and Placing Concrete".
  - 2. Formwork shall have been completed; snow, ice, water, debris removed from within forms.
  - 3. Reinforcement shall have been secured in position.
  - 4. Expansion joint material, anchors and all embedded items shall have been positioned.
  - 5. Subgrade shall be prepared and sprinkled sufficiently to eliminate water loss from the concrete.
  - 6. Concrete shall not be placed on frozen ground.
- B. Conveying: Concrete shall be handled from mixer to final deposit rapidly by methods which will prevent segregation or loss of ingredients to maintain required quality of concrete. Concrete shall not be pumped through a pipe made of

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aluminum or aluminum alloy.

- C. Depositing: Concrete shall be deposited continuously; when continuous placement is not possible, construction joints shall be located as accepted by the Engineer. Concrete shall be placed as nearly as possible to its final position; avoid rehandling or flowing.
- D. Concrete shall be consolidated by vibration, spading, rodding, or forking. Work concrete around reinforcement, embedded items, and into corners, eliminate all air or stone pockets and other causes of honeycombing, pitting or planes of weakness.
  - 1. Internal vibration shall have a minimum frequency of 8000 v/min. with amplitude to consolidate effectively.
  - 2. Vibrators shall be operated by competent workmen.
  - 3. Use of vibrators to transport concrete shall not be allowed.
  - 4. Vibrators shall be inserted and withdrawn approximately every 18 inches for 5 to 15 seconds.

**3.03 COLD WEATHER**

- A. Concrete shall not be placed on frozen subgrade. Do not place concrete when the air temperature is below 0 degrees F or when the air temperature is forecasted to fall below 0 degrees F within 24 hours of placement.
- B. Temperature of concrete delivered at the job-site shall conform to the following:

|                        |                             |
|------------------------|-----------------------------|
| <u>Air Temperature</u> | <u>Concrete Temperature</u> |
| 30 to 45 degrees F.    | 55 to 90 degrees F.         |
| 0 to 30 degrees F.     | 60 to 90 degrees F.         |
- C. Water heated to above 100 degrees F. shall be combined with the aggregates before cement is added. Cement shall not be added to water or aggregates having a temperature greater than 100 degrees F.
- D. All work shall be in accordance with ACI 306R "Cold Weather Concreting".
- E. When the outdoor temperature is less than 40 degrees F., the temperature of the concrete shall be maintained at not less than 50 degrees F. for the required curing time.

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1. Arrangements shall be made before placement to maintain required temperature without injury from excessive heat.
  2. Combustion heaters shall not be used during the first 48 hours without precautions to prevent exposure of concrete and workmen to exhaust gases containing carbon dioxide and carbon monoxide.
- F. Use of additives of so-called anti-freeze compounds for protection from freezing shall not be allowed.

**3.04 HOT WEATHER**

- A. Temperature of concrete delivered at the job-site shall not exceed 90 degrees F. Ingredients shall be cooled before mixing to prevent concrete temperatures in excess of 90 degrees F.
- B. All work shall be in accordance with ACI 305R "Hot Weather Concreting".
- C. Provisions shall be made for windbreaks, shading, fog spraying, sprinkling or wet cover when necessary.
- D. Use an evaporation retarder, finishing aid, similar to "Confilm" manufactured by Master Builders, or equal.

**3.05 DEPOSITING CONCRETE UNDER WATER**

- A. If necessary to deposit concrete under water the methods, equipment, materials, and mix to be used shall be submitted to and shall be approved by the Engineer before the work is started.
- B. Concrete shall not be placed in water having a temperature below 40 degrees F. The temperature of the concrete, when deposited, shall not be less than 60 degrees F. nor more than 90 degrees F.
- C. Cofferdams or forms shall be sufficiently tight to reduce the flow or current of water to 10 feet per minute through the space into which concrete is to be deposited and shall be sufficiently tight to prevent loss of mortar through the walls. Pumping of water will not be permitted while concrete is being placed, nor until 24 hours thereafter.
- D. Concrete shall be placed continuously until it is brought to the required height.

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During placement, the top surface shall be kept as nearly level as possible and the formation of seams shall be avoided. The method to be used for depositing concrete under water shall be one of the following:

1. Tremie: The tremie shall be watertight and large enough to allow a free flow of concrete. It shall be kept filled with concrete at all times during placing. The concrete shall be discharged and spread by so moving the tremie as to maintain a uniform flow and to avoid dropping the concrete through water. The slump of concrete shall be maintained between 4 and 6 inches.
  2. Drop Bottom Bucket: The top of the bucket shall be open. Bottom doors shall open freely downward and outward when tripped. The bucket shall be completely filled and lowered slowly, shall not be dumped until it rests on the surface upon which the concrete is to be deposited, and when discharged shall be withdrawn slowly until well above the concrete. The slump of concrete shall be maintained between 3 and 5 inches.
- E. To minimize the formation of laitance, care shall be exercised to disturb the concrete as little as possible while it is being deposited. Upon completion of a section of concrete, all laitance shall be entirely removed before work is resumed.

**3.06 CURING AND PROTECTION**

- A. Immediately following placement, concrete shall be protected from premature drying, hot and cold temperatures, rain, flowing water and mechanical injury.
- B. Materials and method of curing shall be accepted by the Engineer. Final curing shall continue for not less than 7 days.
- C. Approved methods include: ponding or continuous sprinkling, continuously wet mats, sand kept continuously wet, and liquid membrane - forming compounds.
  1. Applications of waterproof sheet material shall conform to ASTM C 171 "Standard Specification for Sheet Materials for Curing Concrete".
  2. Application of liquid membrane-forming compound shall conform to ASTM C 309 "Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete." Material shall maintain a maximum moisture loss of .035 gm/sq cm when used at a coverage of 200 square feet

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per gallon tested in accordance with ASTM C 156 "Standard Test Method for Water Retention by Concrete Curing Materials."

**END OF SECTION**

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PRECAST CONCRETE**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. This section includes all labor, materials, equipment and related services necessary for the manufacture and erection of precast concrete shown on the plans, or as specified.
- B. All precast concrete shall be a product of a manufacturer who has demonstrated the capability to produce precast concrete products of the quality specified.
- C. It is the intent of this Specification to secure, for every part of the work, precast concrete of homogenous composition which, when erected, will exhibit the required strength, durability, and resistance to weathering. Laboratory testing is required in order to determine compliance with specified strengths.
- D. Elements of the work are shown on the Drawings.

**1.02 QUALITY ASSURANCE**

- A. Materials and work shall conform to the requirements of all standards, codes and recommended practices listed below. In conflicts between standards, or required standards and this Specification, the more stringent requirements shall govern.
  - 1. "Specifications for Structural Concrete" ACI 301.
  - 2. "Metric Building code Requirements for Structural Concrete" ACI 318.
  - 3. "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products" PCI MNL-117, latest edition, Precast/Prestressed Concrete Institute.
- B. The precast manufacturer shall guarantee the precast products against defects in materials and workmanship for a period of one year after acceptance by the Authority.

**1.03 SUBMITTALS**

- A. Submit written evidence, when requested by the Engineer, that the manufacturer has experienced personnel, established quality control procedures, physical

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**SECTION 03400**  
**PRECAST CONCRETE**

facilities, and a management capability sufficient to execute the precast concrete work.

- B. Submit samples of materials being used when requested by the Engineer including names, source and descriptions as required.
- C. Submit test reports, when requested by the Engineer, of compressive strength tests on concrete and water absorption tests on units.
- D. Shop drawings showing unit shapes, dimensions, finishes, reinforcing, joints, lifting points, supporting points, inserts, and connection details shall be submitted for review.
  - 1. Identification marks shall include date of casting and be the same as that on actual units.
  - 2. Show handling procedures and sequence of erection for special conditions.
  - 3. The precast manufacturer shall not proceed with fabrication of any products prior to receiving reviewed shop drawings by both the Engineer and Contractor.
  - 4. For standard precast concrete items, like splash blocks, the manufacturer may substitute descriptive literature in place of actual Shop Drawings.
- E. Samples, where required on the drawings, shall mean a minimum of three samples for each type of finished facing shall be submitted to the Engineer for review of color and texture prior to commencement of manufacture. Samples shall be at least 12 in. by 12 in. in size and of appropriate thickness, representative of the proposed finished product. One of the reviewed samples shall be returned to the Contractor and one to the Precaster prior to manufacture.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Portland Cement, conforming to ASTM C 150. Cement used in the work shall correspond to that on which the selection of concrete proportions was based. Only one brand and manufacturer of approved cement shall be used for exposed concrete. The cement shall be Type I unless another type is accepted by the Engineer.

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- B. Aggregates, conforming to ASTM C 33. Local aggregates not complying with this standard may be used providing it can be shown by special test or a record of past performance that these aggregates produce concrete of adequate strength and durability.
1. Fine aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious, substances, within allowable standards.
  2. Coarse aggregate: Clean, uncoated, graded aggregate containing no clay, mud, loam or foreign matter.
- C. Water shall be fresh, clean, and drinkable.
- D. Admixtures: An air-entraining admixture, conforming to ASTM C 260 shall be used in all concrete. If a chemical admixture is used, it shall meet the requirements of ASTM C 494. If a pozzolan is used, it shall meet the requirements of ASTM C 618.
- E. Metal Reinforcement.
1. Reinforcing steel, conforming to ASTM A 615 "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement."
  2. Welded wire fabric, conforming to ASTM A 185 "Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete."
  3. Metal accessories shall conform to the requirements of the CRSI "Manual of Standard Practice for Reinforcing Concrete Construction," latest edition.
- F. Hardware.
1. Structural steel cast into precast concrete shall be ASTM A 36 and shall be shop painted.
  2. Inserts, bolts and other accessories cast into precast concrete shall be electroplated.
- G. Coloring agent shall be a synthetic mineral oxide that is harmless to concrete set and strength, stable at high temperature, and is sunlight and alkali-fast.

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PRECAST CONCRETE**

**2.02 CONCRETE QUALITY REQUIRED**

- A. Precast concrete shall have a minimum "f<sub>c</sub>" of 4,000 psi, which shall be the specified compressive strength at 28 days. The average strength shall exceed specified compressive strength as required in accordance with ACI 381.
- B. When Type III Portland Cement, high early strength, is used, the specified strength at 7 days shall be the same as that required at 28 days for compressive strength.
- C. Precast Concrete shall have a maximum water-cement ratio by weight of 0.45.
- D. Precast Concrete shall be air-entrained. Total air content required (air-entrained and entrapped air) shall be 6% ± 1%. Air content shall be measured by ASTM C 231 "Test for Air Content of Freshly Mixed Concrete by the Pressure Method."
- E. Facing Mix where required.
  - 1. Minimum thickness of face mix after consolidation shall be at least one inch or a minimum of 1-1/2 times the maximum size of aggregates used, whichever is greater.
  - 2. Water-cement and cement-aggregate ratios of face and back-up mixes shall be similar.

**2.03 MANUFACTURE**

- A. Quality Control.
  - 1. The precast concrete manufacturer shall have an established quality control program in effect prior to letting of the contract.
  - 2. Quality control records shall be kept for at least two years after final acceptance.
  - 3. Manufacturing and testing procedures shall be in general compliance with the PCI recommendation in MNL 117, latest edition.
  - 4. One compression test shall be performed for each day's production of each type of concrete.

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- a. Provide two test specimens for each compression test.
  - b. Obtain concrete for specimens from actual production batch.
  - c. Mold and cure specimens in accordance with "Test Methods of Making and Curing Concrete Test Specimens in the field" ASTM C 31.
  - d. Compressive tests shall be conducted by a qualified testing laboratory and in accordance with "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens" ASTM C 39.
5. Evaluation and acceptance of compression tests will follow ACI 318.
- B. Fabrication.
1. Forms for precast concrete shall be rigid and constructed of materials that will result in finished products conforming to the shape, lines and dimensions shown on the reviewed shop drawings.
  2. Precast Concrete shall be composed of Portland Cement, fine aggregate, coarse aggregate, water and an air-entraining admixture. Proportions of ingredients shall produce concrete which will work readily into corners and angles of forms and bond to reinforcement without segregation or excessive bleed water forming on the surface. Proportioning of materials shall be in accordance with ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete." Proportions of ingredients shall be selected by past field experience or in-lieu of past performance by laboratory trial mixes to produce placability, durability, strength and the additional properties specified.
  3. Concrete shall be deposited and vibrated to insure proper consolidation, elimination of unintentional cold joints and to minimize entrapped air on vertical surfaces.
  4. All reinforcing steel shall have a minimum cover of 3/4 inch and shall be accurately located as indicated on the reviewed shop drawings.
  5. Metal chairs, with or without coatings shall not be used in the finished face.

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6. Embedded anchors, inserts, plates, angles, and other cast-in items shall have sufficient anchorage and embedment for design requirements.
  7. All weldments, including tack welds, shall be made in accordance with the applicable provisions of the "Structural Welding Code-Steel," AWS D 1.1.
  8. The finished surfaces of precast concrete products shall be uniform. Patches shall be similar to surrounding surfaces.
- C. Curing shall be in accordance with the recommendations made by ACI Committee 533.
- D. Mark each precast panel with the date cast and with an identification to correspond with shop drawings for panel location.
- E. Plant records on all production shall be kept available for the Engineer upon request.
- F. Acceptance of the precast units by the Engineer shall depend on the units meeting the color and texture range and the dimensional tolerances required.

**PART 3 - EXECUTION**

**3.01 HANDLING AND TRANSPORTATION**

- A. Precast concrete units shall be lifted and supported during manufacturing, storage, transportation and erection operations only at the lifting or supporting points, or both, as shown on the contract and Shop Drawings.
- B. Blocking shall be clean and non-staining.
- C. Lateral support shall be sufficient to prevent excessive bowing and warping.
- D. Edges of the units shall be adequately protected by padding or other means to prevent staining, chipping or spalling of the concrete.

**3.02 ERECTION**

- A. Prior to installation of precast units, the erector shall check at the job site all dimensions affecting the work under his contract. Any discrepancies between

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design dimensions and field dimensions which could adversely affect installation in strict accordance with the contract documents shall be brought to the Engineer's attention. If such conditions exist, installation shall not proceed until they are corrected or until installation requirements are modified.

- B. Set precast units level, plumb, square and true within the allowable tolerances. They must be positioned so that cumulative dimensional error is not allowed. Unless otherwise stated, dimensional tolerances of the erected units shall be as recommended in PCI MNL 117.
- C. Provide temporary supports and bracing as required to maintain position, stability and alignment as units are being permanently connected.
- D. Each panel shall be securely fastened in place as indicated on the reviewed Drawings.
  - 1. All structural welds shall be made by a certified welder in accordance with the erection drawings which shall clearly show type, extent, sequence and location of welds.
  - 2. Adjustments or changes in connections, which could involve additional stresses in the products or connections, shall not be permitted without acceptance by the Engineer.
  - 3. Lintels shall be set on bearing surfaces that are free of obstructions and in a fresh mortar leveling medium that provides full bearing.
- E. Patching shall match color and texture of surrounding concrete and shall minimize shrinkage.

**3.03 JOINTS**

- A. Horizontal and vertical joints shall be correctly aligned and uniform joint width shall be maintained as erection progresses.
- B. Edges of precast concrete units and of adjacent materials shall be sound, smooth, clean and free of all contaminants prior to joint treatment.
- C. If a sealant and primer are required, they shall be called for on the Drawings.

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**3.04 CLEANING**

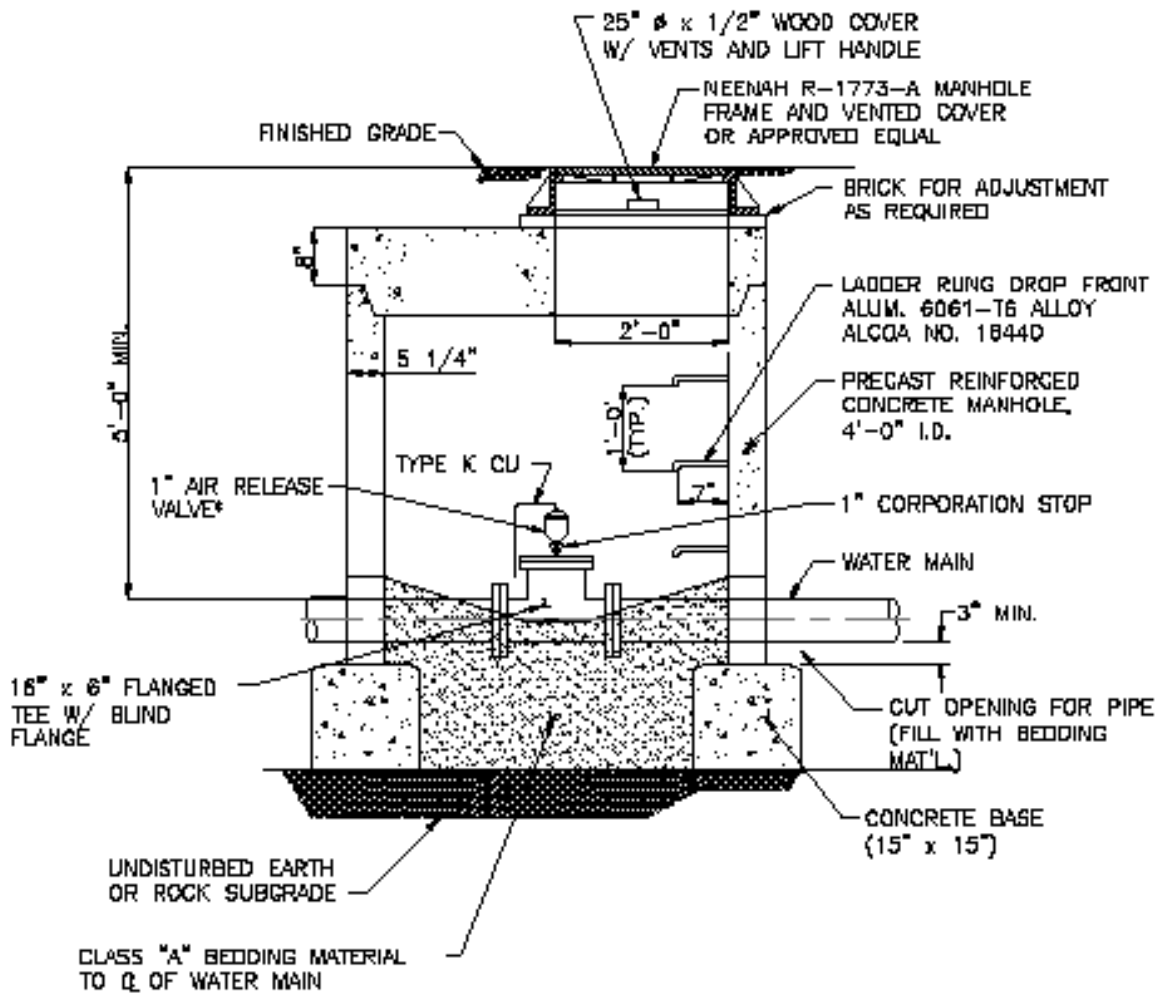
- A. All exposed facing shall be cleaned as necessary to remove dirt and stains which may be on the panels after erection. The precast units shall be cleaned only after all installation procedures, including joint treatment, are completed. The exposed facings shall be washed and rinsed in accordance with the precast manufacturer's recommendation.
  
- B. Care shall be taken that no part of the building or surrounding site work be damaged, or that the character of the finishes be changed by the cleaning material or process.
  
- C. Surface sealants when required shall be applied after the building has been caulked and all repairs and cleaning have been completed.

**END OF SECTION**

## LIST OF STANDARD DETAILS

| <b>DETAIL NO.</b> | <b>TITLE</b>  |
|-------------------|---|
| SWD-1             | Air Valve Manhole Detail                                  |
| SWD-2             | Typical Service Corporation Stop and Curb Stop Detail     |
| SWD-3             | Trench Section & Service Connection for Ductile Iron Pipe |
| SWD-4             | Temporary Blowoff Detail                                  |
| SWD-5             | Permanent Blowoff Detail                                  |
| SWD-6             | Stream Crossing   |
| SWD-7             | Thrust Block Detail                                       |
| SWD-8             | Concrete Thrust Collar                                    |
| SWD-9             | Typical Hydrant   |
| SWD-10            | Typical Jacking and Boring Sections                       |
| SWD-11            | Trench Section – State Highways & Township Roads          |
| SWD-12            | Valve Box Detail  |
| SWD-13            | Water Line Encasement Detail                              |
| SWD-14            | Standard Detail Residential Meter Pit                     |

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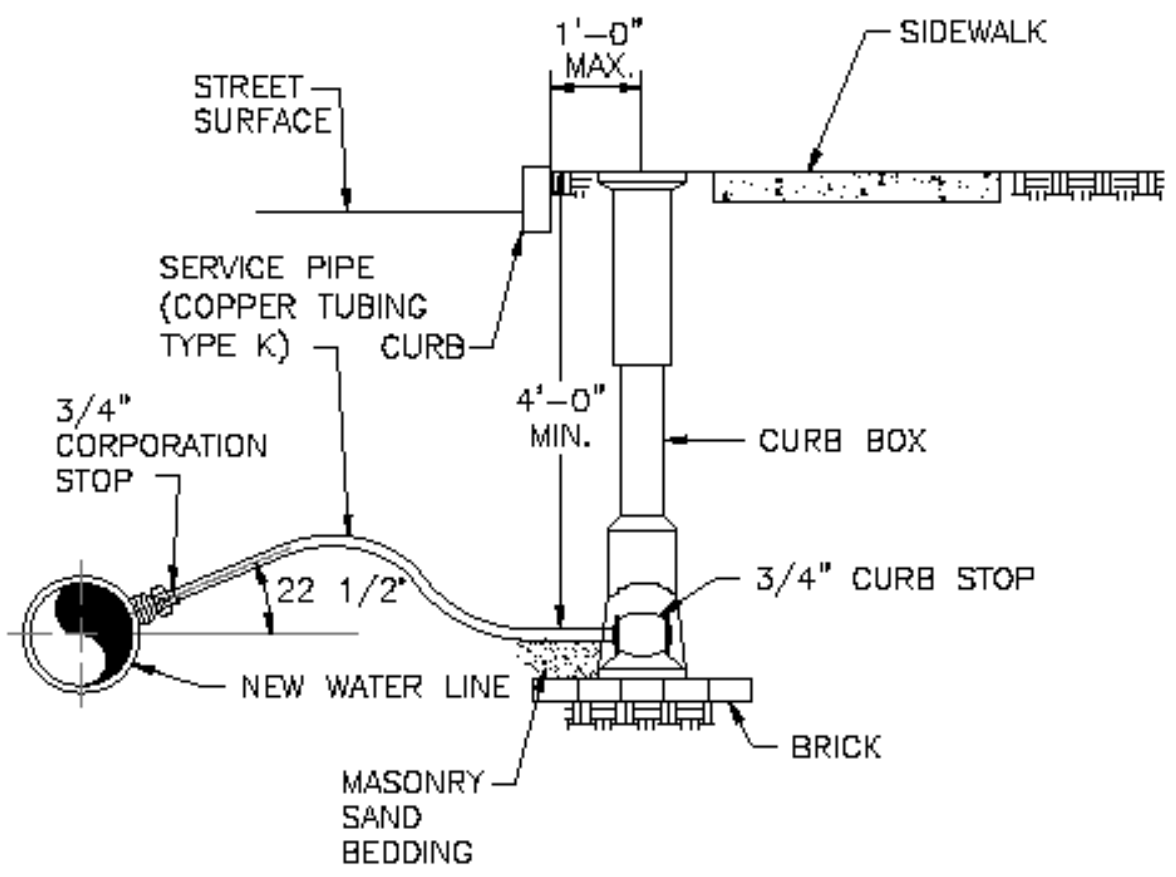


### AIR VALVE MANHOLE DETAIL

NO SCALE

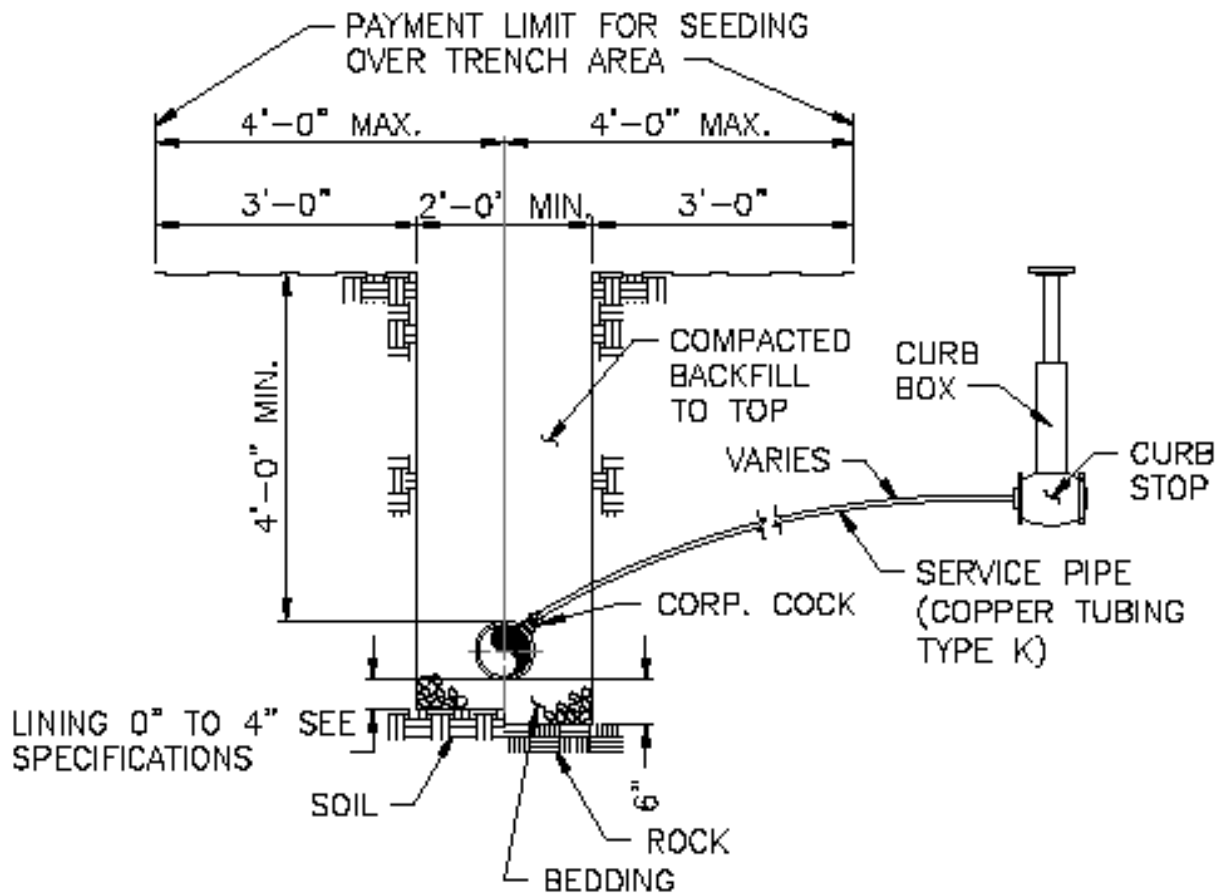
\* SIZE OF AIR RELEASE VALVE MAY VARY DEPENDING ON JOB SPECIFIC REQUIREMENTS.

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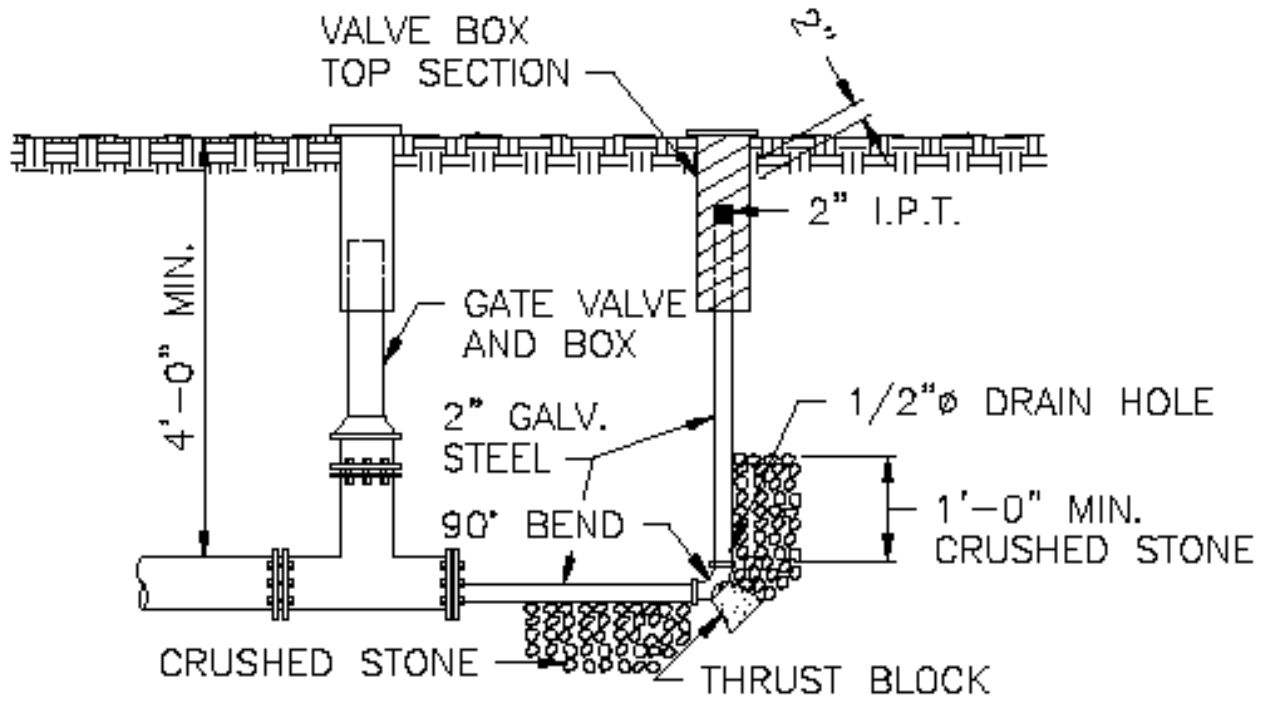
TYPICAL SERVICE CORPORATION STOP  
AND CURB STOP DETAIL

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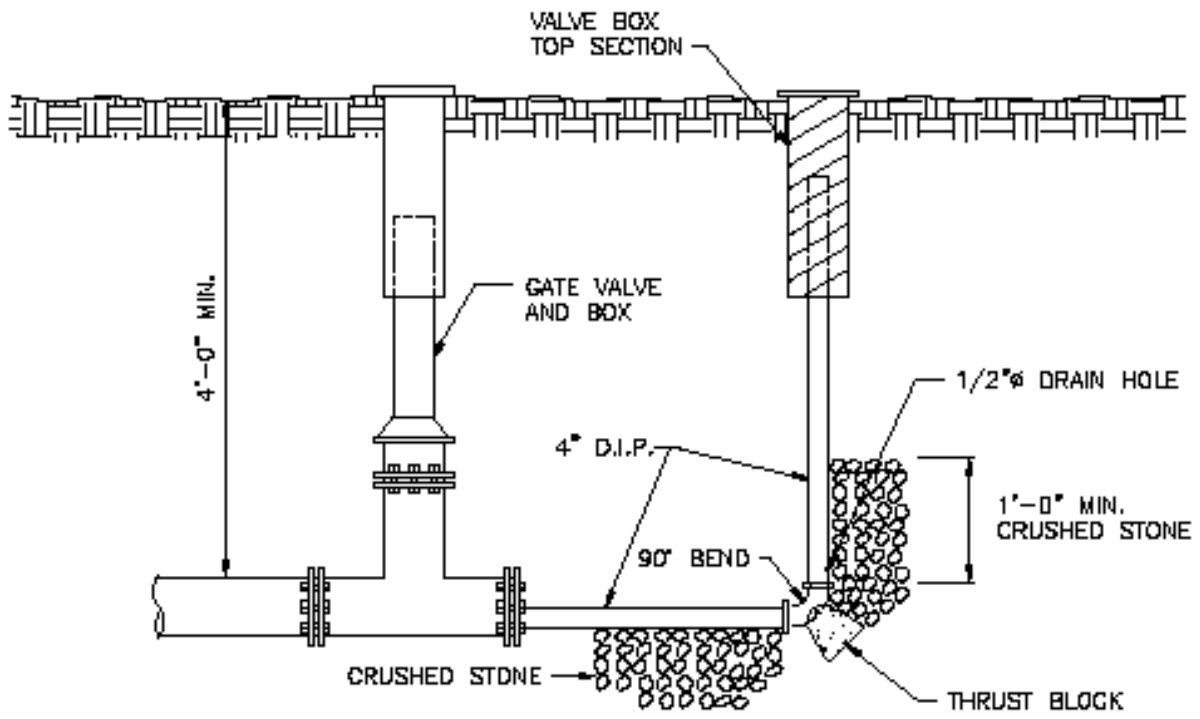


TRENCH SECTION &  
SERVICE CONNECTION  
FOR DUCTILE IRON PIPE  
NO SCALE

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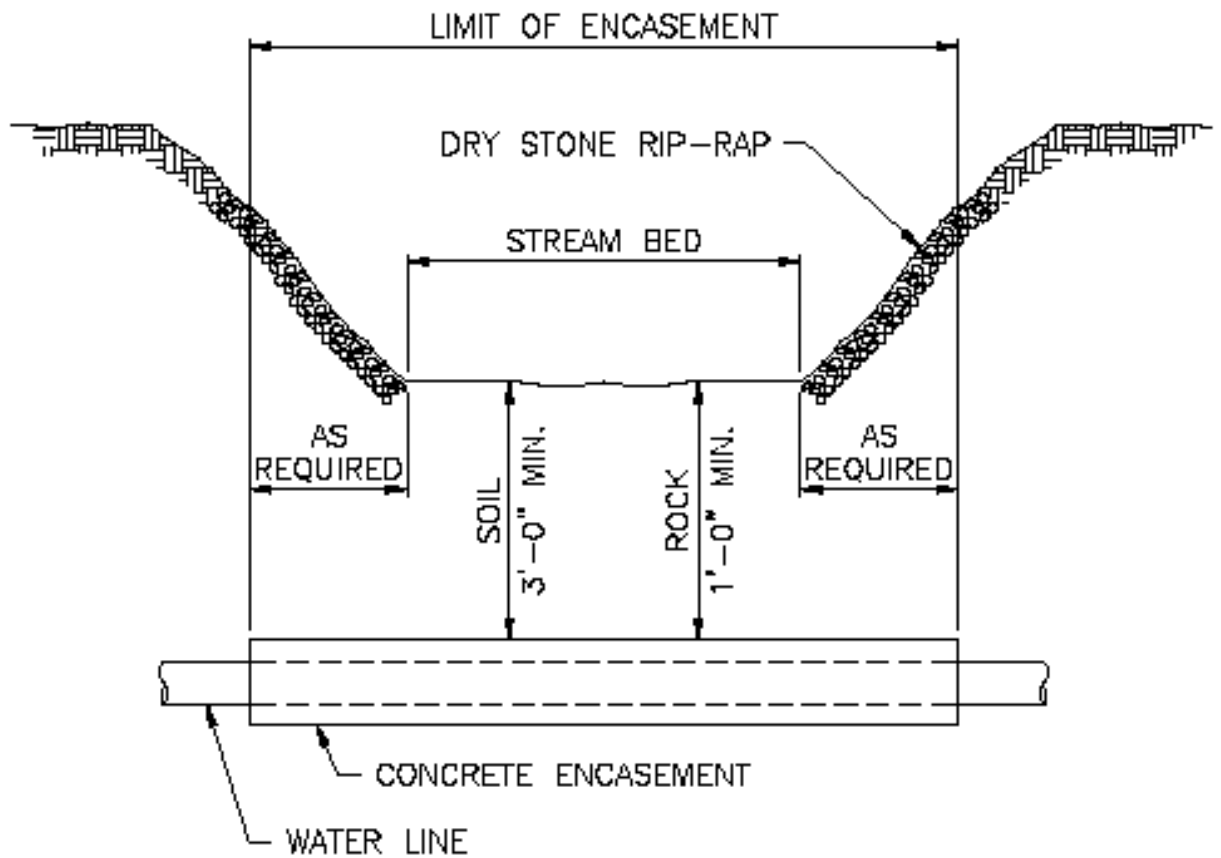


### TEMPORARY BLOWOFF



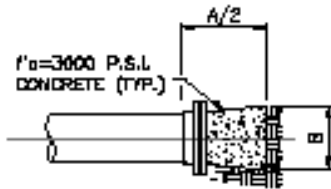
PERMANENT BLOWOFF DETAIL

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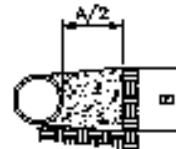


STREAM CROSSING

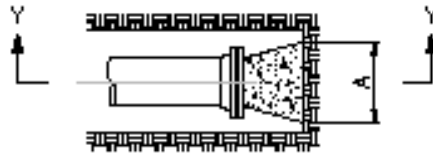




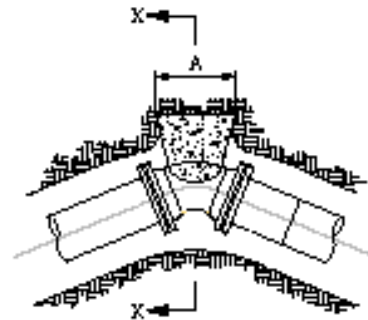
SECTION Y-Y



SECTION X-X



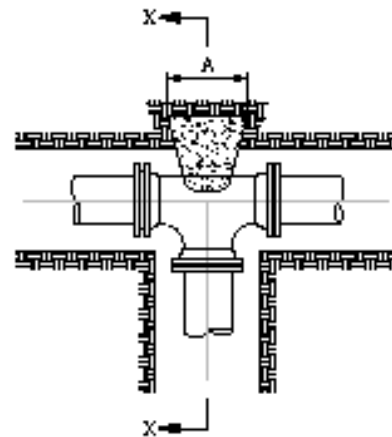
THRUST BLOCK PLAN AT TYPICAL PLUG



THRUST BLOCK PLAN AT TYPICAL BEND

| THRUST BLOCK TABLE |                |             |        |
|--------------------|----------------|-------------|--------|
| PIPE SIZE          | DEGREE OF BEND | *DIMENSIONS |        |
|                    |                | A           | B      |
| 8"                 | TEE OR PLUG    | 2 1/2'      | 2'     |
| 8"                 | 90             | 3'          | 2'     |
| 8"                 | 45             | 3'          | 1 1/2' |
| 8"                 | 22 1/2         | 3'          | 1'     |
| 8"                 | 11 1/4         | 2'          | 1'     |
| 8"                 | TEE OR PLUG    | 4'          | 2'     |
| 8"                 | 90             | 3'          | 2 1/2' |
| 8"                 | 45             | 3'          | 2'     |
| 8"                 | 22 1/2         | 3'          | 1'     |
| 8"                 | 11 1/4         | 2'          | 1'     |
| 10"                | TEE OR PLUG    | 4'          | 3'     |
| 10"                | 90             | 6'          | 3'     |
| 10"                | 45             | 5'          | 2'     |
| 10"                | 22 1/2         | 3'          | 2'     |
| 10"                | 11 1/4         | 3'          | 1'     |
| 12"                | TEE OR PLUG    | 6'          | 3'     |
| 12"                | 90             | 8'          | 4'     |
| 12"                | 45             | 5'          | 3'     |
| 12"                | 22 1/2         | 4'          | 2'     |
| 12"                | 11 1/4         | 3'          | 2'     |
| 16"                | TEE OR PLUG    | 8'          | 6'     |
| 18"                | 90             | 10'         | 6'     |

\*CAST IN PLACE

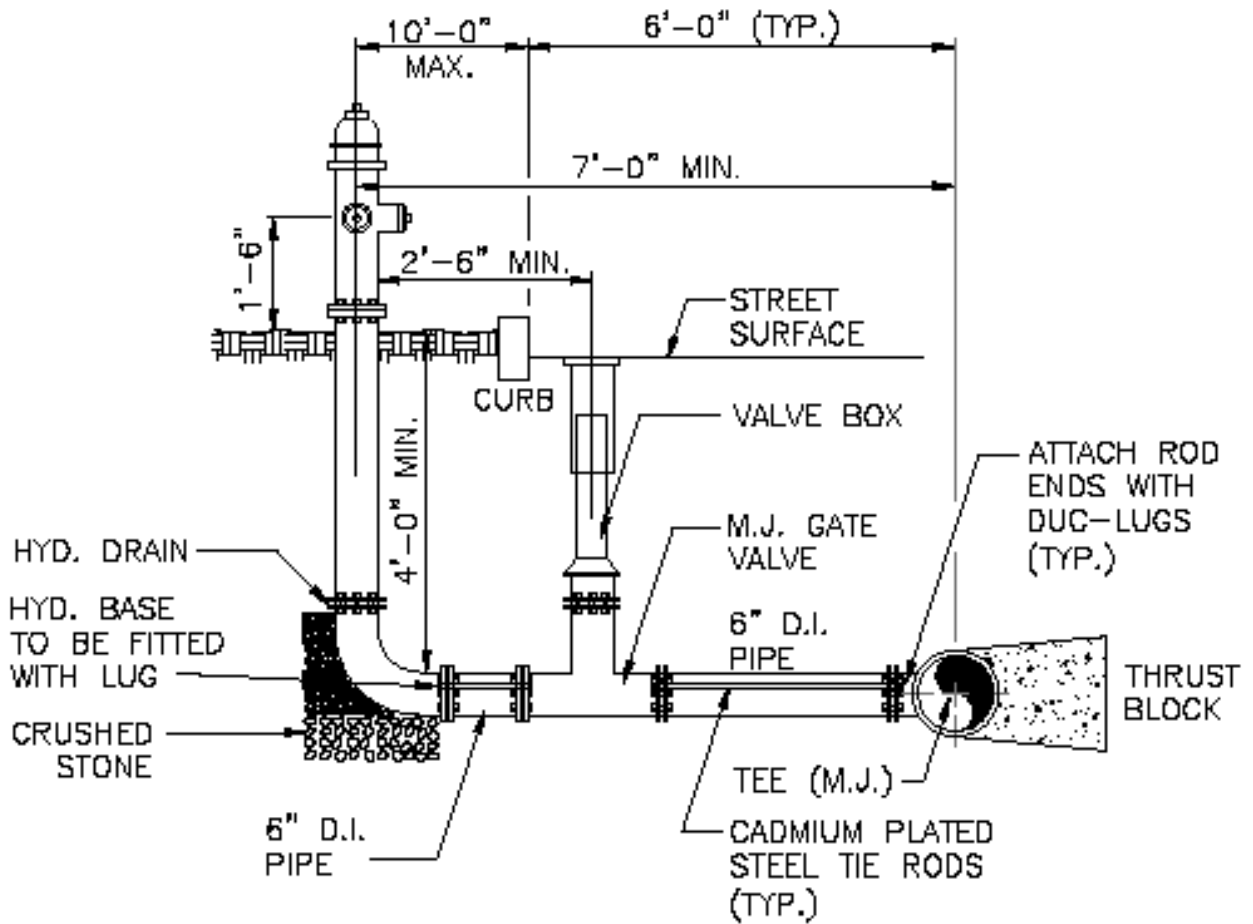


THRUST BLOCK PLAN AT TYPICAL TEE

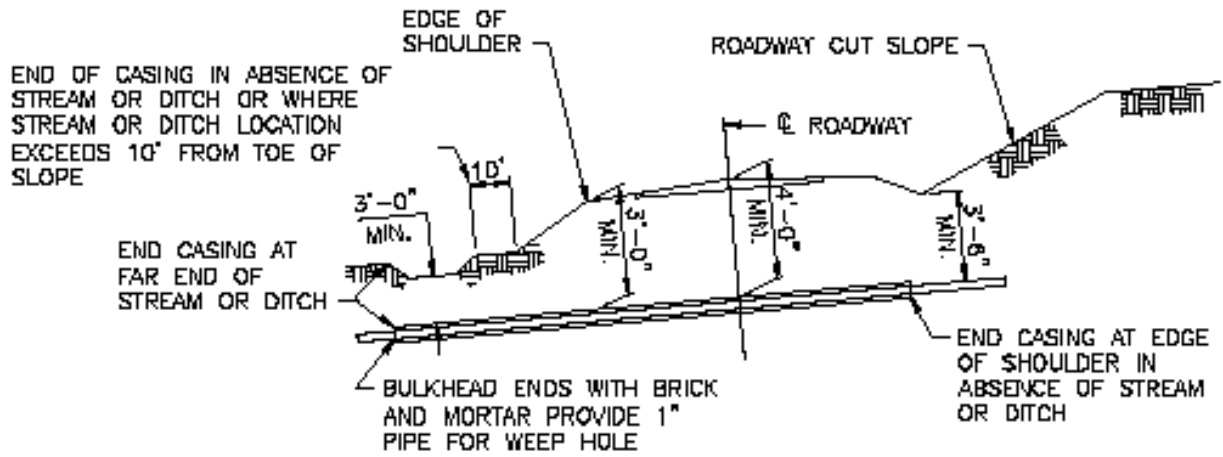
NOT TO SCALE



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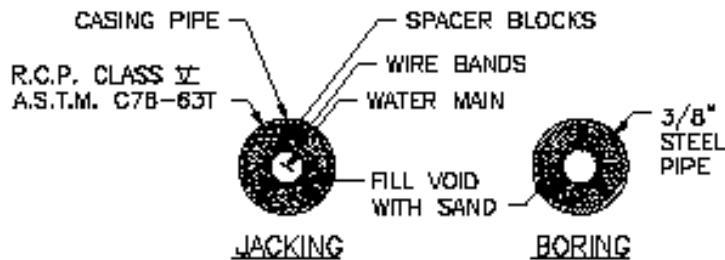


TYPICAL HYDRANT  
NOT TO SCALE

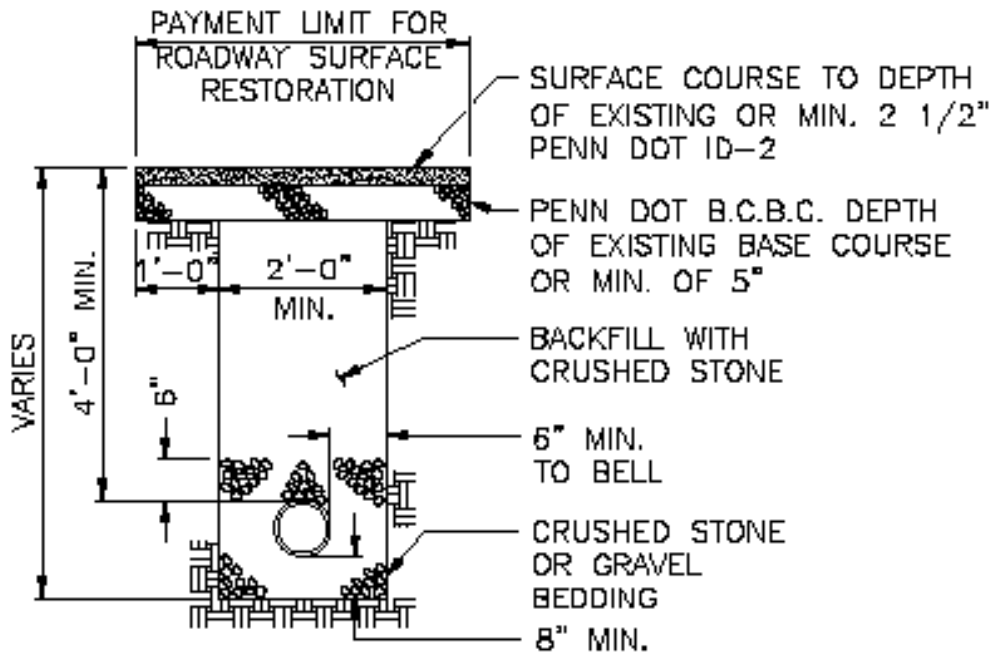


HIGHWAY CROSSING

NOTE: CASING PIPE FOR OPEN CUT CROSSINGS SHALL BE 12 GAUGE BITUMINOUS COATED C.M.P. W/ PAVED INVERT.

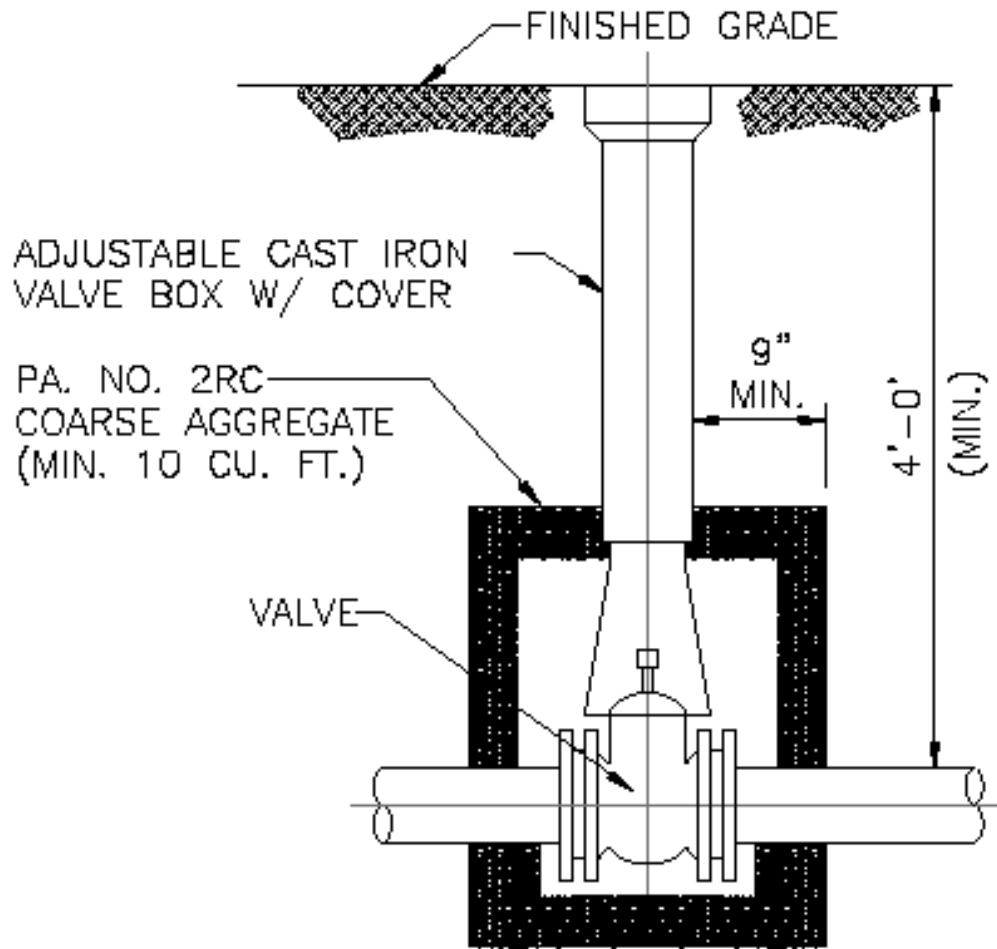


TYPICAL JACKING & BORING SECTIONS

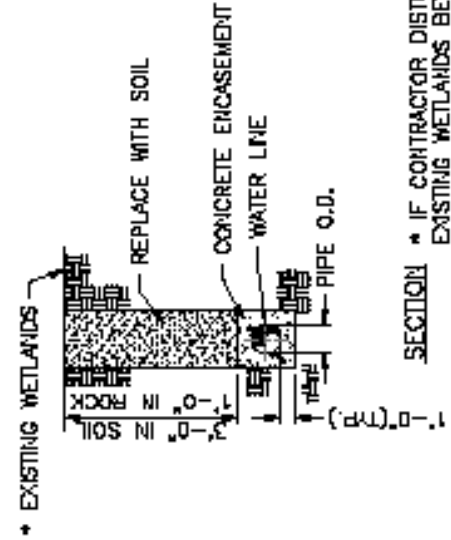
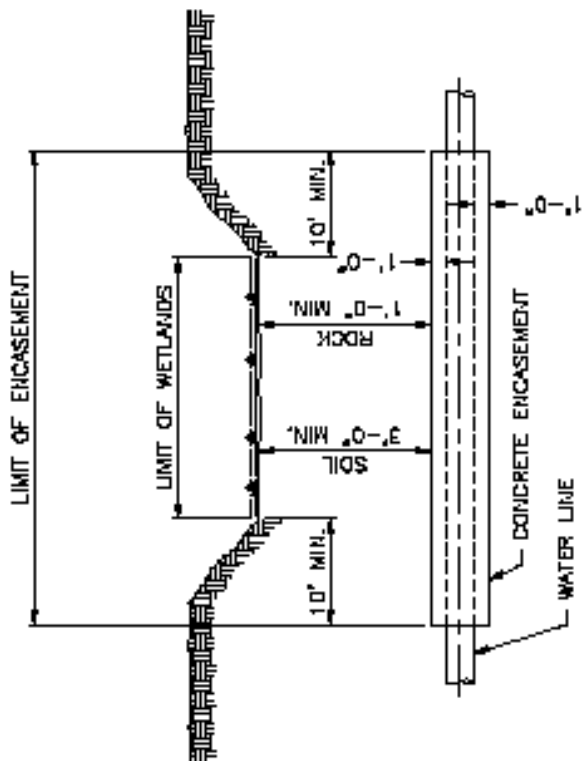
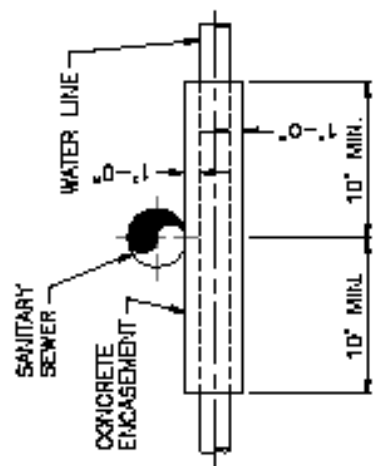


TRENCH SECTION  
STATE HIGHWAYS &  
TOWNSHIP ROADS

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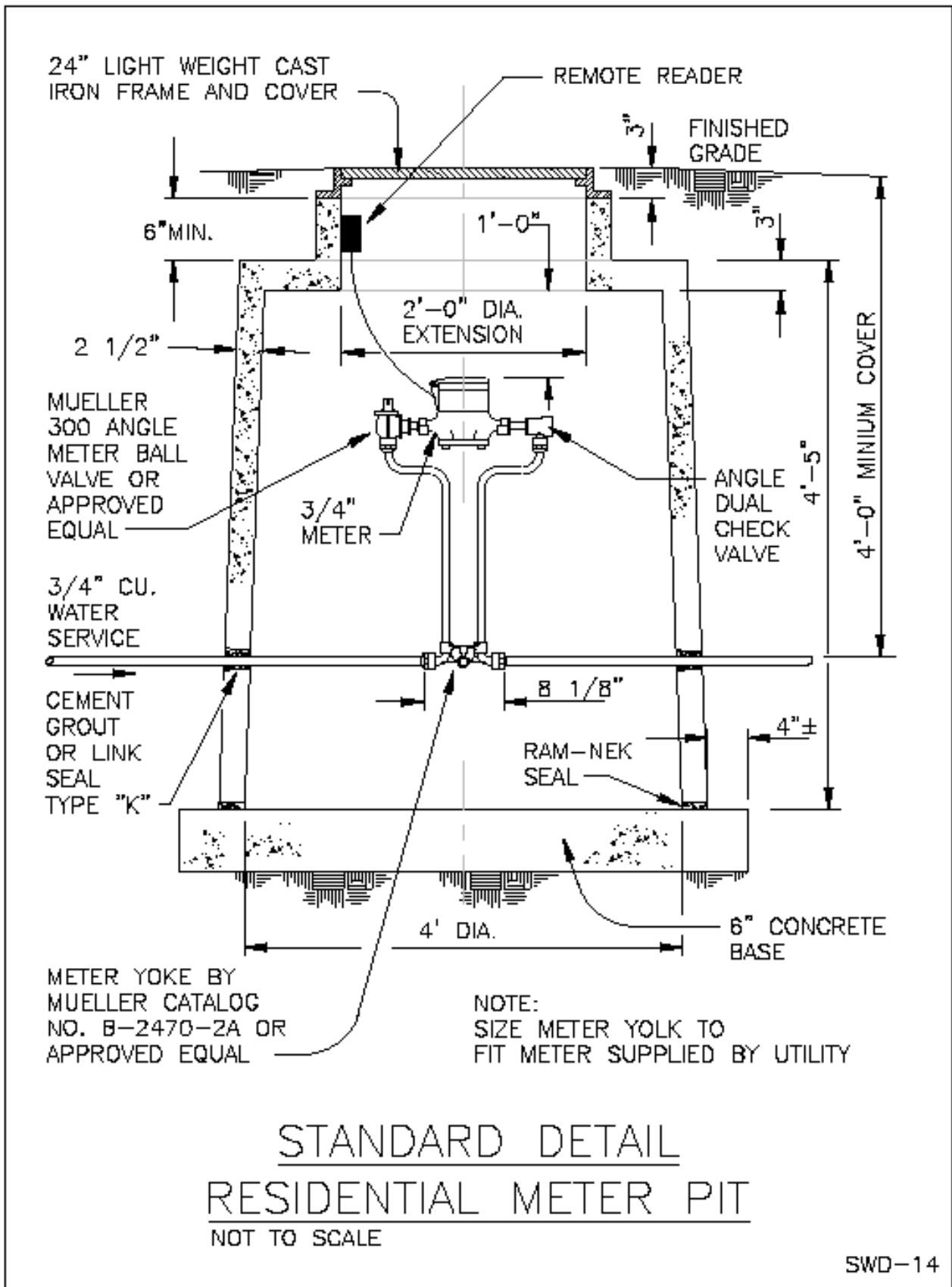
VALVE BOX DETAIL  
NO SCALE



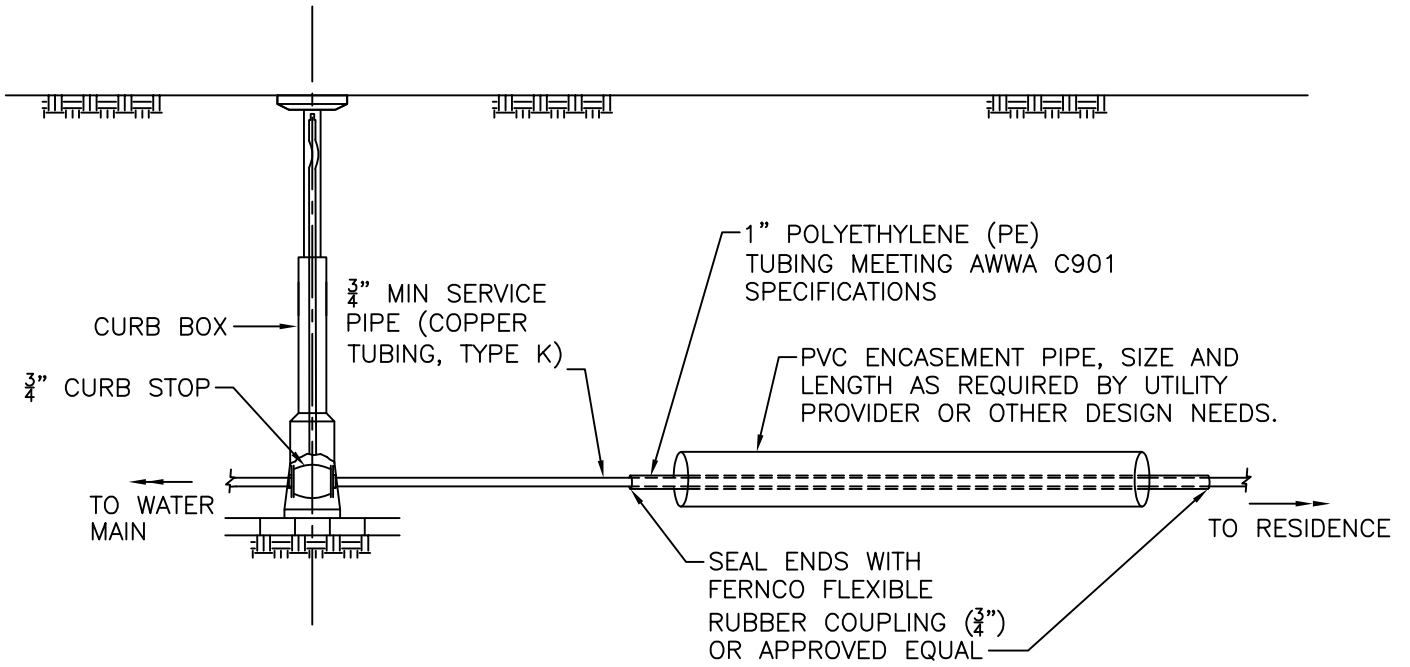
\* IF CONTRACTOR DISTURBS EXISTING WETLANDS BEYOND THE LIMITS SHOWN, CONTRACTOR SHALL EXTEND CONCRETE ENCASEMENT TO UNDISTURBED SOIL OR ROCK AT HIS OWN EXPENSE.

WATER LINE  
ENCASUREMENT DETAIL

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TYPICAL SERVICE LINE PROTECTION  
THROUGH ENCASEMENT DETAIL  
 NOT TO SCALE

NOTES:

1. SLIDE 1" PE TUBING AND FERCO COUPLINGS ONTO 3/4" COPPER TUBING PRIOR TO LAYING IN TRENCH.
2. THE COST AND INSTALLATION OF THE PE PIPE AND FLEXIBLE COUPLINGS SHOWN ABOVE IS INCIDENTAL TO THE SERVICE LATERAL.