



Standard Construction Specifications

Guilford Water Authority

Franklin County, PA

Date:

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INTRODUCTION

These STANDARD CONSTRUCTION AND MATERIAL SPECIFICATIONS (Specifications) set forth the minimum technical requirements for the design and construction of facilities which are intended to become a part of the Guilford Water Authority's (Authority) water distribution system (System). The Specifications are typically used by engineers and contractors working for developers who intend to construct extensions to Authority's existing System.

These Specifications are in addition to Authority's Rates, Rules and Regulations (Regulations) which contain the general administrative requirements as well as some technical requirements for extensions to the System. The emphasis in these Specifications is on the design and installation of distribution pipeline facilities. In the event of any conflict between the Regulations and these Specifications the Regulations shall prevail. The design of facilities other than water mains (pumping stations, wells, treatment facilities, storage facilities, etc.) will be reviewed and regulated on a case-by-case basis. These Specifications cannot cover every possible facility design and installation scenario, therefore the Authority reserves the unqualified right to modify or establish additional requirements to insure the integrity, operational viability, and life span of the facilities to be constructed.

All construction plans must be reviewed and approved by the Authority prior to the commencement of any construction.

All Construction Drawings must contain the following Notes:

WATER SYSTEM NOTES

1. All water line construction shall be performed in accordance with the Guilford Water Authority Standard Construction Specifications and the Pennsylvania Department of Environmental Protection Public Water Supply Manual.
2. Approval of this subdivision/land development plan by the Guilford Water Authority does not, in any way, guarantee or reserve capacity within the Authority's water distribution system to serve the lots and/or plans so approved.
3. Thrust restraint shall be placed at all tees, bends and changes in direction.
4. All water main shall be ductile iron class 52 with four feet of cover.
5. All water mains shall be tested and disinfected to the Authority's satisfaction.
6. Where water mains are constructed on fill material, ensure the main is properly supported. Fill placed under the main shall be bedding material, compacted to 95% of the standard proctor maximum dry density as specified by ASTM D 698. The lift thickness shall be per the equipment manufacturer's specifications, however it shall not exceed the lift thicknesses allowed in the PennDOT 408 Specifications.
7. All water mains shall have a minimum 10 foot horizontal separation from sanitary sewers and 18" vertical separation between the water main and storm or sanitary sewers. The water main must be placed over the sewer pipe.
8. All water mains shall have a minimum 5 foot horizontal separation from site features such as drainage inlets, headwalls, etc. and minimum 3 foot horizontal separation from other buried utilities.

Definitions

Developer - An individual, partnership, corporation or other legal entity intending to develop a tract of land for residential or other purposes which tract is proposed to be served by water facilities of the Guilford Water Authority.

Authority - the Guilford Water Authority, Franklin County, PA acting directly through its Board or through any agent, officer or employee duly authorized to act on its behalf.

Drawings or Plans- Collectively, all of the drawings or plans for the subdivision, or land development project approved by the municipality in which the project is located or in the alternative those drawings or plans approved by the Authority with respect to the proposed water facilities. This term shall include any supplementary drawings or plans issued by the Developer and approved by the Authority to provide clarification or additional details for the proposed facilities.

Engineer - the person or firm duly employed by the Authority to provide engineering services in its behalf. Such person or firm may provide construction observation and resident project representative services for the Authority in connection with the development project. The services may be performed by the Engineer directly or through its duly authorized agents, officers, or employees. At the Authority's sole discretion it may act in the role of the Engineer as the term is used throughout these Specifications.

Contractor - the person or firm engaged by the Developer to construct the proposed water facilities as shown on the Drawings or Plans or otherwise as part of the development project. The term includes the Contractor's agents, officers, and employees.

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SECTION 01 00 00 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Developer shall provide all labor, materials, equipment and services and perform all operations required for complete installation of all items and work in these Specifications and as indicated on the Drawings. Drawings shall be considered construction drawings approved by the Authority or its Engineer. No changes can be made to the approved drawings without the authorization of the Authority or its Engineer.

1.2 REFERENCED STANDARDS AND SPECIFICATIONS

- A. Standards and other publications referenced in these Specifications shall be of the issues in effect at time of construction of the project facilities.
- B. References are made to the Pennsylvania Department of Transportation specifications. Unless otherwise noted, the State specifications referred to are the Department of Transportation Publication 408 Specifications, as Amended. Reference in the State Specifications to 'State', 'Chief Engineer', or 'Department' shall be interpreted as the ENGINEER as herein defined. When particular articles or sections are referred to, all paragraphs other than those relating to measurement and payment shall apply.

1.3 WORK CONDITIONS

- A. Construct the work in stages to provide for public convenience.
 - 1. Do not close off public use of facilities until completion of one stage of construction will provide alternative usage.
- B. Conduct construction operations to ensure the least inconvenience to the general public.
- C. Take measures to control traffic when working on or near public roads and streets.
 - 1. Employ traffic control measures in accordance with Pennsylvania Department of Transportation Publication No. 213, "Work Zone Traffic Control".
- D. Restore existing paving outside the limits of the work that is damaged by the Developer's operations, to its original condition at the expense of the Developer.

Continuously keep rights-of-way, storage areas, streets, roads, highways and adjacent properties free from accumulations of waste materials, excess excavation, rubbish and windblown debris resulting from construction operations.

- E. Protection of Existing Utilities and Structures:

1. Notify Pennsylvania One Call by dialing 811 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. Mark area to be excavated with white paint. Renew notification every 10 days. The Contractor is solely responsible for the protection of existing utilities.
2. Advise each person in physical control of powered equipment or explosives 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 procedures to follow to prevent damage.
3. Immediately report to the Utility Company and to the Authority and its Engineer any break, leak or other damage to the lines or protective coatings made or discovered during the work and immediately alert the occupants of affected premises of any emergency created or discovered.
4. Allow free access to the site to Utility Company personnel at all times for purposes of maintenance, repair and inspection.
5. Notify County Control, all school districts affected, Franklin County EMA and Guilford Township if any interference with the normal flow of traffic will be caused by this work.
6. Developer must obtain a Road Occupancy Permit from Guilford Township if the work affects a Township road.

1.4 PENNDOT HIGHWAY OCCUPANCY PERMIT AND BONDS

- A. The Developer's attention is directed to Chapter 459, Occupancy of Highways by Utilities under Title 67 Transportation of the Pennsylvania Code. The Authority will be designated as the permittee. The Developer will pay the cost of the highway occupancy permit and the costs of inspection as required by PENNDOT. The Developer shall pay all other costs in connection with the highway occupancy permit or permits, including but not limited to all costs for special insurances and bonds and state inspectors.
- B. Bonds for construction to be performed in PennDOT right-of-ways will be held in force for the required maintenance period of two (2) years. This two (2) year period shall begin from the date of PennDOT's final inspection of the restoration

1.5 PERMITS

- A. The Developer will secure and pay the cost for the Department of Environmental Protection Public Water Supply permit, if applicable.
- B. The Developer shall secure and pay for all other permits required to comply with Federal, State, and local ordinances and regulations.
- C. The Developer shall obtain and pay for a Township Road Occupancy Permit when working on Township Roads.

PART 2 - PRODUCT (NOT USED)

PART 3 - EXECUTION

3.1 PROCEDURE

- A. Confer and verify with other contractors and Utility Companies as to locations and extent of their work, to the end that interferences and deletions between trades are prevented.

3.2 DEVELOPER'S USE OF PREMISES

- A. Confine construction equipment, the storage of materials and equipment, and operations of workmen to within the permanent and temporary rights-of-way.
- B. Pipeline materials may be stored appropriately along the route of the work provided such stored materials do not unduly restrict public use or infringe on private property.
- C. Assume full responsibility for materials stored on site.
- D. Transport materials remaining at the completion of the project to an acceptable storage area.

3.3 SEWER AND WATER MAIN SEPARATION

A. Horizontal Separation:

- 1. Sewers (sanitary and storm), including manholes, should be separated at least 10 feet, horizontally, from any existing or proposed water mains. Should local conditions prevent a lateral separation of 10 feet, a sewer may be closer than 10 feet to a water main if:
 - a. it is laid in a separate trench; or if
 - b. it is laid in the same trench with the water main located at one side of a bench of undisturbed earth; and if
 - c. the elevation of the top (crown) of the sewer is at least 18 inches below the bottom of the bottom (invert) of the water main.

B. Vertical Separation:

- 1. Whenever sewers cross under water mains, the top of the sewer shall be at least 18 inches below the bottom of the water main.
- 2. When the elevation of the sewer cannot be varied to provide the required 18" vertical separation, relocate the water main, for a distance of 10 feet extending on each side of the sewer, with one full length of water main centered over the sewer so that both joints will be as far from the sewer as possible. Water main should be constructed of AWWA slip-on or mechanical joint ductile iron pipe.
- 3. Sewers shall be constructed of AWWA mechanical joint cast iron pipe for any portion within 10 feet of the water main with the sewer joints equidistant from the water main and as far as possible from the water main joints. Both sewer and water main services shall be pressure tested to assure watertightness prior to backfilling. Where a water main crosses under a sewer, provide adequate structural support for the sewer to prevent damage to the water main.

- C. A minimum separation is required both horizontally and vertically between water mains and all other utilities (i.e. power lines, gas lines, etc.). Horizontal separation shall be five (5) feet. Vertical separation shall be 12 inches. Where it is not possible to achieve this 12 inches of separation minimum, the Developer must receive approval from the Authority.

3.4 SOIL EROSION AND SEDIMENTATION CONTROL PLAN

- A. The Developer is required to provide soil erosion and sedimentation control measures as indicated in the Soil Erosion and Sedimentation Control Plan from the Franklin County Conservation District which will be completed as necessitated by the nature or extent of the work. The Developer is responsible for obtaining approval of the Erosion and Sediment Control Plan including any associated costs. Approval must be obtained prior to starting work.

3.5 FIELD INSPECTION

- A. Field inspection will be required and provided by the Authority or its Engineer. Inspection will also include witnessing of testing. The Authority's Inspector shall have the authority to halt construction if, in his opinion, construction is not being done according to specifications. The approved design may not be altered without written approval of the Authority and/or its Engineer. A final inspection of all facilities is required before acceptance of flow or dedication of the facilities to the Authority. Any inspection costs incurred by the Authority will be the responsibility of the Developer.

3.6 SAFETY

- A. The Developer and Contractor are responsible for compliance with all laws, codes, and regulations relating to safety provisions at the construction site. The Authority and its representatives will not be responsible for the safety of construction personnel, persons visiting the site, or the general public nor will it be responsible for the enforcement of any laws, codes, or regulations relating to safety. Enforcement of safety regulations will be the responsibility of the appropriate agency.

END OF SECTION

SECTION 03 30 53**CONCRETE FOR UTILITY CONSTRUCTION****PART 1 GENERAL****1.1 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
 - 1. Cast-in-place Cement Concrete Construction
 - 2. Reaction and Support Blocking
 - 3. Cradles and Encasement
- B. Related Work specified elsewhere:
 - 1. Section 31 23 17 - Trenching, Backfilling, and Compacting

1.2 REFERENCES

- A. Pennsylvania Department of Transportation (PennDOT): Publication 408/2011 Specifications.
- B. All materials used in the PennDOT Road right-of-way must be from a certified PennDOT supplier.
- C. American Society for Testing and Materials (ASTM):
 - 1. ASTM A615 Deformed and Plain Billet - Steel Bars for Concrete Reinforcement
 - 2. ASTM C31 Methods of Making and Curing Concrete Test Specimens in the Field
 - 3. ASTM C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - 4. ASTM C42 Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 - 5. ASTM C94 Ready Mixed Concrete
 - 6. ASTM C143 Test Method for Slump of Portland Cement Concrete
 - 7. ASTM C172 Method of Sampling Fresh Concrete
 - 8. ASTM C173 Test Method for Air Content of Freshly Mixed Concrete - Volumetric Method
 - 9. ASTM C231 Test Method for Air Content of Freshly Mixed Concrete - Pressure Method

1.3 SUBMITTALS

- A. General: Submit in accordance with Section 01 30 00.
- B. Submit certification from the concrete producer attesting that the cement concrete conforms to the State Specifications for the class of concrete being used.
- C. Submit certified results of compressive strength tests performed by an independent testing laboratory.
- D. Submit detailed shop drawings of reinforcing steel.

PART 2 PRODUCTS**2.1 CEMENT CONCRETE**

- A. Ready-mixed, conforming to Section 704, cement concrete, Pub. 408/2011 Specifications.
- B. Requirements for State approved batch plants, design computations and plant inspection shall not apply; the acceptability of concrete will be based on conformance with the Cement Concrete Criteria specified below and the results of the specified tests.
- C. Cement Concrete Criteria:

1. Class A:
 - a. 28-day compressive strength: 3300 psi
 - b. Slump: 1 to 3 inches
 - c. Air content: 5% ± 1%
2. Class C:
 - a. 28-day compressive strength: 2000 psi
 - b. Slump: 2 to 6 inches
 - c. Air content: 5% ± 1%
3. High Early Strength:
 - a. 3-day compressive strength: 3000 psi
 - b. Slump: 1 to 3 inches
4. Cement Factor and Maximum Water-Cement Ratio conforming to Table A, Section 704.1(b), Pub. 408 Specifications.

2.2 REINFORCEMENT STEEL

- A. Reinforcement Bars:
 1. New billet-steel bars conforming to ASTM A615.
 2. Deformed, Grade 60.
- B. Steel Wire Fabric: Conforming to Section 709.3, Pub. 408/2011 Specifications.

PART 3 EXECUTION

3.1 GENERAL

- A. Comply with applicable paragraphs of Section 1001, Pub. 408 Specifications for construction requirements including formwork, curing, protection, and finishing of cement concrete.
- B. Excavate and shape trench bottoms and sides to accommodate thrust block forms and encasement.
- C. Support pipe, valves and fittings at the required elevation with brick or concrete block. Do not use earth, rock, wood, or organic material as supports.

3.2 CONSTRUCTION

- A. Construct cast-in-place miscellaneous reinforced structures of Class A concrete; Class A concrete shall be central-plant-mixed.
- B. Construct reaction and support blocking, cradles, encasements, and miscellaneous mass concrete of Class C concrete; Class C concrete may be from a mobile cement concrete plant or truck-mixed.
- C. Provide spacers, chairs, bolsters, ties and other devices for properly placing, spacing, supporting and fastening reinforcement in place.
- D. Place concrete utilizing all possible care to prevent displacement of pipe or fittings; return displaced pipe or fittings to line and grade immediately.
- E. Insure tie rods, nuts, bolts and flanges are free and clear of concrete.
- F. Do not backfill structures until concrete has achieved its initial set, forms are removed, and concrete work is inspected by the Engineer.
- G. Perform backfilling and compaction as specified in Section 31 23 17 - Trenching, Backfilling and Compacting.

3.3 FIELD TESTS OF CONCRETE DURING CONSTRUCTION

- A. Perform compressive strength, slump and air content tests for each 50 cubic yards of each class of structural concrete placed, or fraction thereof.
- B. Testing is not required for non-structural applications.
- C. Retain an independent testing laboratory to test cylinders.
- D. Keep a slump cone and an air meter in close proximity to all concrete placements.
- E. Sample concrete in accordance with ASTM C172.
- F. Determine slump in accordance with ASTM C143.
- G. Determine air content in accordance with ASTM C231 or ASTM C173 as applicable.
- H. Test Cylinders:
 - 1. Cast at least 5 cylindrical test specimens for each batch.
 - 2. Test two cylinders at 7 days; test two cylinders at 28 days.
 - 3. Hold the remaining cylinder in reserve for testing in the event that any of the other cylinders are damaged prior to testing.
 - 4. Prepare and cure test cylinders in accordance with ASTM C31.
 - 5. Determine concrete compressive strength in accordance with ASTM C39.
 - 6. Compute and evaluate in accordance with ASTM C94.
- I. If test cylinders fail to meet compressive strength requirements, the Engineer may require additional core tests in accordance with ASTM C42 at the expense of the Contractor.

END OF SECTION 03 30 53

**SECTION 31 11 00
CLEARING AND GRUBBING**

PART 1 GENERAL

1.1 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
- 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 rail, 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.

1.2 JOB CONDITIONS

- A. The Contractor may clear all obstructions within the permanent and construction rights-of-way or property except those specifically indicated on the Contract Drawings or specified to be saved or restored.
- B. Obstructions specifically designated to be saved or restored will be marked by the Engineer.

1.3 SUBMITTALS

- A. General: Submit in accordance with Section 01 30 00.
- B. Burning Permits: Submit two copies of each on-site burning permit if such permits are required by local jurisdictional authorities.
- C. Permits for Disposal of Debris:
 - 1. Arrange for disposal of debris resulting from clearing and grubbing to locations outside the Owner's property and obtain written agreements with the owners of the property where the debris will be deposited.
 - 2. Submit two copies of the agreement with each property owner releasing the Owner from responsibility in connection with the disposal of the debris.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Temporary Fencing:
 - 1. Temporary fencing shall be 6' high. Fencing shall be firmly attached to posts placed on 6 ft. centers. Posts shall have a 2 ft. depth of bury. Temporary fence shall be made of flexible high density orange polyethylene for maximum visibility and strength, two-inch square mesh design, non-conducting, non-toxic, and resistant to acid and corrosion.
- B. Wood Tree Guards:

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1. Wood posts: 2"x4
 2. Wood stringers: 2"x2"
- C. Wrapping Materials:
1. Burlap: AASHTO M182, Class 1
 2. Krinkle-kraft waterproof paper: 4" width
- D. Tree Wound Dressing: Antiseptic and waterproof, asphalt base.

PART 3 EXECUTION

3.1 PREPARATION

- A. Mark areas to be cleared, the areas to be grubbed, and items to be saved with stakes, flags, paint or plastic colored ribbon for the approval of the Engineer.
- B. Protect benchmarks, utilities, existing trees, shrubs and other landscape features designated for preservation with temporary fencing or barricades satisfactory to the Engineer.
- C. No material shall be stored or construction operation carried on within 4 feet of any tree to be saved or within the tree protection fencing.
- D. 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 owner to remove it, construct a supplemental fence, or make such other arrangements as may be necessary for security purposes; in 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.

3.2 UTILITY RELOCATIONS

- A. Inform utility companies, individuals and others owning or 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 PA One Call System Guidelines, Act 121, and Common Grounds Alliance Best Practices Manual.

3.3 CLEARING

- A. Confine clearing to within the permanent and construction rights-of-way or property.
- B. Fell trees in a manner that will avoid damage to trees, shrubs, and other installations which are to be retained.
- C. Where stumps are not required to be grubbed, flush-cut with ground elevation.

3.4 GRUBBING

- A. Grub areas within the construction limits to remove roots and other objectionable material to a minimum depth of 8".
- B. Remove all stumps within the cleared areas except those designated to be saved as indicated on the Contract Drawings.

3.5 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 Engineer for use in finish grading.
- B. The topsoil is the property of the Owner and shall not be used as backfill. Topsoil shall not be removed from the site unless otherwise authorized by Engineer.

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- C. Surplus topsoil shall become the property of the Contractor and shall not be used as backfill and removed from the project site.

3.6 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.
- 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.

3.7 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 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.
- D. Restore guard posts, guide rail, signs and other interferences to the condition equal to that existing before construction operations.

END OF SECTION 31 11 00

SECTION 31 23 17**TRENCHING, BACKFILLING, AND COMPACTING****PART 1 GENERAL****1.1 DESCRIPTION**

- A. The Work of This Section Includes, but is not limited to:
 - 1. Trench excavation, backfill and compaction
 - 2. Support of excavation
 - 3. Pipe bedding requirements
 - 4. Control of excavated material
 - 5. Restoration of unpaved surfaces
- B. Related Work Specified Elsewhere:
 - 1. Section 32 12 16 - Bituminous Paving
 - 2. Section 33 11 13 - Water Mains

1.2 QUALITY ASSURANCE

- A. Testing Agency: Density testing shall be performed by an independent soils testing laboratory engaged and paid for by the Contractor and approved by the Engineer.
- B. Referenced Standards:
 - 1. Pennsylvania Department of Transportation (PADOT):
 - a. Publication 408/2011 Specifications
 - b. Publication 213 Work Zone Traffic Control
 - c. Regulations Governing Occupancy of Highways by Utilities (67 PA Code, Chapter 459)
 - d. Pennsylvania Test Method, PTM 106
 - e. Pennsylvania Test Method, PTM402
 - 2. American Society for Testing and Materials (ASTM):
 - a. D698 - Test for Laboratory Compaction Characteristics of Soil Using Standard Effort
 - b. D1556 - Test for Density and Unit Weight of Soil in Place by the Sand Cone Method
 - c. D2922 - Test for Density of Soil and Soil Aggregate in Place by Nuclear Methods
- C. All materials used in the PADOT Road right-of-way must be from a certified PADOT supplier.
- D. Density Testing:
 - 1. Conduct a minimum of two tests per conduit/ductbank. Conduct one test in the lower half of the trench and one test in the upper half of the trench at locations as directed by the Engineer during backfilling operations. If any test fails, the Contractor shall take remedial steps to correct the compaction and rerun the test until compliance with the density requirements are shown. A density test that fails does not count toward the number of tests to be taken. The cost of the initial test and any required retesting is the responsibility of the Contractor.
 - 2. Determine density by ASTM D1556 or ASTM D2922.

1.3 SUBMITTALS

- A. General: Submit in accordance with Section 01 30 00.
- B. Certificates:
 - 1. Submit, prior to delivery of the material to the job site, a Statement of Compliance from the materials supplier, together with supporting data, attesting that the composition analysis of pipe

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- bedding and select material stone backfill materials meets specification requirements. Should a change in source of materials be made during construction, submit a new Statement of Compliance from the new source for approval before the material is delivered to the job site.
2. Submit certified density testing results from the soils testing laboratory.
- C. Compaction Equipment List: Submit a list of all equipment to be utilized for compacting, including the equipment manufacturer's lift thickness limitations.
- D. Agreements with Property Owners: Prior to storing or disposing of excavated materials on private property, submit a copy of the written agreement with the property owner.

1.4 JOB CONDITIONS

- A. Classification of Excavation: See Section 01 00 00 - General Requirements.
- B. Control of Traffic: Employ traffic control measures in accordance with Pennsylvania Department of Transportation Publication 213, "Work Zone Traffic Control".
- C. 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 121 of the General Assembly of Pennsylvania, PA One Call System and Common Grounds Alliance Best practices Manual, advise 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 and suggestions for procedures to avoid damage to its lines.
 2. Advise each person in physical control of powered equipment or explosives used in excavation or demolition work of the type and location of utility lines at the job site, the Utility assistance to expect, and procedures to follow to prevent damage.
 3. Immediately report to the Utility and the Engineer 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 personnel at all times for purposes of maintenance, repair and inspection.
- D. Department of Environmental Protection Bureau of Land Recycling and Waste Management - Clean Fill Policy:
1. See Department of Environmental Protection Bureau of Land Recycling and Waste Management Document No. 258-2182-773, Section 00 73 00.40 of these specifications.
 2. Imported Fill: The Contractor will perform environmental due diligence to determine whether imported fill is clean or regulated as specified in DEP Clean Fill Policy. The Contractor will manage the fill following the guidelines of the policy including the furnishing of any certifications, testing or permits that may be required. Testing that may be required shall be included in the Contractor's Base Bid.
 3. Exported Fill: The Contractor will perform environmental due diligence and testing to determine that the excavated material scheduled to be spoiled off site qualifies as clean fill under DEP Clean Fill Policy. Should materials be uncovered that are suspected of being other than clean fill, the Contractor will immediately notify the Owner. Testing requirements shall be included in the Contractor's Base Bid. If evidence of release of regulated substance is found, material shall be disposed of as regulated fill and will be paid for by Change Order.

PART 2 PRODUCTS

2.1 PIPE BEDDING MATERIAL

- A. Type II Pipe Bedding Material for ductile iron pipe: Crushed stone or gravel aggregate conforming to AASHTO No. 8 as specified in Section 703.2, Publication 408/2011 Specifications.

- B. Fine Aggregate Sand for Type IV Bedding of Copper Pipe: Natural or manufactured sand consisting of hard, durable, and uncoated inert particles conforming to Section 703.1, Publication 408/2011 Specifications.

2.2 BACKFILL MATERIAL

- A. Coarse Aggregate Backfill: Crushed stone or gravel aggregate conforming to Subbase (2A), Section 703.2, Publication 408/2011 Specifications.
- B. Suitable Backfill Material (Paved Areas):
 - 1. From top of pipe bedding material to subgrade elevation:
 - a. Select Material Stone Backfill as specified in paragraph 2.2.A.
- C. Suitable Backfill Material (Non-Paved Areas):
 - 1. From top of pipe bedding material to 24 inches over top of pipe:
 - a. Material excavated from the trench if free of stones larger than 2 inches in size and free of wet, frozen, or organic materials.
 - 2. From 24 inches above pipe to subgrade elevation:
 - a. Material excavated from the trench if free of stones larger than 8 inches in size and free of wet, frozen, or organic materials.
- D. Unsuitable Backfill Material: 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 select material stone backfill as specified in paragraph 2.2.A or suitable foreign backfill material.

PART 3 EXECUTION

3.1 MAINTENANCE AND PROTECTION OF TRAFFIC

- A. Coordinate the work to ensure 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.

3.2 CUTTING PAVED SURFACES

- A. Where excavation includes 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. Saw cut concrete surfaces; saw cut other hard surfaces or make straight cuts with jackhammer. No paving shall be broken except that which has been previously cut.
- B. Protect edges of cut pavement during excavation to prevent raveling or breaking; square edges prior to pavement replacement.

3.3 BLASTING

- A. No blasting will be permitted.

3.4 TRENCH EXCAVATION

- A. Topsoil Stripping and Stockpiling: Strip topsoil encountered during trench excavation to its full depth and stockpile for reuse.
- B. Depth of Excavation:
 - 1. Pressure Pipelines:
 - a. Excavate trenches to the minimum depth necessary to place required pipe bedding material and to provide 4' from the top of the pipe to the finish ground elevation, except where specific depths are otherwise indicated on the Contract Drawings.
 - b. 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 concrete cradle is to be installed, refill the trench to required pipeline grade with pipe bedding material.
 - c. Where the Contractor, by error or intent, excavates beyond the minimum required depth, backfill the trench to the required pipeline grade with pipe bedding material.
- C. Width of Excavation:
 - 1. Excavate trenches to a width necessary for placing and jointing the pipe and for placing and compacting bedding and backfill around the pipe.
 - 2. Shape trench walls completely vertical from trench bottom to at least 24 inches above the top of the pipe.
 - 3. For pressure pipeline fittings, excavate trenches to a width that will permit placement of concrete thrust blocks. Provide earth surfaces for thrust blocks that are perpendicular to the direction of thrust and are free of loose or soft material.
 - 4. Where rock is encountered in the sides of the trench, remove the rock to provide a minimum clearance between the pipe and rock of 6 inches.
- D. Length of Open Trench: Do not advance trenching operations more than 400 feet ahead of completed pipeline except as specified in the State Highway Regulations, Section 00 73 00.15.

3.5 SUPPORT OF EXCAVATION

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

3.6 CONTROL OF EXCAVATED MATERIAL

- A. Keep the ground surface within a minimum of 2 feet of both sides of the excavation free of excavated material.
- B. 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.
- 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 watercourses. Where necessary, provide temporary channels to allow the flow of water either along or across the site of the work.

- D. Provide temporary barricades to prevent excavated material from encroaching on private property, walks, gutters, and storm drains.
- E. Do not place or store excavated material on private property without a written agreement signed by the property owner.

3.7 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. Prevent trench water from entering pipelines under construction.
- C. Intercept and divert surface drainage away from excavations. Maintain storm drainage facilities, gutters, and natural surface watercourses open and in operation. Provide and install temporary facilities to maintain excavations free of water as required. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water. When mechanical equipment is utilized to control water conditions, provide and maintain sufficient standby units on-site.
- D. Comply with Federal, State and Local requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control. Comply with the Sedimentation and Erosion Control Plan.

3.8 PIPE BEDDING REQUIREMENTS

- A. Type II Bedding:
 - 1. Depth of bedding material aggregate as shown on the Contract Drawings.
 - 2. Provide Type II bedding as minimum for all pipe materials except plastic pipe, unless otherwise authorized by the Engineer.
 - 3. When using RC pipe, Type II bedding material is limited to the depths indicated in the load tables shown on the Contract Drawings.
- B. 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.

3.9 PIPE LAYING

- A. Lay pipe as specified in the appropriate Section of these Specifications for pipeline construction.

3.10 THRUST RESTRAINT

- A. Provide pressure pipe with concrete thrust blocking or restrained joint fittings at all bends, tees, valves, and changes in direction, in accordance with the Specifications, Contract Drawings and Standard Details 5195 and 5196.

3.11 BACKFILLING TRENCHES

- A. After pipe installation and inspection, backfill trenches from trench bottom or from the top of pipe bedding material, whichever is greater, to 12 inches above the crown of the pipe with specified backfill material hand placed and carefully compacted with hand-operated mechanical tampers in layers of suitable thickness to provide specified density around and under the haunches of the pipe. Backfill and compact the remainder of the trench with specified backfill material.
- B. Exposed Joints for Testing

-
1. The Contractor has the option to test the pipe prior to backfilling the trench. If this option is selected, install reaction blocks where required and place 2 feet of thoroughly compacted backfill over the pipe leaving pipe joints partially exposed.
 2. If the Contractor elects to completely backfill the trench prior to testing, he shall be responsible for locating and uncovering leaks which may cause the test to fail.
- C. Lift Thickness Limitations:
1. 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 density is not obtained, the Contractor shall, at his own expense, remove, replace, and retest as many times as is required to obtain the specified density.
 2. Compact each layer of backfill to 95 percent of the standard proctor maximum dry density as determined by ASTM D698 in load bearing areas and 90 percent in non-load bearing areas.
 3. Lift thickness limitations specified for state highways, shoulders, or embankments govern over the compaction equipment manufacturer's recommendations.
 4. Notwithstanding the specified requirements for trench backfill compaction, trenches that settle below the surrounding grade prior to final completion shall be filled to surrounding grade level with appropriate materials.

3.12 DISPOSAL OF EXCAVATED MATERIAL

- A. Excavated material remaining after completion of backfilling shall remain the property of the Contractor, removed from the construction area and legally disposed.

3.13 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 32 92 00, Finish Grading and Seeding.

END OF SECTION 31 23 17

SECTION 32 92 00**FINISH GRADING AND SEEDING****PART 1 GENERAL****1.1 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. Maintenance
- B. The "Seeding Restoration Table" at the end of this section lists specific seeding restoration requirements.
- C. Related Work specified elsewhere:
 - 1. Section 31 23 17 - Trenching, Backfilling, and Compacting

1.2 QUALITY ASSURANCE

- A. 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.
- B. Collect soil samples under the direction of the Engineer.
- C. Reference Standards:
 - 1. Pennsylvania Department of Transportation (PADOT); Publication 408 Specifications.
 - 2. Pennsylvania Seed Act of 1965, Act 187, as Amended.
 - 3. Pennsylvania Soil Conditioner and Plant Growth Substance Law, Act of December 1, 1977, P.L. 258, No. 86(3P.S.68.2), as Amended.
 - 4. Pennsylvania Agricultural Liming Materials Act of 1978, P.L. 15, No. 9(3P.S.132-1), as Amended.
 - 5. Rules for Testing Seeds of the Association of Official Seed Analysts.
- D. All materials used in the PADOT road right-of-way must be from a certified PennDOT supplier.

1.3 SUBMITTALS

- A. General: Submit in accordance with Section 01 30 00.
- B. Certificates:
 - 1. Prior to use or placement of material, submit a Statement of Compliance, Section 00 62 33.14, from the materials suppliers, together with supporting data, attesting that the composition of the following products meets specification requirements.
 - a. Fertilizer - Analysis content and percent of each.
 - b. Lime - Analysis content and percent of each.
 - c. Seed mixture(s) - State percentage of mixtures, purity, germination and maximum weed seed content of each grass mixture.
 - 2. Submit certified soil sample analyses, including laboratory's recommended soil supplement formulation, topsoil analysis - State pH, texture, organic content, and macro nutrients.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Seed:

1. Deliver seed fully tagged and in separate packages according to species or seed mix.
2. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

PART 2 PRODUCTS

2.1 TOPSOIL

- A. All topsoil stripped from the site and stockpiled may be reused provided the following requirements are met:
1. Have a pH of between 6.0 and 7.0; contain not less than 2 percent nor more than 10 percent organic matter as determined by AASHTO T194.
 2. 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.
 3. Free of clods, grass, roots, or other debris harmful to plant growth. Free of pests, pest larvae, and matter toxic to plants.

2.2 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.
- B. Percentage of pure seed present shall represent freedom from inert matter and from other seeds distinguishable by their appearance.
- C. All seeds will be subject to analysis and testing.
- D. Seed mix in accordance with Seeding Restoration Table.
- E. Individual species comprising 20 percent or less of the total seeding mixture may be of one variety. All varieties utilized shall have a mean quality rating of 7.0 or higher as listed in Table 1, for the Pennsylvania, University Park, high maintenance test plot, the USDA National Turfgrass Evaluation Program.

TABLE 1 - GRASS AND AGRICULTURAL SEEDS

<u>Individual Species</u>	<u>Minimum Guaranteed Purity (Percent)</u>	<u>Maximum Weed Seed (Percent)</u>	<u>Minimum Guaranteed Germination (Percent)</u>
Kentucky Bluegrass (<i>Poa pratensis</i>) min. 21 lb. per bushel	98	0.20	80
Perennial Ryegrass (<i>Lolium perenne</i>)	98	0.15	90
Tall Fescue (<i>Festuca arundinacea</i>)	98	0.15	85
Crownvetch (<i>Coronilla varia</i>)	99	0.10	70
Red Fescue (<i>Festuca rubra</i>)	98	0.15	85

Timothy (<i>Phleum pratense</i>)	98	0.25	95
Birdsfoot Trefoil Mixture (<i>Lotus corniculatus</i>) A mixture of 1/2 Viking & 1/2 of either Empire, Nocen, or Leo	98	0.10	80

Redtop (<i>Agrostis alba</i>)	92	0.15	80
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2.3 FERTILIZER

- A. Liquid formulations may be used in lieu of dry formulations, provided the rate of application is adjusted to apply the same quantities of nitrogen, phosphorus and potassium per unit area as specified for dry formulations.
- B. Basic Dry Formulation Fertilizer: Analysis 0-20-20 and as defined by the Pennsylvania Fertilizer Law.
- C. Starter Fertilizer: Analysis 10-5-5 or 12-6-6 and 12-18-10 or 18-24-10 as defined by the Pennsylvania Fertilizer Law.
- D. Contractor must submit soils samples to an approved laboratory for fertilizing recommendations. Recommendations shall be submitted to Owner for his review and decision relating to modifying the application rate as shown on the Seeding Restoration Table.

2.4 LIME

- A. Pulverized agricultural limestone conforming to Section 804.2(a), Publication 408 Specifications.
- B. Provide all lime in accordance with application rates shown in the Seeding Restoration Table, or as recommended by the soil test laboratory.

2.5 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.

2.6 EROSION CONTROL FABRIC

- A. Shall be a knitted construction of yarn with uniform openings interwoven with strips of biodegradable paper, furnished in rolls with 4-mil opaque polyethylene base as protection for outdoor storage.
- B. Fabric 0.2 pound per square yard.

2.7 JUTE MATTING

- A. Shall be heavy weight, minimum 0.9 pound per square yard, jute mesh with 1 inch opening.

2.8 FABRIC/MATTING ANCHORS

- A. Staples for fastening fabric to ground shall be minimum 11 gauge wire, "U" shaped, with a 1 inch crown and 6 inch legs.

2.9 MULCHING MATERIALS

- A. Mulches for seeded areas shall be one, or a combination, of the following:
 - 1. Wheat or oat straw; thoroughly threshed.
 - a. Cured to less than 20 percent moisture content by weight.
 - b. Containing no stems of tobacco, soybeans, or other coarse or woody material, free of mature

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- seed bearing stalks or roots of prohibited or noxious weeds.
2. Wood Cellulose:
 - a. Containing no growth or germination-inhibiting substances.
 - b. Green-dyed and air-dried.
 - c. Packages not exceeding 100 pounds.
 - d. Moisture Content: 12 percent \pm 3 percent
 - e. Organic Matter (Dry oven basis): 98.6 percent \pm 0.2 percent
 - f. Ash Content: 1.4 percent \pm 0.2 percent
 - g. Minimum Water-Holding Capacity: 100 percent
 - B. Mulch Binders:
 1. Emulsified Asphalt AASHTO M140, Grade SS-1
 2. Cut Back Asphalt AASHTO M81, RC 250
 3. Nonasphaltic Emulsion - Natural Vegetable Gum Blended with Gelling and Hardening Agents
 4. Polyvinyl Acetate Emulsion Resin, Containing 60 percent (+ 1 percent) Total Solids by Weight

PART 3 EXECUTION

3.1 TIME OF OPERATIONS

- A. Conduct seeding operations during the times specified in the Seeding Restoration Table.

3.2 PREPARATION OF SUBGRADE

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

3.3 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 4 inches.
- B. Roller weighing over 120 pounds per foot of width shall not be used for compaction.
- C. Remove all materials unsuitable or harmful to plant growth, and legally dispose off site.
- D. Do not place topsoil when the subgrade is frozen, excessively wet, or extremely dry; do not handle topsoil when frozen or excessively wet.
- E. Finish surface of topsoil shall be smooth, even and true to lines and grades with no ponding areas.

3.4 TILLAGE

- A. After seed bed areas have been brought to proper compacted elevation, thoroughly loosen to a minimum depth of 5 inches by discing, harrowing, or other approved methods.
- B. Do not work topsoiled areas when frozen or excessively wet.
- C. Liming:
 - 1. Distribute limestone uniformly at the rate indicated by the soil test.
 - 2. Thoroughly incorporate into the topsoil to a minimum depth of 4 inches as a part of the tillage operation.
- D. Basic Fertilizer:
 - 1. Distribute basic fertilizer uniformly at the rate indicated by the soil test.
 - 2. Incorporate into soil to depth of 4 inches by approved methods as part of tillage operation.

3.5 FINISH GRADING

- A. Remove unsuitable material larger than 1 inch in any dimension.
- B. Uniformly grade surface to the required contours without the formation of water pockets.
- C. Distribute starter fertilizer at the rates indicated on the Seeding Restoration Table, or as recommended by the soil test laboratory.
- D. Incorporate starter fertilizer into the upper 1 inch of soil.

3.6 SEEDING

- A. Uniformly sow specified seed mix by use of approved hydraulic seeder, power-drawn drill, power-operated seeder or hand-operated seeder.
- B. Do not seed when winds are over 15 miles per hour.
- C. Upon completion of seed covering, roll the area with a roller, exerting a maximum force of 65 pounds per foot width of roller.

3.7 MULCHING

- A. Mulch within 48 hours of seeding.
- B. Place straw mulch in a continuous blanket at a minimum rate of 1,200 pounds per 1,000 square yards.
- C. Anchor straw mulch by use of twine, stakes, wire staples, plastic nets, or asphalt or chemical mulch binder. Apply binders by the manufacturer's method and rate.
- D. Apply wood cellulose fiber hydraulically at a rate of 320 pounds per 1,000 square yards; incorporate as an integral part of the slurry after seed and soil supplements have been thoroughly mixed.
- E. Protect structures, pavements, curbs, and walls to prevent asphalt staining.
- F. Do not spray asphalt and chemical mulch binders onto any area within 100 feet of a stream or other body of water.

3.8 MAINTENANCE

- A. Contractor shall be responsible for maintenance of seeded work.

- B. Maintenance includes watering, weeding, two initial mowings, cleanup, edging, and repair of washouts or gullies.
- C. Keep seeded areas moist to a depth of 3 inches for a period of 14 days following seeding.
- D. Those areas which do not show a prompt catch of grass within 24 days of seeding shall be reseeded until complete grass catch occurs.
- E. When the grass reaches an average height of three inches, cut to a height of two inches; irregularities or depressions which show up at this time shall be leveled and reseeded.
- F. Contractor's maintenance shall continue until all areas are grassed and free from bare spots or off-color areas, and turf areas are accepted.

SEE ATTACHED SEEDING RESTORATION TABLE

SEEDING RESTORATION TABLE

<u>Restoration Condition</u>	<u>Topsoil</u>	<u>Lime*</u>	<u>Basic Fertilizer</u>	<u>Starter Fertilizer</u>	<u>Seed Mix & Sowing Rate (% by Weight)</u>
Temporary Cover**	N/A	N/A	N/A	N/A	100% Annual Ryegrass, Sow 9 lb. per 1,000 sq. yd. Mar thru May/Aug thru Sept
Roadside, Non-Mowed	Yes	100 lb. per 1,000 sq. ft.	No	10-5-5 at 50 lb. per 1,000 sq. ft. <u>or</u> 12-6-6 at 33 lb. per 1,000 sq. ft.	80% Kentucky 31 Fescue 20% Pennlawn Red Fescue Sow 21 lb. per 1,000 sq. yd. Mar thru May/Aug thru Sept
Roadside, Mowed	Yes	100 lb. per 1,000 sq. ft.	No	10-5-5 at 50 lb. per 1,000 sq. ft. <u>or</u> 12-6-6 at 33 lb. per 1,000 sq. ft.	50% Kentucky Bluegrass 30% Pennlawn Red Fescue 20% Perennial Ryegrass Sow 21 lb. per 1,000 sq. yd. Mar thru May/Aug thru Sept
Bank Areas, Steeper than 3:1 Slopes	Yes	100 lb. per 1,000 sq. ft.	No	12-18-10 at 18 lb. per 5,000 sq. ft. <u>or</u> 18-24-10 at 20 lb. per 5,000 sq. ft.	45% Crownvetch 55% Annual Ryegrass Sow 9 lb. per 1,000 sq. yd. Any time except Sept-Oct
Lawns	Yes	100 lb. per 1,000 sq. ft.	0-20-0 50 lb. per 1,000 sq. ft.	12-18-10 at 18 lb. per 5,000 sq. ft. <u>or</u> 18-24-10 at 20 lb. per 5,000 sq. ft.	50% Kentucky Bluegrass 30% Pennlawn Red Fescue 20% Perennial Ryegrass Sow 21 lb. per 1,000 sq. yd. Mar thru May/Aug thru Sept
Fields and pasture, Non-Cultivated	No	No	No	10-5-5 at 50 lb. per 1,000 sq. ft. <u>or</u> 12-6-6 at 33 lb. per 1,000 sq. ft.	100% Timothy Sow 9 lb. per 1,000 sq. yd. Mar thru May/Aug thru Sept

Fields, Cultivated	No	No	No	10-5-5 at 50 lb. per 1,000 sq. ft. or 12-6-6 at 33 lb. per 1,000 sq. ft.	100% Annual Ryegrass Sow 9 lb. per 1,000 sq. yd. Mar thru May/Aug thru Sept
Woods, Sparse	No	No	No	10-5-5 at 50 lb. per 1,000 sq. ft. or 12-6-6 at 33 lb. per 1,000 sq. ft.	100% Red Fescue Sow 36 lb. per 1,000 sq. yd. Mar thru May/Aug thru Sept
Woods, Dense	No	No	No	No	Stabilize soil with biodegradable netting and paper fabric material

*Unless lesser rate indicated by soils tests

END OF SECTION 32 92 00

SECTION 33 05 23**BORING AND JACKING****PART 1 GENERAL****1.1 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
 - 1. Approach trench excavation
 - 2. Installation of casing pipe
 - 3. Installation of carrier pipe
- B. Related Work specified elsewhere:
 - 1. Section 31 23 17 - Trenching, Backfilling, and Compacting

1.2 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. ASTM A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 2. ASTM C144 - Specification for Aggregate for Masonry Mortar
 - 3. ASTM C150 - Specification for Portland Cement
 - 4. ANSI/AWWA - Ductile Iron Pipe, Centrifugally Cast for Water or C151/A21.51 Other Liquids
- B. Construction operations shall be undertaken only by a contractor well experienced in operations of similar magnitude and having had similar experience boring and jacking under transportation arteries and under surface areas which cannot be disturbed.
- C. Design Criteria:
 - 1. Pipe and joints of leakproof construction design for the earth and/or other pressures present, plus railway E80 live loading with the associated recommended impact loading.
 - 2. Design bracing, backstops, and use 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.
- D. Allowable Tolerances:
 - 1. Do not overcut excavation by more than one inch 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.
 - 3. Maintain a minimum one inch design clearance between casing spacer runner outside diameter and the casing inside diameter.
- E. Reference Codes and Specifications:
 - 1. Comply with applicable Federal, State and local ordinances, codes, statutes, rules and regulations, and affected jurisdictional bodies.
 - 2. Pennsylvania Department of Transportation (PennDOT): Publication 408 Specifications, as amended.

1.3 SUBMITTALS

- A. General: Submit in accordance with Section 01 30 00.
- B. Certificates: Submit certification from materials manufacturers attesting that the materials provided and installed conform to specification requirements.

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- C. Submit history of previous work completed of equivalent nature and scope. Include qualification and experience of key personnel.
 - D. Submit description of proposed construction methods, including methods to establish and maintain vertical and horizontal alignment.

1.4 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 and jacking under roads, public rights-of-way, and railroads, comply with applicable right-of-way occupancy permits.
- C. If boring is obstructed, relocate or jack crossing as approved by the Engineer.

PART 2 PRODUCTS

2.1 STEEL CASING PIPE

- A. ASTM A53; Grade 8, Black, Asphalt Coated; minimum thickness as shown on the Contract Drawings inches; minimum yield strength 35,000 psi.
- B. Coat pipe, inside and outside, with a petroleum asphaltic coating one mil thick; coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun and adhere to pipe.
- C. Full circumference welded joints.
- D. Diameter and wall thickness as indicated on the Contract Drawings.

2.2 CARRIER PIPE

- A. Ductile iron, ANSI/AWWA C151/A21.51, class as indicated on the Contract Drawings.

2.3 CASING SPACERS

- A. Non-Metallic Casing Spacers:
 1. Casing spacers shall be all non-metallic (polypropylene), molded in segments for field assembly without any special tools. Spacer segments shall be secured around carrier pipe by insertion of a Slide-Lock. The casing spacer polymer shall contain ultraviolet inhibitors and shall have a minimum compressive strength of 3,000 psi, an 800 Volts/mil dielectric strength and impact strength of 1.5 ft-lbs./inch. Each casing spacer shall have full length, integrally molded skids extending beyond the bell or mechanical joint of the carrier pipe.
 2. The casing spacers shall be the PSI Ranger II® Casing Spacers as manufactured by Pipeline Seal and Insulator, Inc., Houston, Texas, or equal.

Carrier Pipe Diameter Inches	Model Number
0.83 to 3.07"	Micro
2.48 to 5.51"	Mini
5.51 to 16.65"	Midi
16.77 to 25.98"	Medi
25.98 to 37.60"	Maxi

2.4 SAND (FINE AGGREGATE)

- A. AASHTO M6, Latest Edition

2.5 GROUT

- A. One part portland cement (ASTM C150) and 6 parts mortar sand (ASTM C144) mixed with water to a consistency applicable for pressure grouting.

2.6 END SEALS

- A. After insertion of the carrier pipe into the casing, the ends of the casing shall be closed by installing 1/8 inch thick synthetic rubber end seals, as manufactured by Pipeline Seal and Insulator, Inc., Advance Products & Systems, Inc., or equal.

2.7 STONE DUST

- A. AASHTO #10, crushed stone dust, 3/8 inch top size.

PART 3 EXECUTION**3.1 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 one foot above top of casing.
- D. Install adequate excavation supports as specified in Section 31 23 17, Trenching, Backfilling and Compacting.

3.2 CASING PIPE INSTALLATION METHODS

- A. Boring:
 1. Push the pipe into the ground with a boring auger rotating within the pipe to remove the soil.
 2. 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.
 3. The machine bore and cutting head arrangement shall be removable from within the pipe.
 4. Arrange the face of the cutting head to provide a barrier to the free flow of soft material.
 5. 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.
 6. 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.

3.3 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 dry subgrade, approved by the Engineer, for the prosecution of subsequent operations.
- C. Comply with Federal and State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

3.4 PRESSURE GROUTING

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

3.5 CARRIER PIPE INSTALLATION

- A. All provisions regarding cleaning, inspection and handling specified under pipe material sections apply to this work.
- B. 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 casing spacers to barrel of carrier pipe; do not rest carrier pipe on bells.
- D. Casing spacers shall be spaced a maximum of eight feet apart along the length of the carrier pipe with one casing spacer within two feet of each side of a pipe joint and the rest evenly spaced.
- E. After the carrier pipe has been installed in the encasing pipe and has been tested, fill the encasing pipe with stone dust.
 - 1. Install end seals in accordance with manufacturer's instructions.

END OF SECTION 33 05 23

SECTION 33 11 13**WATER MAINS****PART 1 GENERAL****1.1 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
 - 1. Water Distribution Lines and Fittings
- B. Related Work specified elsewhere:
 - 1. Section 03 30 53 - Concrete for Utility Construction
 - 2. Section 31 23 17 - Trenching, Backfilling & Compacting
 - 3. Section 33 12 19 - Valves and Fire Hydrants
 - 4. Section 33 12 13 - Water Service Connections
 - 5. Section 33 13 00 - Testing & Disinfecting Water Mains

1.2 REFERENCES

- A. American National Standards Institute (ANSI)/ American Water Works Association (AWWA):
 - 1. ANSI/AWWA C104/A21.4 Cement Mortar Lining for Ductile Iron and Gray Iron Fittings for Water
 - 2. ANSI/AWWA C110/A21.10 Ductile Iron and Gray Iron Fittings, 3" Through 48", for Water and Other Liquids
 - 3. ANSI/AWWA C111/A21.11 Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
 - 4. ANSI/AWWA C150/A21.50 Thickness Design of Ductile Iron Pipe
 - 5. ANSI/AWWA C600 Installation of Gray and Ductile Cast Iron Water Mains and Appurtenances
- B. NSF International:
 - 1. NSF 61 Drinking Water System Components
 - 2. NSF 372 Lead Content Certification

1.3 SUBMITTALS

- A. General: Submit in accordance with Section 01 30 00.
- B. Submit manufacturers' 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.
- C. Submit a Statement of Compliance, together with supporting data, from the materials suppliers of each type of pipe, fitting, gasket, lubricant or other joint materials attesting that each of the products provided meets or exceeds specifications requirements.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Do not place materials on private property without written permission from the property Owner.
- B. During loading, transporting and unloading, exercise care to prevent damage to materials.
- C. Do not drop pipe or fitting.
- D. Avoid shock or damage at all times.

- E. Use padded slings, hooks and tongs to prevent damage to the exterior surface or internal lining of the pipe.
- F. Pipe may be strung along alignment where approved by the Engineer.
- G. Do not stack higher than Maximum Stacking Heights shown in AWWA C600 or as recommended by the pipe manufacturer.
- H. Keep interior of pipe and fittings free from dirt or other foreign matter.
- I. 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

2.1 PIPE, FITTINGS AND JOINTS

- A. Ductile Iron:
 - 1. Pipe, ANSI/AWWA C150/A21.50; standard cement mortar lining, ANSI/AWWA C104/A21.4, outside coated.
 - a. Pipe - 3" to 12": Minimum Class 52, Pressure Class - 350 psi
 - 2. Ductile Iron Fittings:
 - a. ANSI/AWWA C110/A21.10; psi pressure rating to match above and to be cement mortar lined and outside coated as for ductile iron pipe.
 - 3. Joints:
 - a. Mechanical or Push-on Joints conforming with ANSI/AWWA C111/A21.11.
 - b. Flanged Joints conforming with ANSI/AWWA C110/A21.10.

PART 3 EXECUTION

3.1 EXCAVATION

- A. Excavate trenches as specified in Section 31 23 17 - Trenching, Backfilling and Compacting.
- B. Provide at least 4' - 0" of cover from the top of the pipe to the finished grade elevation.

3.2 PIPE BEDDING

- A. Shape recesses for the joints or bell of the pipe by hand.
- B. Assure that the pipe is supported on the lower quadrant for the entire length of the barrel.

3.3 PIPE LAYING

- A. Clean and inspect each length of pipe or fitting before lowering into the trench.
- B. Do not lower pipe into the trench except that which is to be immediately installed.
- C. Lay pipe to a uniform line with the barrel of the pipe resting solidly in pipe bedding material throughout its length.
- D. Excavate recesses in pipe bedding material to accommodate joints, fittings, and appurtenances.
- E. Do not subject pipe to a blow or shock to achieve solid bearing or grade.
- F. Lay each section of pipe in such a manner as to form a close concentric joint with adjoining section and to avoid offsets.

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- G. 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.
 - H. Grade Check:
 - 1. Check each pipe installed as to line and grade in place.
 - 2. Correct deviations immediately.
 - 3. Deflection of pipe joints in excess of maximum recommended by manufacturer will be cause for rejections.
 - I. Install fittings and valves as pipe laying progresses; do not support weight of fittings and valves from pipe.
 - J. 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.
 - K. Backfill concurrently with pipe laying to hold installed pipe in place.
 - L. Install detectable utility marking tape above all plastic pressure pipeline, 12" to 18" below final grade.
 - M. Push-on Joints:
 - 1. Clean the inside of the bell and the outside of the spigot.
 - 2. Insert rubber gasket into the bell recess.
 - 3. Apply a thin film of gasket lubricant to either the inside of the gasket or the spigot end of the pipe, or both.
 - 4. Insert the spigot end of the pipe into the socket using care to keep the joint from contacting the ground.
 - 5. Complete the joint by forcing the plain end to the bottom of the socket.
 - 6. Mark pipe that is not furnished with a depth mark before assembly to assure that the spigot is fully inserted.
 - N. Mechanical Joints:
 - 1. Wash the socket and plain end.
 - 2. Apply a thin film of lubricant.
 - 3. Slip the gland and gasket over the plain end of the pipe.
 - 4. Apply lubricant to gasket.
 - 5. Insert the plain end of the pipe into the socket and seat the gasket evenly in the socket.
 - 6. Slide the gland into position, insert bolts, and finger-tighten nuts. Tighten bolts, 180-degrees apart alternately, to uniform tightness.
 - 7. Coat all bolts and nuts with bitumastic paint after installation.
 - O. Coupled Joints: Assemble in accordance with manufacturer's recommendations.

3.4 CUTTING PIPE

- A. Cut pipe without damaging pipe or lining.
- B. Grind cut ends and rough edges smooth.
- C. Bevel end for push-on joints.
- D. Do not field cut reinforced concrete pipe; provide special lengths to make up distances shown.

3.5 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: Per manufacturer's recommendations.

3.6 THRUST RESTRAINT

- A. Provide pressure pipeline with restrained joints or concrete thrust blocking at all bends, tees, and changes in direction.
 - 1. Construct concrete thrust blocking as shown on the Contract Drawings.
 - 2. If restrained joints are utilized, submit design calculations showing determination of restrained lengths and submit joint restraint details. Method of joint restraint shall utilize devices specifically designed for the application for which manufacturer's data is available for the application. Submit manufacturer's literature for approval.
- A. Internal Trim Parts: Stainless Steel.

3.7 SPECIAL CONDITIONS

- A. Connections:
 - 1. Wherever an existing water main is to be cut and closed, or extended or connected to the proposed new line, construct connections as shown on the Contract Drawings.
 - 2. Provide seven (7) days notice to the Authority prior to making connections to an existing water main.
 - 3. For connecting pipe of different materials, use transition fittings as recommended by the manufacturer and approved by the Authority.
- B. Stream Crossings:
 - 1. Install water mains crossing streams in accordance with requirements of all permitting agencies and as approved by the Authority.
 - 2. Provide a valve with valve box on each side of the stream in an accessible location.
- A. Highway Crossings:
 - 1. Install water mains crossing highways as approved by PennDOT and the Authority using casing spacers where casing pipe is required.
- B. Dead Ends:
 - 1. All dead ends shall be provided with a gate valve at roughly 20' from the end of the pipe.
 - 2. Dead ends shall be mechanical joint with Filed Lok gaskets 2 joints before the end of the pipe.
 - 3. The pipe shall terminate with a mechanical joint cap, blow off assembly and thrust block.

3.8 TESTING AND DISINFECTING

- A. Test and disinfect water mains as specified in Section 33 13 00 - Testing and Disinfecting Water Mains.

END OF SECTION 33 11 13

SECTION 33 12 13**WATER SERVICE CONNECTIONS****PART 2 - GENERAL****2.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
 - 1. Tapping water mains by installation of corporation stops or other suitable fittings or couplings (work by water authority).
 - 2. Installation of service pipe and fittings and curb stops (work by water authority).
 - 3. Excavation for water main tap and service line installation (work by Contractor/Developer).

- B. Related Work specified elsewhere:
 - 1. Section 02221 - Trenching, Backfilling & Compacting
 - 2. Section 02615 - Water Mains
 - 3. Section 02653 – Testing and Disinfecting Water Mains

2.02 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American National Standards Institute (ANSI):
 - a. B16.1 Cast Iron Pipe Flanged Fittings, Class 25, 125, 250, and 800
 - 2. American Society for Testing and Materials (ASTM):
 - a. B62 Specification for composition Bronze or Ounce Metal Castings
 - b. B88 Specification for Seamless Copper Water Tube
 - c. B584 Standard Specification for Copper Alloy Sand Castings for General Applications
 - 3. American National Standards Institute (ANSI)/American Water Works Association (AWWA):
 - a. ANSI/AWWA C104/A21.4 Cement-Mortar Lining for Ductile-Iron and Gray-Iron Pipe and Fittings for Water
 - b. ANSI/AWWA C110/A21.10 Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch for Water and Other Liquids
 - c. ANSI/AWWA C111/A21.11 Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
 - d. ANSI/AWWA C115/A21.15 Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges
 - e. ANSI/AWWA C151/A21.51 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
 - f. ANSI/AWWA C515 Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
 - g. ANSI/AWWA C800 Underground Service Line Valves and Fittings
 - 4. NSF International:
 - a. NSF 61 Drinking Water System Components
 - b. NSF 372 Lead Content Certification

2.03 SUBMITTALS

- A. Manufacturer's Literature: Submit manufacturer's literature for each size and type of pipe, fitting, and coupling.

- B. Shop Drawings and Samples: Submit shop drawings, and samples as directed, of all products to be assembled by the Contractor at site for prior approval of the Engineer.

- C. Certificates: Submit a Statement of Compliance, together with supporting data, from the materials suppliers attesting that products and materials provided meet or exceeds specification requirements.

2.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Product Delivery: During loading, transporting and unloading of all materials and products, exercise care to prevent any damage.
- B. Storage: Store all products and materials off the ground and under protective coverings and custody, away from walls and in a manner to keep these clean and in good condition until used.

PART 3 - PRODUCTS**3.01 PROVISION AND INSTALLATION**

- A. The Authority will provide and install all products from the water main tap to the water meter.

3.02 PIPE OR TUBING AND FITTINGS

- A. Copper Water Tubing:
 - 1. ASTM B88, Type K, Seamless
 - 2. Matching Fittings of Flared, or Compression Type
 - 3. CTS 250 PSI NSF POLY Pipe
- B. Ductile and Cast Iron Pipe:
 - 1. ANSI/AWWA C151/A21.51 or ANSI/AWWA C115/A21.15
 - 2. Class 52, 350 psi Pressure Class
 - 3. Cement-mortar lining: ANSI/AWWA C104/A21.4
 - 4. Fittings: ANSI/AWWA C110/A21.10 Standard cement mortar lined in accordance with ANSI/AWWA C104/A21.4
 - 5. Joints:
 - a. Mechanical or Push-on: ANSI/AWWA C111/A21.11
 - b. Flanged: ANSI/AWWA C115/A21.15

3.03 TAPPING ACCESSORIES

- A. Tapping Sleeves:
 - 1. Mechanical Joint, or as indicated on the Contract Drawings.
 - 2. 200 psi working pressure.
 - 3. Outlet Flange: ANSI B16.1, Class 125.
- B. Tapping Valves:
 - 1. ANSI/AWWA C515.
 - 2. Inlet Flange, Class 125.

3.04 METERS

- A. For services up to 2" diameter the Authority will provide the meter and meter vault.
 - 1. All meters up to ¾" shall be Sensus iPERL.
 - 2. All meters over ¾" shall be Sensus Omni.
 - 3. All commercial services shall have Sensus 100 cubic foot meters.

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- B. For services over 2" diameter the property owner will provide the meter vault.
 - 1. Such installations will be reviewed on a case by case basis to determine the size and specific components of the meter vault, to the Authority's satisfaction.

3.05 ACCESSORIES

- A. Provide insert sleeves on all service connections.

PART 4 - EXECUTION

4.01 PREPARATION

- A. Establish location of curb stops with the Authority for each service connection, 35' from centerline of roadway
- B. Excavate trench to the line and grade as shown on the Contract Drawings and as specified; jack and bore service lines underneath paved highways where approved by the engineer.
- C. The Authority will make the service tap and install the service line and curb stop, unless other arrangements have been made with the Authority. The Authority will provide all materials to perform this work.

4.02 CONNECTIONS

- A. General: 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: 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; sufficient quantity of select pipe dope of graphite and oil shall be used for lubrication of assembly.

4.03 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 for all mains other than those of cast or ductile iron.
- C. 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 Engineer.

4.04 SERVICE LINE AND FITTINGS

- A. Use bends 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.
- B. 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.
- C. 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.
- D. Install service fittings and appurtenances on suitable brick or concrete supports as shown on the Contract Drawings; do not use earth, rocks, wood or other organic materials as supports.

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- E. Prevent displacement of pipes and fittings at the time of placing concrete for thrust blocks or for any structures and until initial setting of concrete is assured.
 - F. Operate each corporation stop before and after installation.
 - 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 any dirt or foreign substances from entering the lines.
 - H. Provide concrete thrust blocking or restrained joints at all bends, tees and changes in direction.
 - I. Test and disinfect mains and service lines as specified in Section 33 13 00.

4.05 SERVICE LINE INSTALLATION BY THE AUTHORITY

- A. The Contractor or Developer will have a twenty-four (24) inch ditch open to and around the water main. In cases where two taps are made in the same ditch, the ditch will be thirty-six (36) inches wide at the main, etc. The Authority will make the tap, install service line and curb stop, as well as provide all materials to do so.
- B. All service laterals to be opened up to 35' from centerline of road.
- C. All service ditches will be dug so that at no time will the corporation, service line, or curb stop be less than forty-eight (48) inches deep.
- D. All ditches must be reasonably straight and level - no going around or up and over rocks, sewer pipes, etc. Ditches will be sloped on both sides if soil is unsuitable and ditch is deeper than six (6) feet. Ditches shall be constructed in accordance with Section 31 23 17 -Trenching, Backfilling, and Compacting.
- E. Ditches may parallel, but not be closer than ten (10) feet from other utility service lines (example; sewer or gas service laterals).
- F. Ditches are to be dug at the common property corner to provide separate services to two lots with one ditch, except in cases where the property line divides a driveway that is shared by two lots. In which case two (2) ditches will be dug.
- G. Contractor must be prepared to backfill service ditches the same day as taps are made.
- H. Backfill in service ditch is to be rock-free and may be the excavated fill or sand, or 2RC stone, but the Authority requests that stone dust or 2RC stone not come in contact with service lines.
- I. No meter vaults are to be located in a driveway. The Authority reserves the right to relocate or install a new service at the Contractor's expense.
- J. Contractor will dig no closer than 4 feet from curb stop and allow sufficient service line for connection.

4.06 SPECIAL CONDITIONS

- A. Service lines shall be three (3) feet deep under drainage pipes.
- B. In the phase of the development where the tapping crew is working, all water mains must be tested, chlorinated, completely flushed, and all possible valves opened.
- C. All taps within each phase of a development shall be completed at the same time. All service taps shall be made before any new roads are paved.

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- D. A two week notice and quantity of taps is MANDATORY.
 - E. No service line ditches shall be dug after noon on Friday, or left open over a weekend or holiday.
 - F. Curb box or meter vault damaged by the Contractor will be subject to replacement at the Contractor's expense.

END OF SECTION 33 12 13

SECTION 33 12 19**VALVES AND FIRE HYDRANTS****PART 1 GENERAL****1.2 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
 - 1. Water Main and Service Valves
 - 2. Fire Hydrants
- B. Related Work specified elsewhere:
 - 1. Section 33 11 13 - Water Mains
 - 2. Section 33 12 13 - Water Service Connections

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American National Standards Institute (ANSI); American Water Works Association (AWWA):
 - a. ANSI/AWWA C502 Dry-Barrel Fire Hydrants
 - b. ANSI/AWWA C515 Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
 - 2. NSF International:
 - a. NSF 61 Drinking Water System Components
 - b. NSF 372 Lead Content Certification

1.4 SUBMITTALS

- A. General: Submit in accordance with Section 01 30 00.
- B. Certificates: Submit a Statement of Compliance, together with supporting data, from the materials suppliers attesting that valves, hydrants, and accessories provided meet or exceed ANSI/AWWA Standards and specification requirements.
- C. Product Data: Submit manufacturer's latest published literature including illustrations, installation instructions, maintenance instructions and parts lists.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Prepare valves, hydrants, and accessories for shipment according to AWWA Standards and seal valve and hydrant ends to prevent entry of foreign matter into product body.
- B. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

PART 2 PRODUCTS**2.1 GATE VALVES**

- A. Iron body, bronze trim conforming to ANSI/AWWA C515
 - 1. Resilient wedge gate, ductile iron body.
 - 2. Non-rising stem; O-ring stem seals.
 - 3. Two inch square operating nut; open counterclockwise unless otherwise indicated.

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4. Flanged ends for exposed pipe in vaults, mechanical joint end connections for buried pipe.
 5. Provide valves 16 inches and larger with bypass valves and gear operators.
 6. Gate Valves to be American Flow Control 2500 Series or Mueller 2362 Series.

2.2 VALVE BOXES

- A. 12" Valves and Smaller: Domestic cast iron, two-piece, screw type.
- B. Valves Larger than 12": Domestic cast iron, three-piece, screw type; round base.
- C. Cast iron lid.

2.3 FIRE HYDRANTS

- A. Dry-barrel break-away type conforming to AWWA C502. Hydrants to be American Darling 5-1/4" B62B Hydrant OL, painted red
 1. Bury Depth: 4'-6", or as indicated on the Contract Drawings.
 2. Inlet Connection: 6".
 3. Valve Opening: 5-1/4".
 4. Mechanical Joint or Bell End.
 5. Corrosion resistant bolts and nuts.
 6. Guilford Spec.
 7. Stainless steel ball bearing AFC 62-4
 8. Operation Counter Clockwise "Open Left"
 9. Standard operating nut (B-41)
- B. One pumper, two hose nozzles.
 1. Obtain thread type and size from local fire department.
 2. Attach nozzle caps by separate chains.

2.4 AIR RELEASE VALVES

- A. Air Release valves to be manufactured by Crispin.
- B. Cast iron body and cover, stainless steel float, orifice seat, linkage mechanism, mountings and trim. Buna-N orifice valve designed for maximum venting capacity under normal main pressure.
- C. 150 psi minimum rated working pressure; hydrostatically tested to 2 times rated working pressure.

2.5 BLOWOFF VALVE

- A. Blow off Valves to be Mueller MKII 2" Oriseal stop and waste style curb stop with Tyler curb box.
 1. NSF/ANSI 372 Certified.
 2. 2" Inlet and outlet
 3. 5-1/4" Valve Box
 4. Set in 4 cuft of crushed stone for proper drainage.

PART 3 EXECUTION

3.2 GENERAL

- A. Determine the exact location and size of valves from the Contract Drawings; the Standard Details represent typical details only; obtain all necessary clarification and directions from the Owner or Engineer prior to the execution of work.

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- B. Perform trench excavation, backfilling and compaction in accordance with Section 31 23 17.
 - C. Install pipe in accordance with Sections 33 11 13 and 33 12 13 and applicable Standard Details.

3.3 GATE 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 Owner.

3.4 FIRE HYDRANTS

- A. Install fire hydrants as shown on the Contract Drawings; provide support blocking and drainage gravel as shown; do not block drain hole.
- B. Set hydrants plumb with pumper nozzle facing the roadway; set hydrants with centerline of pumper nozzle at least 18 inches above finished grade and the safety flange not more than 6 inches nor less than 2 inches above grade.
- C. Paint hydrants in accordance with local color scheme.
- D. After hydrostatic testing, flush hydrants and check for proper drainage.

3.5 BLOW-OFFS

- A. Install a blow-off on the dead ends of all water mains
- B. Blow-offs shall be plugged, drilled and tapped for 2" stop and waste ball valve blow-off with curb stop and curb box.

END OF SECTION 33 12 19

SECTION 33 13 00**TESTING AND DISINFECTING WATER MAINS****PART 1 GENERAL****1.1 DESCRIPTION**

- A. The Work Of This Section Includes, but is not limited to:
 - 1. Testing water pipeline:
 - a. Hydrostatic pressure testing
 - b. Leakage testing
 - 2. Disinfecting:
 - a. Preliminary flushing
 - b. Chlorine application methods
 - c. Final flushing
 - d. Bacteriological testing
- B. Related Work Specified Elsewhere:
 - 1. Section 33 11 13 - Water Mains
 - 2. Section 33 12 13 - Water Service Connections
 - 3. Section 33 12 19 - Valves and Fire Hydrants

1.2 QUALITY ASSURANCE

- A. Testing Agency: Bacteriological testing shall be performed by a testing laboratory approved by the State Health Department, engaged and paid for by the Contractor and approved by the Engineer.
- B. Referenced Standards:
 - 1. American National Standards Institute (ANSI); American Water Works Association (AWWA):
 - a. ANSI/AWWA B300 Standard for HypoChlorites
 - b. ANSI/AWWA B301 Standard for Liquid Chlorine
 - c. ANSI/AWWA C600 Standard for Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances, Section 4, Hydrostatic Testing
 - d. AWWA 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.

1.3 SUBMITTALS

- A. General: Submit in accordance with Section 01 30 00.
- B. Test Procedures: Submit a testing sequence schedule including a list of testing equipment to be used.
- C. Certificates:
 - 1. Submit a Statement of Compliance, together with supporting data, from the materials suppliers attesting that the chlorine form composition provided meets specification requirements.
 - 2. 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.

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- D. Test Reports: Submit two copies of the testing laboratory certified test reports of each bacteriological test.

PART 2 PRODUCTS

2.1 HYDROSTATIC TEST EQUIPMENT

- A. Hydro pump
- B. Pressure hose
- C. Test connections
- D. Water meter
- E. Pressure gauge, calibrated to 0.1 pounds per square inch
- F. Pressure relief valve

2.2 DISINFECTING CHEMICALS

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

PART 3 EXECUTION

3.1 PREPARATION

- A. Backfill trenches in accordance with Section 31 23 17.
- B. Provide the water line under test with reaction thrust blocking; hydrostatic testing shall not begin until the concrete thrust blocking has set; allow 2000 psi 28-day strength concrete to set (cure) for a minimum of 7 days prior to testing; if High Early Strength 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 pigs, and appurtenances at no additional expense to the Owner. Owner will provide the necessary water for testing. Water for retests that result from failure of the initial test will be at the expense of the Contractor.

3.2 TESTING WATER LINES

- A. Hydrostatic Testing: Test each newly installed section of water line by hydrostatic test procedure in accordance with the recommended practice established by AWWA, Standard C600, Section 5, hydrostatic testing, as modified hereinbelow.
 - 1. Pressure Test:
 - a. Conduct pressure tests for a period of not less than 2 hours at 200 psig or at a pressure of not less than 1.25 times the working pressure based upon the elevation of the lowest point in line under test corrected to the elevation of the test gauge, but shall not exceed 200 psi.
- B. Observe joints, fittings and valves under test; remove and renew cracked pipe, joints, fittings, and valves showing visible leakage; retest.
 - 1. Leakage Testing:
 - a. Conduct the leakage test concurrently with the pressure test for the 2-hour period at the specified test pressure.

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- b. Water pipe installation is deemed to have failed the leakage test if the leakage obtained is greater than that determined by the formula or the leakage exceeds 10 gallons per inch pipe diameter in 24-hours.

$$L = NDvP/7,400$$
 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
 - c. If the line under test contains sections of various diameters, the allowable leakage shall be the sum of the computed leakage for each size.
 - d. If test results indicate that the pipe 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.

3.3 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 C651; conduct water line disinfection in the following steps:
 - a. Preliminary flushing
 - b. Chlorine application
 - c. Final flushing
 - d. Bacteriological tests
- B. During construction, place calcium hypochlorite granules at the upstream end of the first section of pipe, at the upstream end of each branch main and at 500-ft. intervals. (Refer to Table 1 at the end of this section for quantity of granules to be used.)
 - 1. CAUTION: This procedure must not be used on solvent welded plastic or on screwed joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.
- C. Preliminary Flushing - Use one of the following two methods:
 - 1. Prior to disinfection, except when the tablet method is used, flush the line with pipe cleaning plugs or "pigs"; these "pigs" shall be polyurethane blown elastomer foam bullets hydraulically propelled; the "pigs" shall have the ability to negotiate fabricated mitered bends and short radius elbows and pass through tees, crosses, and multi-dimensional sizes of pipe and valves; the "pigs" shall be approved for use in potable water systems by governing regulatory agency; dispose of flushing water used with "pigs".
 - 2. Prior to disinfection, except when the tablet method is used, the main shall be filled to eliminate air pockets and shall be flushed to remove particulates; the flushing velocity in the main shall be not less than 2.5 fps unless the Engineer determines that conditions do not permit the required flow to be discharged to waste; (Refer to Table 3 at the end of this section for the rates of flow to produce a velocity of 2.5 fps in pipes of various sizes.) Flushing water shall be safely disposed of in a manner acceptable to the governing regulatory agency.
- D. Chlorine Form: The chlorine form to be applied to the system shall be either liquid chlorine, calcium hypochlorite or sodium hypochlorite; the Engineer's written approval of the chlorine form to be used is required.
- E. Chlorine Application:
 - 1. Tablet Method:
 - a. CAUTION: The tablet method cannot be used unless the main is kept clean and dry during construction because the preliminary flushing step must be eliminated; do not use the tablet

-
- method in mains having diameters over 24 in.
- b. During construction, place 5g calcium hypochlorite tablets in each section of pipe and place one such tablet in each hydrant, hydrant branch and other appurtenances to achieve the required dose of 25 mg/l available chlorine; (Refer to Table 2 at the end of this section for the proper number of 5g calcium hypochlorite tablets needed.) attach all the tablets inside and at the top of the main with an adhesive; there shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe; attach the tablets before the pipe section is placed in the trench and mark their position on the section so it can be readily determined that the pipe is installed with the tablets at the top.
 - c. When pipeline installation is completed, fill the main with water at a rate such that water within the main will flow at a velocity not greater than 1 fps; retain the water in the pipe for 24 hours; if the water temperature is less than 41 degrees F, retain the water in the pipe for at least 48 hours; position valves so that the strong chlorine solution in the main being treated will not flow into water mains in active service.
2. Continuous Feed Method:
 - a. The continuous feed method consists of placing calcium hypochlorite granules in the main during construction (at the option of the Engineer), completely filling the main to remove all air pockets, flushing the completed main to remove particulates and filling the main with potable water chlorinated so that after a 24-hour holding period in the main there will be a free chlorine residual of not less than 10 mg/l.
 - b. At a point not more than 10 feet downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water entering the new main will not have less than 25 mg/l free chlorine; assure this concentration is provided by measuring chlorine concentration; Engineer shall approve of the method before proceeding with disinfection.
 - c. During the application of chlorine, position valves so that the strong chlorine solution in the main being treated will not flow into water mains in active service.
 - d. Retain the chlorinated water in the main for a 24-hour period. During the 24-hour treatment, operate valves, curb stops and hydrants in order to disinfect appurtenances and pipe branches; at the end of this 24-hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/l of free chlorine.
 3. Slug Method:
 - a. The slug method consists of placing calcium hypochlorite granules in the main during construction, completely filling the main to eliminate all air pockets, flushing the main to remove particulates, and slowly flowing through the main a slug of water dosed with chlorine to a concentration of 100 mg/l in order that all parts of the main and its appurtenances will be exposed to the highly chlorinated water for a period of not less than 3 hours.
 - b. Chlorinate the main as specified in AWWA C651, Section 5.3.
 - c. During the 3-hour treatment, operate all valves, curb stops and hydrants in order to disinfect appurtenances and pipe branches.
- F. Final Flushing:
1. Flush the heavily chlorinated water from the system under treatment until the chlorine concentration in the water leaving the system is no higher than that generally prevailing in the system or is acceptable for domestic use.
 2. Comply with Federal, State and local laws when discharging the flushed chlorine solution.
- G. Bacteriological Testing:
1. After final flushing is completed and before the water main is placed in service, test the line for bacteriological quality.
 2. Collect a minimum of one sample at the end of each new main for each test, and one sample of the incoming water from the existing water system for comparison.
 3. Collect samples in sterile bottles treated with sodium thiosulphate.
 4. Sampling tap shall consist of corporation stop installed in the main with copper tube gooseneck assembly through which a portion of the chlorinated water has been allowed to flow; sterilize the
-

- tap, valves and pipe in a manner similar to the sterilization of the main; do not use hose or fire hydrant to collect samples.
5. Provide bacteriological test reports to the Owner and the 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 Owner.
 6. If trench water has entered the main, or if in the opinion of the Engineer, excessive quantities of dirt or debris have entered the main, take bacteriological samples at intervals of approximately 200 feet from the water that has stood in the main for at least 16 hours after final flushing has been completed.

SEE ATTACHED TABLES

TABLE 1
Ounces of Calcium Hypochlorite Granules to be Placed at Beginning of Main and at each 500-ft Interval

Pipe Diameter (in.)	Calcium Hypochlorite Granules (Oz)
4	1.7
6	3.8
8	6.7
10	10.5
12	15.1
14 and larger	D ² x15.1*

*D is the inside pipe diameter in feet D = 12/d

TABLE 2
Number of 5g Hypochlorite Tablets Required for Dose of 25mg/l^a

Pipe Diameter (inches)	Length of Pipe Section (feet)				
	13 or less	18	20	30	40
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7
16	4	6	7	10	13

^a Based on 3.25g available chlorine per tablet, any portion of tablet rounded to next higher number.

TABLE 3
Required Flow and Openings to Flush Pipelines ²
(40 psi Residual Pressure in Water Main)

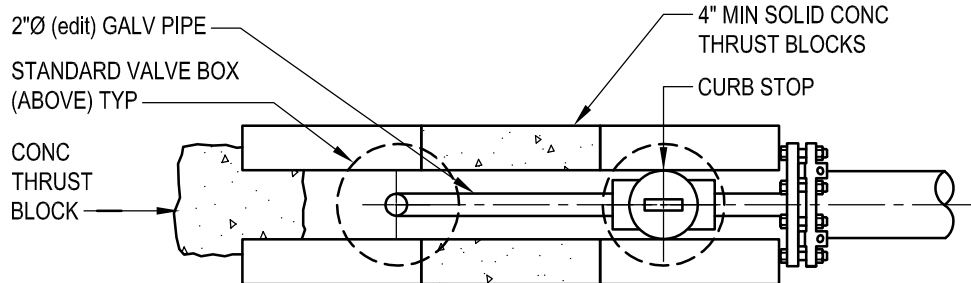
Pipe Diameter (inches)	Flow Required to Produce 2.5 fps Velocity in Main (gpm)	Hydrant Outlets	
		Number	Size (inches)
4	100	1	2-1/2
6	220	1	2-1/2
8	400	1	2-1/2
10	600	1	2-1/2
12	900	2	2-1/2
16	1600	2	2-1/2

² With a 40 psi pressure in the main with the hydrant flowing to atmosphere, a 2-1/2" hydrant outlet will discharge approximately 1000 gpm; a 4-1/2" hydrant nozzle will discharge approximately 2500 gpm.

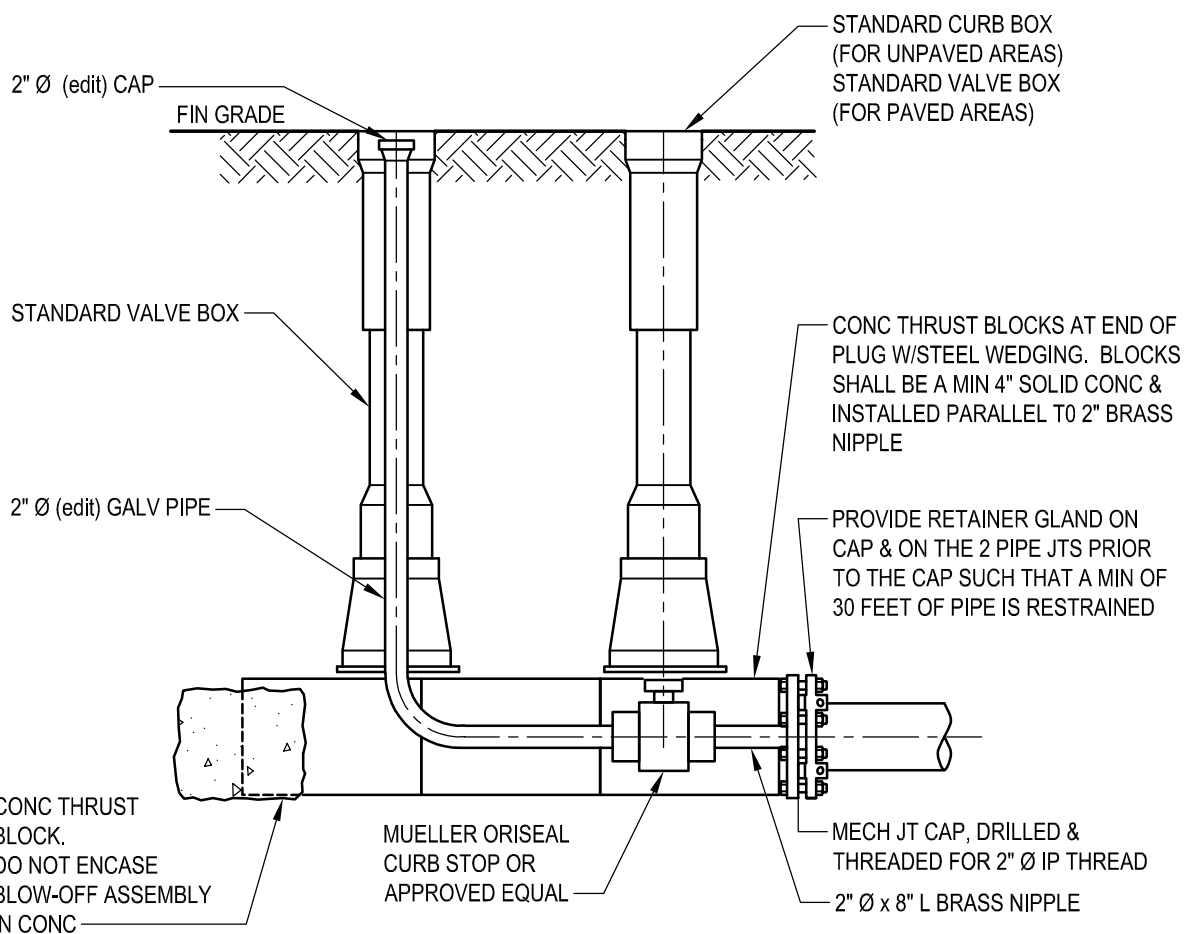
TABLE 4
Chlorine Required to Produce 25 mg/l Concentration in 100 Ft. of Pipe

Pipe Diameter (inches)	100% Chlorine lbs.	1% Chlorine Solution Gal.
4	.013	.16
6	.030	.36
8	.054	.65
10	.085	1.02
12	.120	1.44
16	.217	2.60

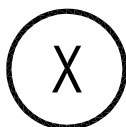
END OF SECTION 33 13 00



PLAN



BLOW OFF ASSEMBLY (TYP)



NOT TO SCALE

Z:\ACBHR\01-CAD STANDARDS\CAD\LIB\BH DETAIL\DWG\331219_VALVES AND FIRE HYDRANTS\331219_04 BLOW OFF ASSEMBLY.DWG/5/3/2019 8:45 AM



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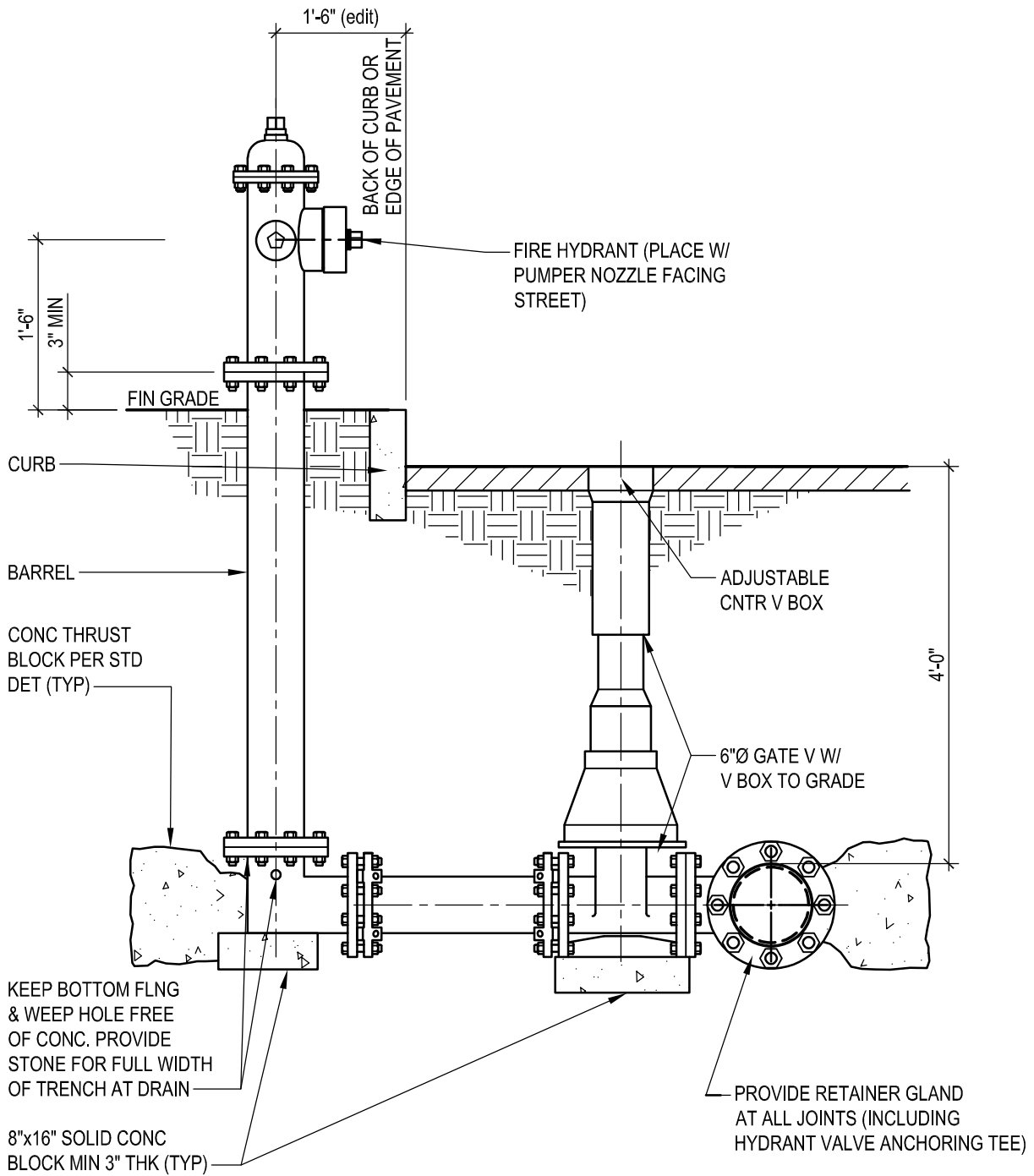
VALVES AND FIRE HYDRANTS

GUILFORD WATER AUTHORITY

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DWG NO:

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NOTES:

1. PAINT ALL EXPOSED STEEL WITH ASPHALTIC PAINT.



FIRE HYDRANT ASSEMBLY

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VALVES AND FIRE HYDRANTS

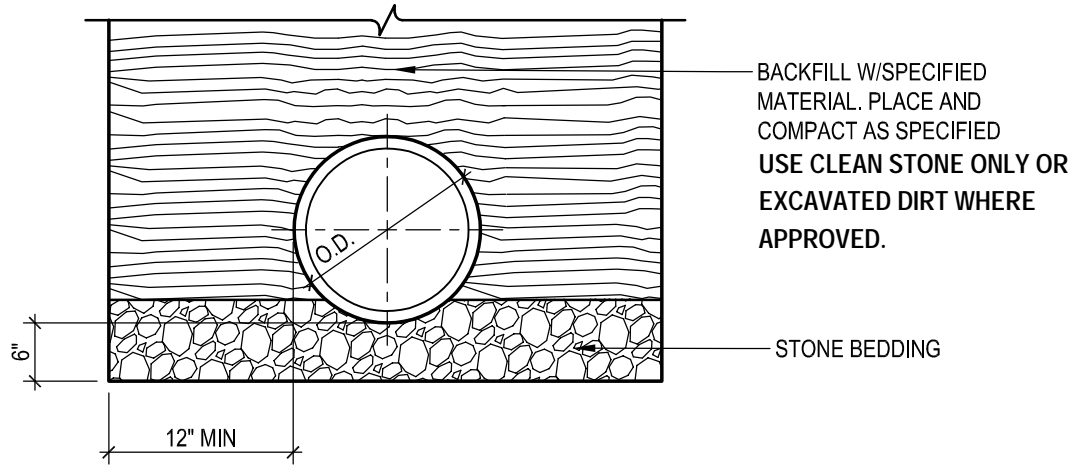
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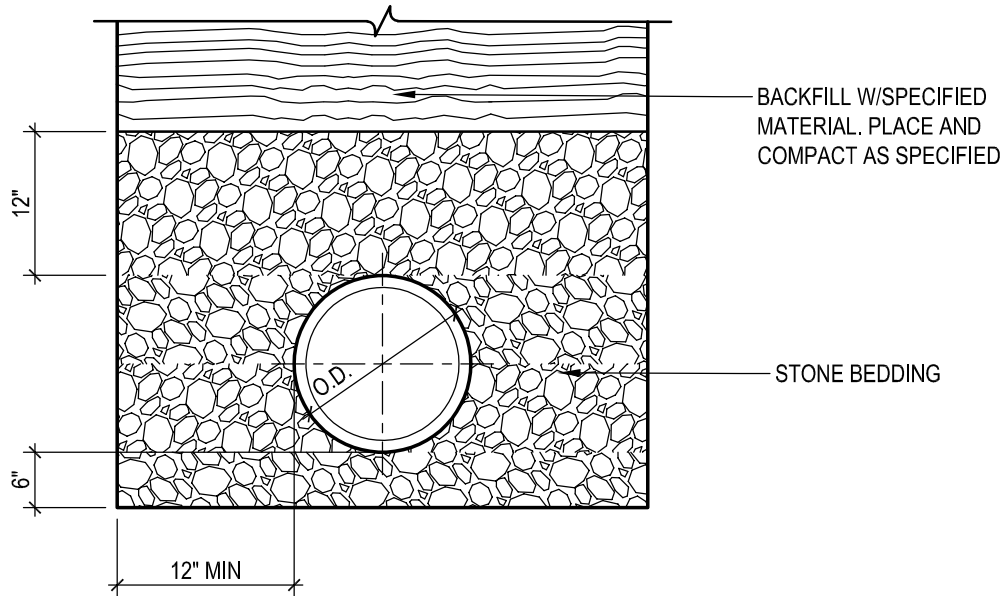
DWG NO:

DWG NO:

Z:\ACBHR\01-CAD STANDARDS\CAD\LIB\BH DETAIL\DWG\312317_TRENCHING, BACKFILLING AND COMPACTING\312317_01 STANDARD PIPE BEDDING.DWG/5/3/2019 9:27 AM



TYPE II BEDDING



TYPE IV BEDDING

NOTES:

- 1. SEE OTHER TYPICAL DETAILS FOR TRENCH RESTORATION AT GRADE.

STANDARD PIPE BEDDING DETAIL



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TRENCHING, BACKFILLING AND COMPACTING

GUILFORD WATER AUTHORITY

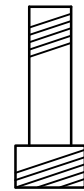
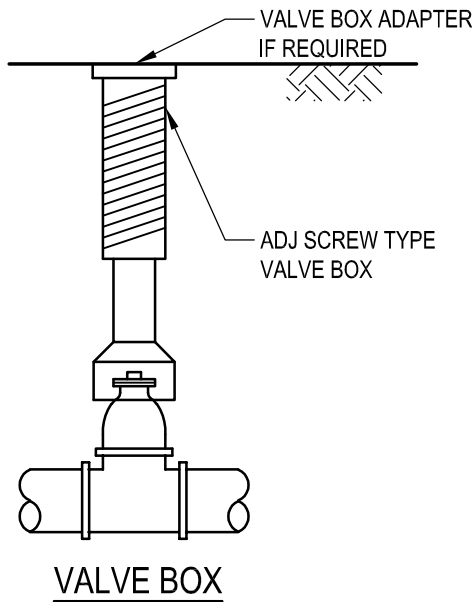
PROJECT NO:
DATE: 4/2019
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DWG TITLE:

DWG NO:

Z:\ACBHR\01-CAD STANDARDS\CAD\LIB\BH DETAIL\DWG\331219 VALVES AND FIRE HYDRANTS\331219_03 VALVE BOX INSTALLATION.DWG/5/3/2019 8:46 AM

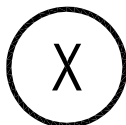
MINIMUM AND MAXIMUM TRENCH DEPTHS FOR VALVE BOX							
VALVE BOX EXTENSION	SIZE OF VALVE						
	2"	3"	4"	6"	8"	10"	12"
18 - 24	23-29	27-33	28-34	33-39	37-43	44-50	48-54
24 - 36	29-41	33-45	34-46	39-51	43-55	50-62	54-66
36 - 48	41-53	45-57	46-58	51-63	55-67	62-74	66-78
36 - 60	41-65	45-69	46-70	51-75	55-79	62-86	66-90
48 - 72	53-77	57-81	58-82	63-87	67-91	74-98	78-102
60 - 84	65-89	69-93	70-94	75-99	77-103	86-110	90-114
TRENCH DEPTHS	5	9	10	15	19	26	30



EXTENSION PIECE-
ADJUSTABLE SCREW TYPE

NOTES:

1. VALVE BOX ADAPTER IS ADDED TO TOP OF INSTALLED VALVE BOX, RAISING THE TOP OF THE BOX WITHOUT DISTURBING THE UPPER SECTION. THE ADAPTER FITS IN THE SOCKET OF THE INSTALLED BOX. THE SIZE IS THE AMOUNT THE TOP OF THE BOX IS RAISED. ALL BOXES AND ADAPTERS SHALL BE FURNISHED WITH LIDS.



VALVE BOX INSTALLATION

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VALVES AND FIRE HYDRANTS

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DWG TITLE:

DWG NO:

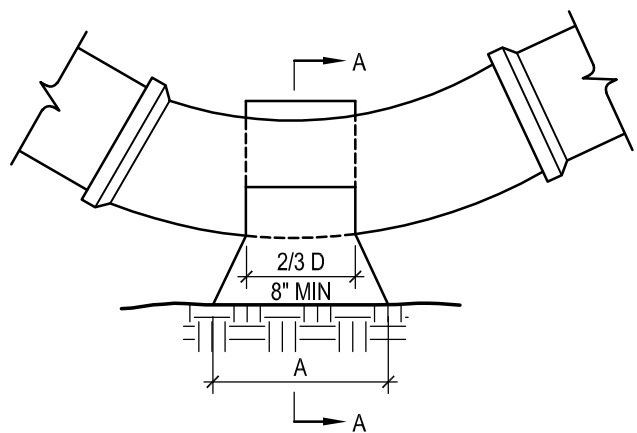
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ISSUED DATE: 4/2019
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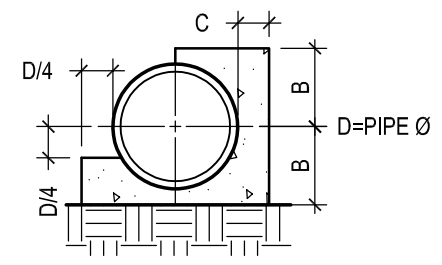
SHEET NO:

BUTTRESS FOR HORIZONTAL BENDS							
BEND		SIZE OF BRANCH (D)					
		4"	6"	8"	10"	12"	16"
11 1/4° 1/32	A	4"	6"	8"	10"	1'-0"	1'-4"
	B	5"	7"	8"	9"	10"	1'-0"
	C	5"	7"	7"	8"	8"	9"
22 1/2° 1/16	A	6"	9"	1'-0"	1'-6"	1'-9"	2'-3"
	B	6"	7"	8"	9"	10"	1'-0"
	C	6"	8"	9"	10"	11"	1'-2"
45° 1/8	A	10"	1'-3"	1'-8"	2'-1"	2'-6"	3'-4"
	B	7"	7"	8"	9"	11"	1'-3"
	C	7"	8"	9"	10"	11"	1'-2"
90° 1/4	A	1'-6"	2'-0"	2'-6"	3'-0"	3'-6"	5'-0"
	B	6"	6"	9"	1'-0"	1'-3"	1'-6"
	C	1'-6"	1'-10"	1'-9"	1'-8"	1'-7"	1'-5"
CAPS	E	6"	6"	8"	8"	10"	1'-0"
	F	9"	1'-0"	1'-4"	1'-8"	2'-0"	2'-9"
	G	11"	1'-5"	1'-11"	2'-5"	2'-10"	3'-9"
TEES	C	6"	8"	9"	10"	1'-0"	1'-2"
	H	6"	8"	9"	10"	1'-0"	1'-2"
	I	6"	9"	1'-0"	1'-3"	1'-5"	1'-11"
	J	4"	6"	8"	10"	1'-0"	1'-4"
	K	6"	6"	8"	8"	8"	10"

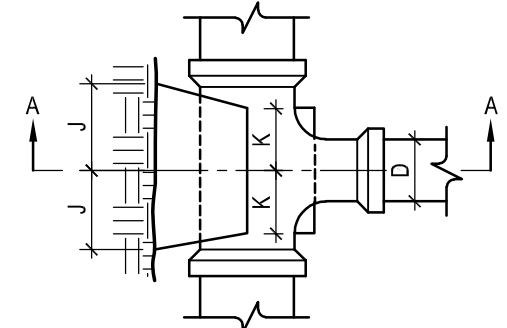
- NOTES:
1. ALL BUTTRESSES TO BE CARRIED TO UNDISTURBED EARTH.
 2. ALL CONCRETE TO BE AS SPECIFIED FOR MASS CONCRETE.
 3. BUTTRESS DIMENSIONS SHOWN ARE FOR MINIMUM DIMENSIONS AND ARE BASED UPON SOIL BEARING PRESSURE OF 3,000 P.S.F. AND STATIC WATER PRESSURE OF 150 PSI WHERE PRESSURE EXCEEDS 150 PSI OR WHERE SOIL BEARING PRESSURE IS LESS THAN 3,000 P.S.F. SPECIAL BUTTRESS DESIGN IS REQUIRED.
 4. USE DIMENSIONS SHOWN UNDER 4" PIPE FOR ALL PIPES LESS THAN 4"Ø.



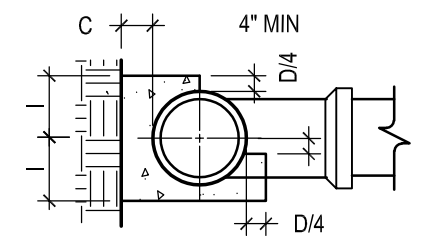
PLAN
BUTTRESS FOR
HORIZONTAL BENDS



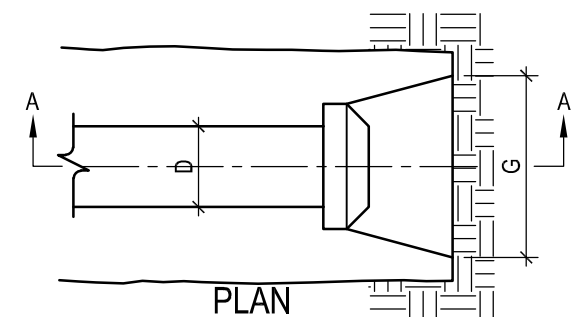
SECTION A-A
BUTTRESS FOR
HORIZONTAL BENDS



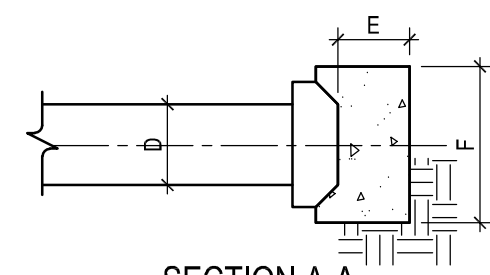
PLAN
BUTTRESS FOR TEES



SECTION A-A
BUTTRESS FOR TEES

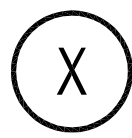


PLAN
BUTTRESS FOR CAPS



SECTION A-A
BUTTRESS FOR CAPS

THRUST BLOCK FOR HORIZONTAL BENDS, TEES AND CAPS

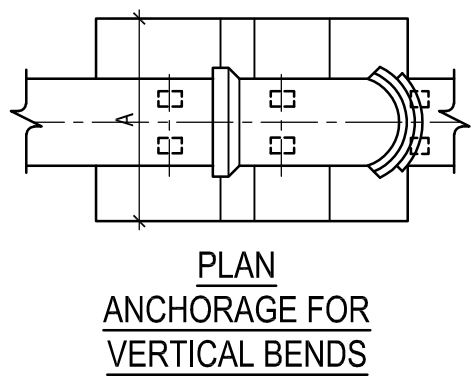
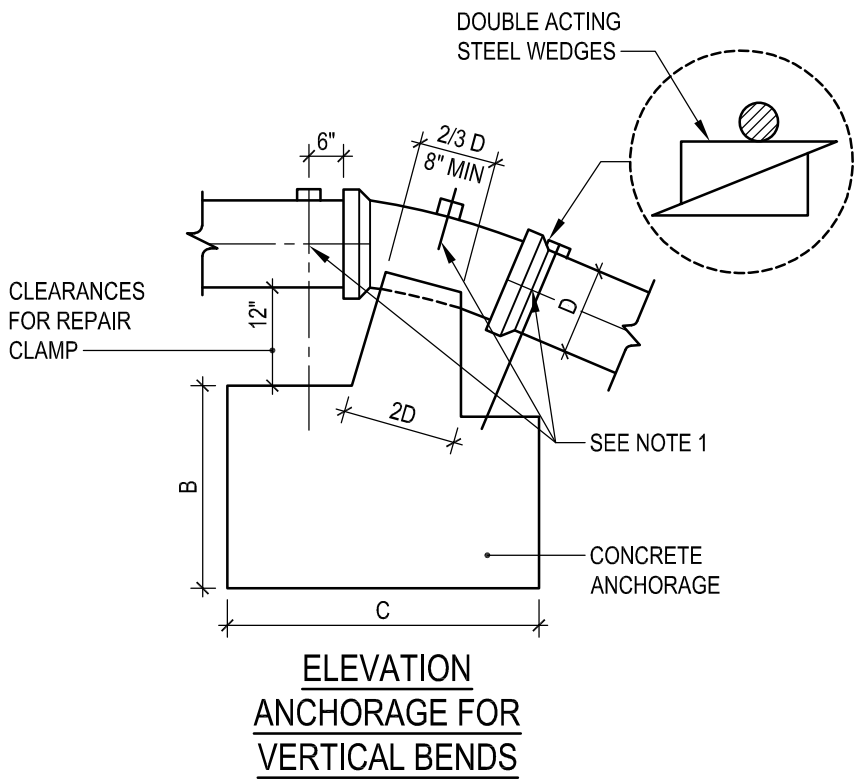
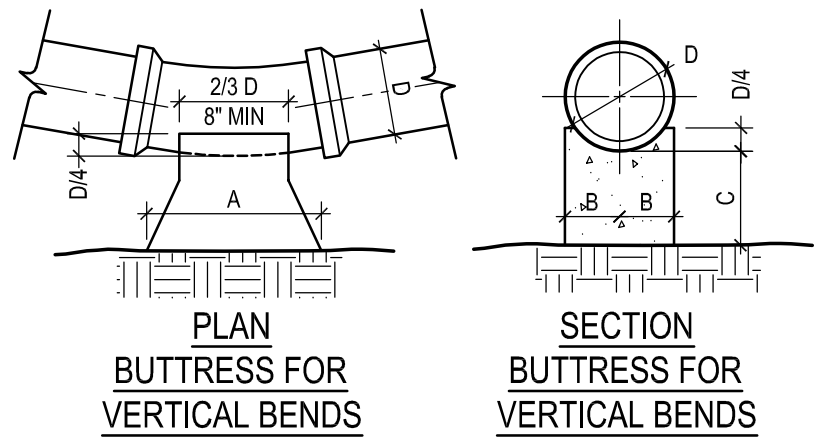


NOT TO SCALE

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BUTTRESS FOR VERTICAL BENDS							
BEND	SIZE						
	4"	6"	8"	10"	12"	16"	
11 1/4° 1/32	A	4"	6"	8"	10"	1'-0"	1'-4"
	B	5"	7"	8"	9"	10"	1'-0"
	C	5"	7"	7"	8"	8"	9"
22 1/2° 1/16	A	6"	9"	1'-0"	1'-6"	1'-9"	2'-3"
	B	6"	7"	7"	8"	10"	1'-0"
	C	6"	7"	7"	8"	8"	9"
45° 1/8	A	10"	1'-3"	1'-8"	2'-1"	2'-6"	3'-4"
	B	7"	7"	8"	9"	11"	1'-3"
	C	7"	7"	8"	10"	11"	1'-3"

ANCHORAGE FOR VERTICAL BENDS							
BEND	SIZE						
	4"	6"	8"	10"	12"	16"	
11 1/4° 1/32	A	1'-4"	1'-6"	1'-6"	2'-6"	3'-0"	4'-0"
	B	1'-0"	1'-6"	1'-9"	2'-0"	2'-6"	2'-6"
	C	2'-0"	2'-0"	2'-6"	3'-0"	3'-0"	4'-0"
22 1/2° 1/16	A	1'-8"	2'-0"	3'-4"	3'-8"	4'-0"	4'-4"
	B	1'-6"	1'-9"	2'-3"	2'-3"	2'-3"	2'-6"
	C	2'-0"	3'-0"	2'-8"	3'-10"	4'-0"	5'-9"
45° 1/8	A	2'-3"	2'-6"	3'-0"	4'-0"	4'-6"	5'-2"
	B	1'-9"	2'-6"	2'-9"	3'-0"	3'-6"	4'-0"
	C	2'-6"	3'-0"	4'-0"	4'-6"	4'-9"	6'-6"



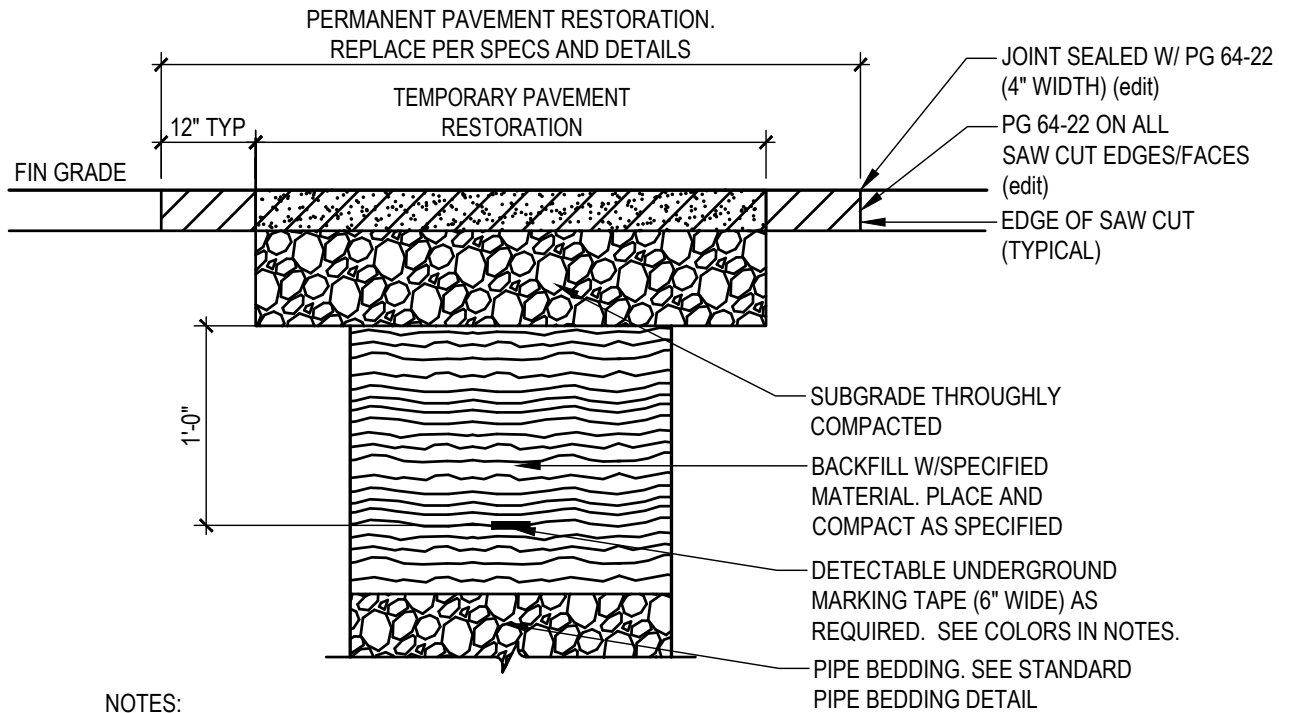
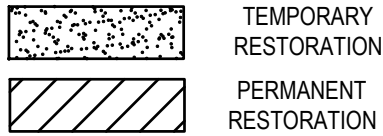
- NOTES:**
- USE 3 #6 REINFORCING BARS AS SHOWN. IMBED 30 DIAMETERS IN CONCRETE AND PAINT EXPOSED SURFACE WITH 2 COATS OF APPROVED BITUMINOUS PAINT.
 - ALL CONCRETE TO BE CLASS AS SPECIFIED FOR MASS CONCRETE.
 - ALL BUTTRESSES TO BE CARRIED TO UNDISTURBED EARTH.
 - BUTTRESS DIMENSIONS SHOWN ARE MINIMUM. DIMENSIONS ARE BASED UPON SOIL BEARING PRESSURE OF 3,000 P.S.F. AND STATIC WATER PRESSURE OF 150 PSI WHERE PRESSURE EXCEEDS 150 P.S.I. OR WHERE SOIL BEARING PRESSURE IS LESS THAN 3,000 P.S.F. SPECIAL BUTTRESS DESIGN IS REQUIRED.
 - USE DIMENSIONS SHOWN UNDER 4" PIPE FOR ALL PIPES LESS THAN 4"Ø.

X **THRUST BLOCK FOR VERTICAL BENDS**
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REVISIONS	MARK	ISSUED DATE	DESCRIPTION

PROJECT NO:
ISSUED DATE: 4/2019
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SHEET NO:

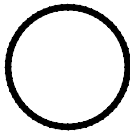
Z:\ACB\DR\01-CAD STANDARDS\CAD\BIBH\DETAILS\DWG\3113_333113_02 THRUST BLOCK VERTICAL.DWG:Model6/5/2019 8:52 AM:Schaefer, Stephanie



NOTES:

1. SAWCUT PAVEMENT 12" MINIMUM PAST THE EDGE OF THE TRENCH OPENING.
2. PERFORM TRENCH WORK.
3. INSTALL SELECT STONE BASE AND TEMPORARY PAVEMENT.
4. SAWCUT 12" MINIMUM BASE THE EDGE OF THE TEMPORARY PAVEMENT AND REMOVE THE LOOSE PAVEMENT.
5. INSTALL PERMANENT PAVEMENT RESTORATION.
7. PERMANENT RESTORATIONS SHALL OCCUR NO LATER THAN 180 DAYS AFTER INITIAL OPENING OF PAVEMENT.
8. DETECTABLE TABLE COLORED AS FOLLOWS:
 - YELLOW: GAS AND ASSOCIATED LINES, SUCH AS FUEL LINES.
 - ORANGE: TELEPHONE AND ASSOCIATED LINES, SUCH AS CATV.
 - BLUE: WATER AND ASSOCIATED LINES SUCH AS IRRIGATION LINES.
 - RED: ELECTRIC AND ASSOCIATED LINES.
 - GREEN: SEWER AND ASSOCIATED LINES.

TYPICAL PIPE/UTILITY TRENCH RESTORATION IN PAVED AREAS



NOT TO SCALE

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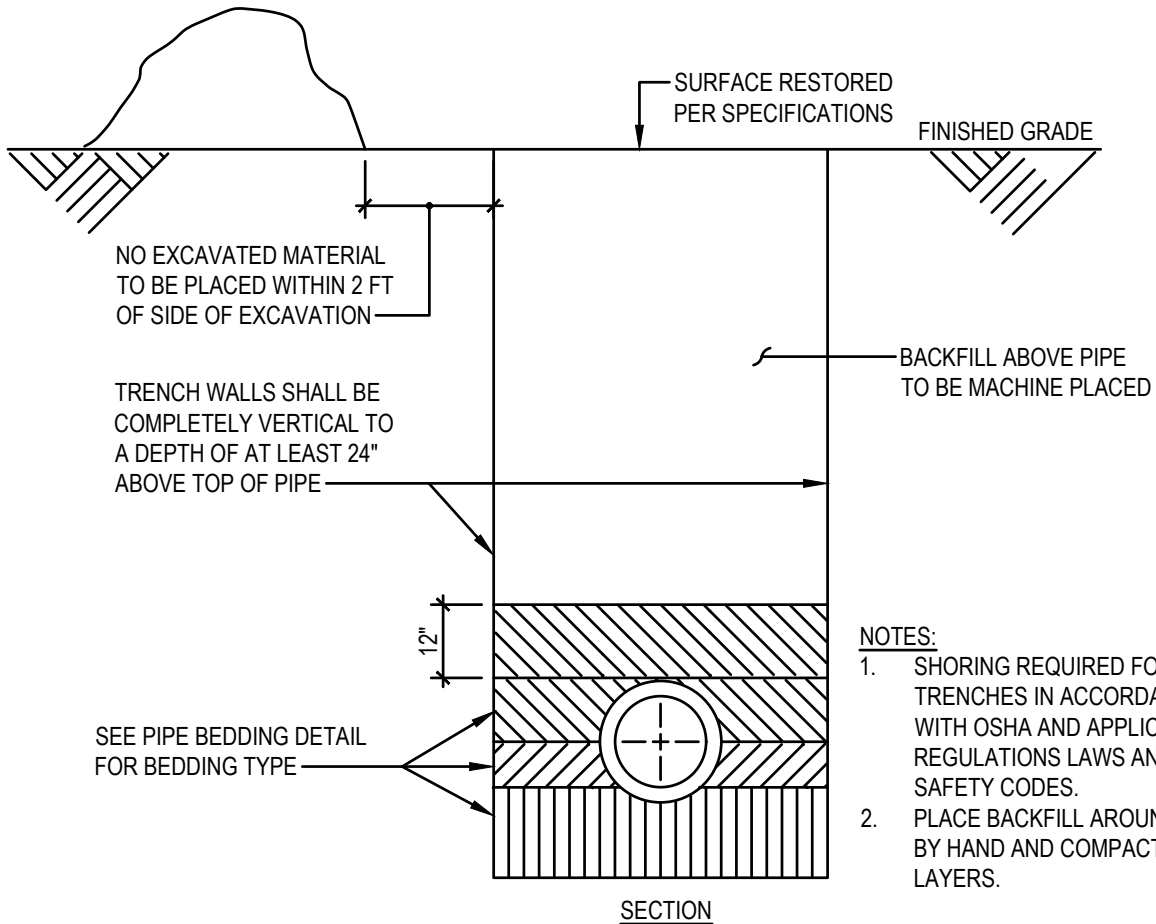
SITE RESTORATION

GUILFORD WATER AUTHORITY

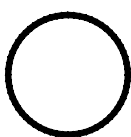
PROJECT NO :	
DATE :	
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SHEET TITLE:

SHEET NO:




- NOTES:**
1. SHORING REQUIRED FOR ALL TRENCHES IN ACCORDANCE WITH OSHA AND APPLICABLE REGULATIONS LAWS AND SAFETY CODES.
 2. PLACE BACKFILL AROUND PIPE BY HAND AND COMPACT IN 6" LAYERS.

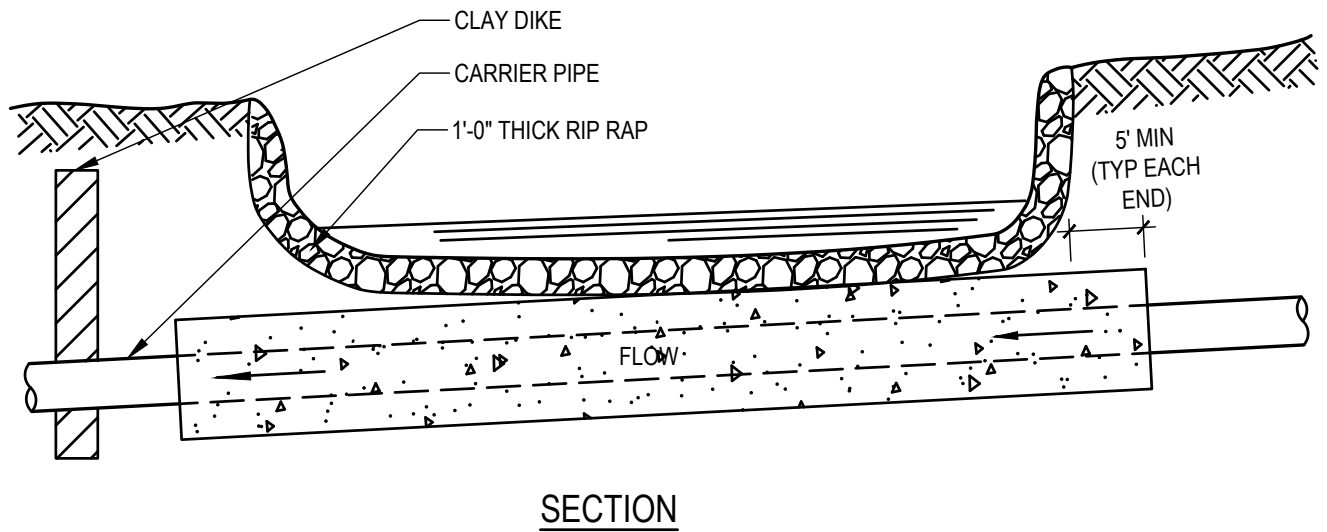
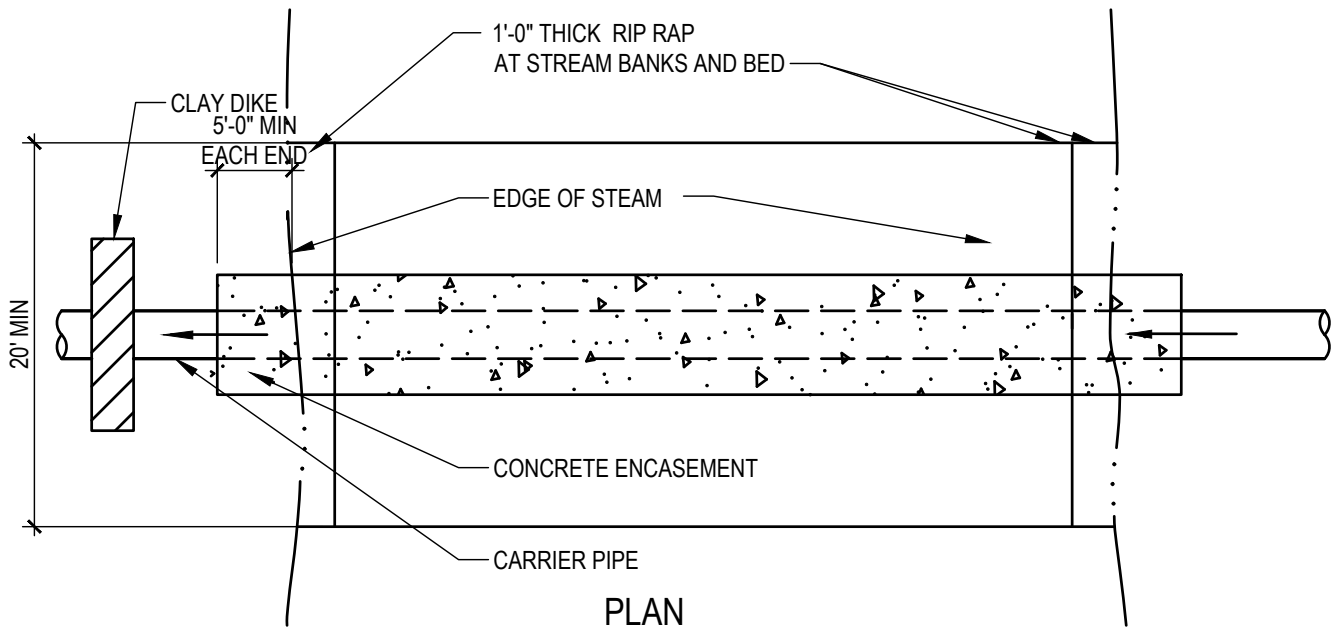


TYP PIPE TRENCH

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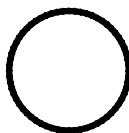
1804952047/PROJ/12584-12584-1/STANDARD CONSTRUCTION SPECIFICATIONS/RESTORATION OF PIPE TRENCH/01/2022 2:28 PM/INK: 04/11

 BUCHART HORN ENGINEERS • ARCHITECTS • PLANNERS	SITE RESTORATION		SHEET TITLE: <hr/> SHEET NO.:
	GUILFORD WATER AUTHORITY		
	PROJECT NO : DATE : DRAWN BY : CHECKED BY :	© BUCHART HORN, INC.	



NOTES

1. STREAM CROSSING PAY ITEM INCLUDES EXCAVATION, CONCRETE ENCASEMENT, CARRIER PIPE, CLAY DIKE, RIP RAP, BACKFILL & OTHER WORK INCIDENTAL TO STREAM CROSSING CONSTRUCTION.



STREAM CROSSING DETAIL

NOT TO SCALE

18199752041RPT012584-RS18-18199752041RPT012584-CONSTRUCTION SPECIFICATIONS FOR TRENCHING, BACKFILLING AND COMPACTING OF STREAM CROSSING DETAIL DIVISION 4115022 257 PWS/SH KPH



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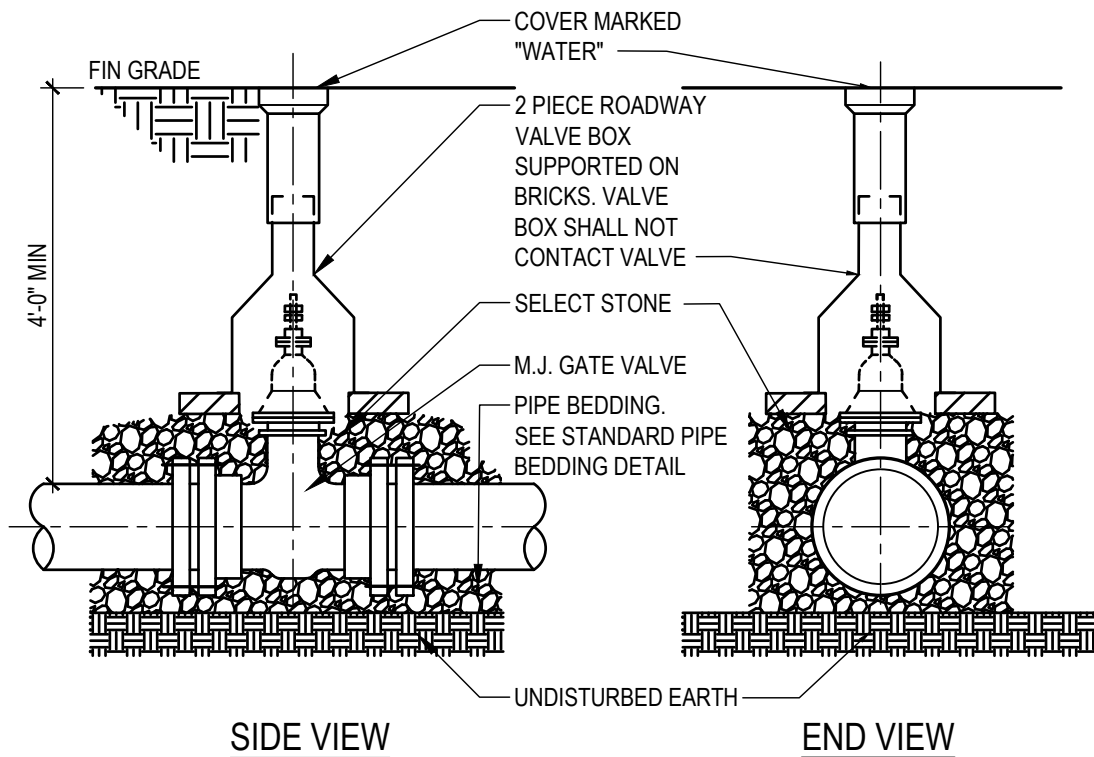
TRENCHING, BACKFILLING AND COMPACTING

GUILFORD WATER AUTHORITY

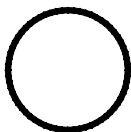
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VALVE AND VALVE BOX INSTALLATION



NOT TO SCALE

B:\PROJECTS\VALVE BOX\STANDARD CONSTRUCTION SPECIFICATIONS\VALVES, PI VALVE AND VALVE BOX.DWG (REV. 12/2022) 257 PMS/SHK, RPH



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VALVES AND FIRE HYDRANTS

GUILFORD WATER AUTHORITY

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