

**STANDARD SPECIFICATIONS
FOR WATER AND SEWER LINE CONSTRUCTION
FOR THE BOROUGH OF ADAMSTOWN**

JUNE 2001

**Approved by Adamstown Borough Council on
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AMENDED SECTIONS
TO THE
BOROUGH OF ADAMSTOWN
STANDARD SPECIFICATIONS
FOR
WATER AND SEWER LINE CONSTRUCTION

1ST AMENDMENT, NOVEMBER 2004

Please Note Bolded Items for Changes in the following Sections:

Section 02730 – Manholes

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DEFINITIONS

Wherever used in these Specifications, the following terms have the meanings indicated which are applicable to both the singular and plural thereof.

- 1.1 **Agreement:** The written Agreement between the Owner and the Developer covering the Work to be performed.
- 1.2 **Applicant:** A person who applies for water service at a premises.
- 1.3 **Borough Specifications:** Standard Specifications for the Adamstown Borough.
- 1.4 **Borough:** Adamstown Borough, a Pennsylvania Municipal Corporation.
- 1.5 **Building Sewer:** The Private System Sewer pipe and sewer appurtenances extending from the Sewage Drainage System of any structure to the Sewer Lateral.
- 1.6 **Commercial Facility:** Any structure intended to be used wholly or in part of the purpose of carrying on a trade, business, or professional or for social, amusement, religious, educational, charitable or public uses.
- 1.7 **Commercial Water Hauler:** A person delivering the Borough's water supply to retail customers.
- 1.8 **Contractor:** The person, firm, or corporation constructing the water line facilities and appurtenances on behalf of the Developer, if other than Developer.
- 1.9 **Cross-Connection:** Any connection, direct or indirect that physically joins a customer service line or any piping extrusion there of to a non-potable source of water or to a water system other than that of the Borough.
- 1.10 **Customer:** Any one to whom water or sewer service is supplied by the Borough or Borough and shall include a person, partnership, association, or corporation.
- 1.11 **Customer's Service Line:** That part of the water service pipe extending from the Borough's service line to the premises, except the water meter.
- 1.12 **Detailed Drawing:** The detailed construction drawing provided in the Borough or Borough Specifications.
- 1.13 **Developer:** The person, firm or corporation ultimately responsible for construction of the water or sewer line with whom the Owner has entered into the Agreement, as well as agents acting on behalf of the Developer, including the Developer's Contractor.
- 1.14 **Developer Drawings:** The Drawings which show the character and scope of the Work to be performed and which have been prepared by the Developer and approved by the Engineer.
- 1.15 **Dwelling Unit:** A dwelling, or portion thereof, providing complete living facilities for one family.
- 1.16 **EDU:** An Equivalent Dwelling Unit;

1.17.1 Water Service: The amount of water usage by an average Residential Unit in a day is estimated to be 175 gallons per day (gpd)(16,000 gal per quarter). Non-Residential Units shall be assigned a number of EDU's based upon the actual or estimated water usage, and each or portion thereof shall be considered an EDU, with such usage being calculated using the consecutive 90 day period with the highest usage.

1.17.2 Service Line: The water service pipe and appurtenances extending from the Borough's main including: The corporation in the main, the water pipe to a point at or near the property line, the curb stop or service valve, and the curb box or valve box.

- 1.17 Engineer:** The appointed Engineer of record for the Borough.
- 1.18 Housing Unit:** Any Structure intended to be occupied as a whole by one family, or an apartment intended to be occupied as a whole by one family or an apartment intended to be occupied by one family or any other one-family living unit, containing plumbing for the kitchen or for toilet facilities.
- 1.19 Improved Property:** Any property upon which there is erected a structure intended for continuous or periodic habitation, occupancy, or use by human beings or animals and from which structure sanitary sewage and/or industrial wastes shall be or may be discharged.
- 1.20 Industrial Facility:** Any structure intended to be used wholly or in part for the manufacturing, fabricating, storing, or warehousing, processing, cleaning, laundering or assembling of any project, commodity, or article.
- 1.21 Industrial Waste:** Any solids, liquids or gaseous substance or form of energy rejected or escaping from any industrial, manufacturing, trade or business process or from the development, recovery or processing of natural resources and distinct from Sanitary Sewage.
- 1.22 Law and Regulations:** Laws, rules, regulations, ordinances, codes and/or order of the Adamstown Borough, Lancaster County, Commonwealth of Pennsylvania, and United States of America.
- 1.23 Main Extension:** Water service requiring the construction of one or more additional water mains.
- 1.24 Meter:** A device for measuring the quantity of water used, which is a basis for determining charges for water service to a customer.
- 1.25 Non-Residential Unit:** Any room, group of rooms, building or other enclosure including institutional dormitories, which do not or does not constitute a Residential Unit.
- 1.26 Observation:** The examination of the work performed by the Contractor to ascertain its conformity with the technical specifications.
- 1.28 Owner:** Any person vested with ownership, legal or equitable, sole, or partial, of any Improved Property.
- 1.29 Permit:** A plumbing permit for water service or a Lateral connection to the Borough water or the Borough's Sewer System as issued by the appropriate body.

- 1.30 **Person:** Shall mean and include any natural persons. This term is further defined to include any individual, partnership, co-partnership, firm company, corporation, association, joint stock company, trust, estate, government, entity, or any other legal entity or their legal representatives, agents or assigns. The masculine gender shall include the feminine and/or neuter, and the singular shall include the plural, where indicated by the context.
- 1.31 **Premises:** The property, building, or other site to which water service is furnished, including:
1. A building under one roof, owned or leased by one person, and occupied as one resident or business;
 2. Each combination of buildings owned or leased by one person, served by one service line, and occupied by one family or business;
 3. Each side of a double house or each housing unit;
 4. Each apartment, condominium, manufactured housing, mobile home, office, or suite of offices located in a building having several such apartments, offices, or suites of offices and using in common one or more means of entrance; or
 5. Such other situations as the Borough shall deem proper and advisable.
- 1.32 **Private Systems:** The Water or Sewer System from the curb stop or Sewer Lateral to and wholly within the dwelling or dwellings, or the structure upon an Owner's Improved Property.
- 1.33 **Project:** All the necessary labor, services, and materials required for satisfaction completion of the Work as defined by the Developer Drawings and Borough or Borough Specifications.
- 1.34 **Project Inspector:** The authorized representative of the Borough, Borough or Engineer assigned to the site or any part thereof for observation of construction.
- 1.35 **Residential Unit:** Consists of a single dwelling occupied or intended to be occupied as separate living quarters by a family or any other group of Persons or Person living alone within the whole or part of a building; the dwelling must contain a minimum of a bathroom and a kitchen. This definition shall not include institutional dormitories.
- 1.36 **Rules and Regulations:** Rules, regulations, and/or standards of the Borough of Adamstown, Lancaster County, Pennsylvania, and the United States of America.
- 1.37 **Sanitary Sewage:** The normal water-carried household and toilet wastes from any improved property.
- 1.38 **Service Connection:** The part of the Water System extending from the Borough's mains to the property line or curb stop of the property so connected.
- 1.39 **Standby Service:** Water service intended to supplement service provided from a source of supply other than that of the Borough.
- 1.40 **Sewage Drainage System:** All sewer pipe and sewer appurtenances situated inside the walls of the structure to be served by a Lateral Connection.
- 1.41 **Sewer Lateral:** That part of the sewer system extending from a sewer to the curb line or, if there shall be no curb line, to the property line or if no such lateral shall be provided, then lateral shall mean that portion of, or place in, a sewer which is provided for connection of any building.

- 1.42 **Sewer System:** All the facilities and properties, as of any particular time for collection, pumping and conveyance of wastewater owned by the Borough.
- 1.43 **Shop Drawing:** All Drawings, diagrams, illustrations, schedules, and other data which are specifically prepared by or for the Developer to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance chart's, instructions, diagrams, and other information prepared by a supplier and submitted by the Developer to illustrate material or equipment for some portion of the Work.
- 1.44 **Substantial Completion:** The Work (or a specified part thereof) has progressed to the point, where, in the opinion of the Engineer as evidenced by the Engineer's definitive letter of Substantial Completion, it is sufficiently complete, in accordance with the Specifications so that the Work (or specified part) can be utilized for the purposes for which it is intended.
- 1.45 **Supplier:** A manufacturer, fabricator, supplier, distributor, material man, or vendor.
- 1.46 **Tapping Fee:** A fee imposed under the Authorities Act to enable the recovery of the Borough's equity in the Water and Sewer System which shall be composed of the following parts: capacity, distribution, connection, and customer facilities parts, and may in the future, if warranted, include for some customers, a special purpose part and/or a reimbursement part. A Tapping Fee shall be considered the fee referred to as a "Tapping Fee" in Act 203 of 1990.
- 1.47 **Technical Specifications:** Those portions of the Specifications consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.
- 1.48 **Tenant:** A person who leases or rents premises from an owner.
- 1.49 **Underground Facilities:** All pipe or main constituting part of the Water or Sewer System used or usable for water supply or wastewater conveyance purposes.
- 1.50 **Water Line:** Any pipe or main constituting part of the Water System used or usable for water supply purposes.
- 1.51 **Water System:** All the facilities and properties, as of any particular time, for production, pumping, delivery, transporting, storing, treating, and distribution of water and owned by the Borough.
- 1.52 **Work:** The entire completed construction of the Water Line or Sanitary Sewer, the various separately identifiable parts thereof required to be furnished under the Technical Specifications. Work is the result of performing services, furnishing labor and furnishing and incorporating materials and equipment into the construction, all as required by the Technical Specifications.

GENERAL CONDITIONS

1.1 GENERAL

- A. All public water and sewer facilities proposed to be served by the Borough require approval of the design by the Borough before construction.
- B. Where a Developer desires to design and construct a separate sewer or water supply system, the Applicant shall consult with the Borough prior to design, to obtain approval and to establish design criteria.
- C. All private water and sewer facilities connected to the Borough system must meet Specifications.
- D. All water and sewer service projects shall be completed in accordance with the latest edition of the Borough Rules and Regulations for Water Service and these Standard Specifications.

1.2 RESPONSIBILITY FOR COSTS

- A. The Developer shall be responsible for all improvements required by the Borough.
- B. Specifications, Rules, and Regulations including the cost of engineering reviews and construction observation.
- C. The Borough may require the Developer to post a retainer to cover the cost of design reviews and studies required to obtain approval from the Borough.
- D. A Developer's Agreement and escrow will be required for all proposed construction to guarantee that adequate funds are available to complete construction and observation of the improvements.

1.3 SEWER SYSTEM DESIGN CRITERIA

- A. General. An applicant for extension of Sewer Service shall submit three sets of plans providing the following information:
 - 1. Base all elevations on the datum of the existing sewers.
 - 2. Include a note on each drawing that materials used and construction methods employed are in accordance with the latest edition of the Borough Standard Specifications.
 - 3. For details of required sewer system components make reference to use of the Borough details recorded on the enclosed CD.

B. Indicate on the drawings the following general items:

1. Name of the design engineer.
2. Seal of the design engineer.
3. Signature of the design engineer.
4. Name of the development and the Owners.
5. Date of plans and the last revision date.
6. Act 287, (172) list of utilities.

C. Include the following drawings:

1. **Location Plan:** Showing approximate area of the Borough in which the project is located. No particular scale is required.
2. **Index Map(s):** Drawn to a scale of 1" = 400' and having the following items included thereon:
 - a.) Sewer sizes other than 8" sewers.
 - b.) Names of all streets.
 - c.) Number designation of each manhole.
3. **Detail Sheets (Plan and Profile):** Plan View drawn to scale of 1" = 50' and Profile View drawn to a horizontal scale of 1" = 10' and having the following items included thereon:
 - a.) Location of each existing or proposed building with elevation of the existing or proposed first floor (Plan View). The drawings must include a note stating that lots are not intended to be provided with gravity basement drainage.
 - b.) Sewer ties to existing permanent features (Plan View).
 - c.) Top elevations of manholes (Profile View).
 - d.) Invert elevations of manholes (Profile View).
 - e.) Manhole numbers corresponding to those on Index Map (Plan View and Profile View).
 - f.) Distance between manholes (Profile View).
 - g.) Grade of proposed sewer (Profile View).

- h.) Size of proposed sewer (Profile View).
 - i.) Location, size, and elevation of all existing and proposed underground utilities (Plan View and Profile View).
- D. Submit the following information as a supplement to the construction drawings:
- 1. Number of lots to be served initially.
 - 2. Number of lots to be served in the future.
 - 3. Number of acres to be served initially.
 - 4. Number of acres to be served in the future.
 - 5. Initial and future sanitary sewer flows if the development is other than residential.
- E. Locate new sewers in streets and paved areas to facilitate access for maintenance purposes. If it is necessary and demonstrated to the Borough's satisfaction that the sewers must be located on private property, a right-of-way with a minimum of 20-foot wide centered on the sewer shall be dedicated from the Developer to the Borough. An additional 10-foot wide temporary construction casement shall also be provided.
- F. Do not connect storm water or ground water drainage to any sewer extension of the Borough's system. No rain water leaders, roof drainage, area or yard drainage, basement, surface or water from fire hydrants, ground water or water from underground drainage fields shall be permitted to drain into or be admitted into the sanitary sewer system, nor shall any of these be admitted to the sanitary sewer system by the use of pumps of any type. The sanitary sewer system, and all extensions, is intended to convey sanitary sewage only.
- G. Pump Station Design:
- 1. Pump station design shall be permitted at the discretion of the Borough when the following alternatives for gravity service are unavailable.
 - a.) Available gravity service at the necessary elevation is more than 2,500 feet away.
 - b.) Individual simplex residential grinder pumps shall normally be utilized for development of 10 or less equivalent EDU's residential units as proposed for all phases of the development and potential service areas.
 - c.) A duplex grinder unit is required whenever more than one EDU is served.

- d.) Individual residential grinder units shall be owned, operated and maintained by the homeowner. All individual residential grinder units shall meet the specifications and detail drawings included herein.
- e.) All pump stations with a design capacity greater than 50 EDU's shall be designed as a wastewater pumping station, meeting the following requirements for a Borough operated pump station.

2. Borough Operated Pump Station Requirements

- a.) Solids reduction units are required prior to pumping Solids reduction unit to be designed for peak flows and utilize counter rotating cutting shafts. A back up bar screen shall be provided.
- b.) A minimum of two (2) pumps are required. The station must be able to handle maximum peak design flow with one pump out of service.
- c.) Permanent flow metering of the influent flow is required. Flow metering shall utilize a level inducing flume and ultrasonic level detection. Flows shall be indicated on an electronic recording device measuring instantaneous and total flow to be downloaded to a computer interface with reporting software.
- d.) An emergency auto dialer shall be provided to record and indicate up to eight (8) different alarms as selected by the Borough.
- e.) Phone service shall be provided.
- f.) Water service shall be provided. If public water is not available, a well and pressure tank shall be provided to maintain a flow of 5(gpm) for 10 minutes at 35 (psi).
- g.) Emergency Power shall be provided by way of a secondary service line or generator on site. The generator shall be propane powered with a 24-hour fuel supply. The emergency generator and electrical equipment shall be housed in a weatherproof enclosure large enough to permit operator service with protection from precipitation.
- h.) The pump station shall be accessible by a paved access drive meeting Borough standards. The device shall provide for off street parking of service vehicles.
- i.) The pump station facilities shall be provided with a fenced enclosure of 8-foot height including barbed wire overhang. A vehicle entry gate of a minimum of 10-foot width shall be provided.
- j.) The Pump Station shall be provided with interior and exterior security and work lighting. Site lighting shall include emergency power lighting.

- k.) Pump Station wet well level detection shall utilize a pressurized bubbler airline.
- l.) Pump Station pumping equipment shall be capable of handling a minimum 3-inch spherical solid.
- m.) All internal wet well materials shall be explosion proof and constructed of non-corrodible materials. Concrete surfaces shall be treated to prevent corrosion by hydrogen sulfides.
- n.) All Pump Station below grade equipment must be serviceable from the surface by the operator. Equipment to retrieve below grade equipment must be provided on site (ie: hoist, release mechanisms).
- o.) All submersible pumps must be provided with dual seal chambers and leak detection before the motor chamber is fouled.
- p.) The Developer shall demonstrate the potential for service using surface mounted self-priming pumps if possible.
- q.) Landscaping shall be provided to screen the pump station equipment from view.
- r.) Building enclosures shall architecturally match surrounding structures.
- s.) Pump Station location shall provide for potential service to the entire upstream drainage area.
- t.) The Pump Station shall be accessible and operable in a 100-year storm event. Surface drainage shall be directed away from the pump station site.
- u.) Electrical service shall be 3-phase, 60 hertz.

H. Lateral Connection Requirements:

1. Administrative Provisions and Responsibilities of the Owner

- a.) Permission for connecting to the Borough's Sewers must be obtained from the Borough through application made by the property Owner or his agent.
- b.) No repairs, alterations, or additions to any connection to the Borough sewer may be made until application has been made to and permission has been granted by the Borough. The application for a Permit shall be supplemented by any plans, specifications, or other information considered pertinent in the judgment of the Borough.
- c.) No connection shall be made until the tapping and connection fee has been paid.

- d.) All new laterals shall be inspected by the Borough and /or such inspector as they may assign. Construction of the Service Connection and/or Lateral may not proceed until the Borough has been notified and has authorized the construction to proceed.
- e.) Wherever the surface of any public street, sidewalk, or cart way is disturbed for construction of any service Connection or Lateral, it shall be restored, at the cost of the Owner of the Improved Property being connected, in a manner satisfactory to the Borough. All construction within the right-of-way of a public street of the Borough shall comply with the ordinances of the Borough and all construction within the right-of-way of a State highway shall comply with Pennsylvania Department of Transportation requirements and specifications respectively.
- f.) All permits issued for construction will require that streets or roads under construction remain passable for vehicular traffic during the period of construction. Every excavation for a Service Connection or Lateral shall be guarded adequately with barricades and lights to protect all Persons from damage and injury.
- g.) If a building Sewer, Service Connection, or Lateral becomes clogged, the opening, repair, or replacement of same shall be the responsibility of the Property Owner.
- h.) All costs and expenses for the installation and connection of the Building Sewer, Service Connection, and the Lateral shall be borne by the Owner. The Owner shall indemnify the Borough from any loss or damage that may result directly or indirectly from the installation of the Building Sewer, Service Connection, or the Lateral.
- i.) The Owner of an Improved Property, on which the principal building is situated 150-feet or less from the Borough Sewer System, shall upon direction from the Borough connect to the sewer system. If the Owner of such Improved Property fails to connect to the Sewer System within 60-days notice from the Borough, or such longer time designated by the Borough, the Borough may enter upon such Improved Property and construct the sewer connection. The Borough may collect the costs and expenses of connection from the Owner of such Improved Property, in the manner approved by applicable State Law.
- j.) Before commencing any phase of the Service Connection or Lateral construction, the contractor shall obtain a Permit and shall notify the Borough as to when the construction will commence. At the time of final inspection, and before the Service Connection and Lateral are approved, he shall give to the Borough an as-built drawing of the Service Connection and Lateral installation, which shall include:
 - 1. The Plan view of the new Service Connection and Lateral.
 - 2. Surveyed locations of all cleanouts and other special fittings.

3. Point of connection to the sewer system.
 4. Accurate measurements of the Service Connection and Lateral length and the depth at the point of connection to the sewer system. Measurements shall be made from permanent surface structures.
- k.) At least forty-eight (48) hours notice of the time when such connection will be made must be given to the Borough prior to inspection.
 - l.) Any Service Connection or Lateral that is in violation of these specifications shall be re-laid in the proper manner at the expense of the Owner.
 - m.) The Building sewer and sewer lateral from the property to the main interceptor collection sewer of the Borough shall at all times be the responsibility of the property Owner for maintenance, repair or replacement and shall not be the responsibility of the Borough regardless of whether the sewer lateral has been installed by the Borough.

2. General Requirements for Laterals

- a.) No more than one (1) Lateral per excavation ditch will be permitted. The minimum separation between two or more adjacent Laterals shall be 20-feet. Each Lateral and Service Connection to the sewer must be made within the owner's property lines and/or the Borough's right-of-way or the public right-of-way.
- b.) Lateral connections shall be laid to a straight line and grade. The minimum grade for a 4-inch I.D. pipe shall be 1/4-inch to the foot. Where physical conditions preclude the installation of pipe at a grade of 1/4 - inch or more to the foot, a minimum grade of 1/8-inch to the foot may be used, but only with the prior approval of the Borough. For 6-inch I.D. or larger pipe, the minimum grade shall be 1/8-inch to the foot.
- c.) Before commencing any phase of the construction for a Lateral and Service Connection, the plumbing contractor shall locate and expose, where applicable the existing wye or stub provided for the connection to the Borough Sewer. If no Service Connection is provided, the contractor shall locate and expose the Borough sewer main at the point where the Service Connection is to be made. Upon exposing the wye, stub, or main, as applicable, the contractor shall then verify that there is a 1/4 - inch per footfall by obtaining the differential elevation. If the elevations are such that the connection cannot be made at 1/4-inch per footfall, the contractor shall contact the Borough for permission to install the line at a minimum grade of 1/8-inch per foot is acceptable. This will be the minimum grade and will be used only if a fall of 1/4-inch per foot is unattainable. No cap, stopper, or plug shall be removed or punctured until permission has been granted by the Borough.

- d.) No sewer pipe shall be reduced in size between the house and the sewer, except for one 6-inch by 4-inch reduction at the edge of the right-of-way or inside the curb line, as approved by the Borough.
- e.) All pipes shall be a minimum of 4-inches inside diameter. Pipe sizes for apartments and commercial buildings must be approved by the Borough. Joints shall be permanently watertight.
- f.) All Lateral connections to Sewage Drainage System stubs will be made with an adapter acceptable to the Borough.
- g.) A minimum of three feet of earth cover over the invert of the Lateral shall be provided to protect the pipe from frost or freezing.
- h.) All changes in grade and direction shall be made with pipefittings. No fittings exceeding 45° will be permitted. When two or more bends are used, a length of pipe (minimum 3 feet) shall be placed between them. Pipe bends greater than 45° are prohibited. In lieu of a 90° bend, two 45° fittings separated by a minimum of 3 feet of straight pipe shall be used. Detailed drawings showing the required pipefittings for a deep Sewage Drainage System are provided.
- i.) Cleanouts shall be provided in each sanitary sewer Lateral at 50-foot intervals to permit complete rodding with a 50-foot long cable or tape. Cleanouts shall be constructed using a wye fitting in the run and riser pipe brought to a minimum of 6-inches above grade with a screw type ferrule and shall be watertight.
- j.) A cleanout shall be provided for each sanitary sewer Lateral at a point 1-foot from the basement wall of the building to be served.
- k.) A main trap and air vent are required inside the right-of-way or near the curb.
- l.) If, for any reason, construction is delayed or stopped, the pipe connected to the sewer main must be temporarily capped with a waterproof stopper until construction resumes.
- m.) Wherever, in the opinion of the Borough, the trenching conditions require either a specific type of pipe, joint material or encasement in concrete, such materials as the Borough may direct shall be installed.

5. Trench and Pipe Requirements

- a.) All Excavation for a Sewage Drainage System or a Lateral installation shall be adequately guarded with barricades and lights to protect the public from hazard. Street, sidewalks, parkways, and other public property disturbed in the course of the work shall be restored in a manner satisfactory to the Borough.

- b.) In all trenches (both earth and rock trenches), Crushed stone shall be provided as a foundation for all pipes. The bedding material shall consist of crushed stone conforming to the Commonwealth of Pennsylvania Department of Transportation (PENNDOT) grading and quality requirements for 1B aggregate (AASHTO No. 8 stone). The crushed stone shall be placed on the bottom of the trench to a minimum depth of 4-inches, along the sides of the pipe to a depth of 1-foot above the pipe.
 - c.) When the bottom of the trench has been dug too deep, it shall be refilled to grade with a minimum of 4-inches of PENNDOT 1B aggregate (AASHTO No. 8 stone).
 - d.) Unsuitable material encountered in excavation, such as ashes, muck and unstable soils shall be removed. Stabilization of the Lateral shall be achieved by over-excavating the trench to a depth of two times the pipe diameter below the grade line of the Lateral and then backfilling the trench to the grade line of the pipe with PENNDOT 2B stone (AASHTO No. 57 stone) tamped in place so as to provide a solid and continuous bearing foundation for the pipe.
 - e.) All groundwater, which may be found in the trenches, and any other water which may get into them from any source whatsoever, shall be pumped or bailed out so that the trench shall be completely dry during pipe laying and backfilling. Water shall be kept away from any mortar or concrete work until it has thoroughly set. When water is encountered, no less than 6-inches of PENNDOT 1B stone (AASHTO No. 8 stone) shall be used as foundation for the pipe.
 - f.) No spring water, ground water, trench water, storm water, or surface water of any nature whatsoever shall be allowed to enter the sanitary sewer system during construction.
6. Backfilling
- a.) No work shall be covered or concealed in any way until inspected and approved by the Borough. Use of a new Lateral connection to the Sewer System will not be permitted until after the entire Lateral and Sewage Drainage System has been air tested and have been proved satisfactory.
 - b.) When the Sewage Drainage System and Lateral construction line have been approved by the Borough and the joints have set properly, the trench may be backfilled. Coarser material, free of stones, may be backfilled over the bedding and compacted by mechanical means in not less than 6-inch layers to a point 1-foot above the top of the pipe. Coarser material, free of stones larger than 8-inches, may then be used for backfill. Care shall be exercised not to disturb the pipe.
 - c.) When the Lateral or Sewage Drainage System crosses a driveway or walkway, PENNDOT 2RC (AASHTO select granular material) backfill

shall be provided and thoroughly stamped by hand or machine in the trench from a point 1-foot above the sewer to the top of the trench.

- d.) Following connection of the building to public sewers, all septic tanks, holding tanks, seepage pits and cesspools must be pumped out by a licensed, approved sewage pumper and filled with sand or earth on the same day or before the contractor leaves the job. All building sewer lines to such systems shall be disconnected and the hole in the foundation filled. Proof of pumping must be provided to the Borough in the form of a signed statement by the licensed hauler or dated receipt to the property Owner.

7. Clean Up

- a.) Removal of debris, which may be stored within the public right-of-way, including road, cart way, or sidewalk, shall be removed within 24-hours of completion of the Sewage Drainage System or Lateral Work.
- b.) Any concrete sidewalk or curb removed for the purpose of making sewer connection must be temporarily restored within 48-hours, and permanent replacement within 30-days from the time installation has been approved. Replacement materials shall conform to Borough Specifications.

8. Plumber Requirements

- a.) General Requirements: Every plumber must provide evidence of adequate insurance coverage for himself and/or his subcontractors and register with the Borough providing the necessary data on the plumber's application as required by the Borough. Non-compliance with this Article will be sufficient cause for the Borough to refuse to permit a plumber to construct building sewers in the Borough.
- b.) Insurance Requirements: Evidence of insurance coverage shall be presented to the Borough in the form of insurance certificates and shall indicate coverage with the following minimum limits:
 - 1. General liability insurance with blasting (where applicable), collapse hazard, and underground property damage coverage:
 - a.) Bodily Injury-\$300,000 per Occurrence - \$500,000 Aggregate
 - b.) Property Damage -\$50,000 per Occurrence - \$100,000 Aggregate
 - 2. Automotive
 - a.) Bodily Injury- \$100,000 each person - \$300,000 Aggregate
 - b.) Property Damage-\$50,000 per Occurrence

3. Workmen's Compensation- Statutory

Insurance certificates shall be kept current with the Borough during the period the firm is working in Adamstown Borough for the purposes of constructing building sewer.

- c.) **Plumber's Application:** Prior to beginning work in the Borough, every plumber must register with the Borough providing data relative to experience, equipment available, business location, etc., on the Plumber's Application as provided by the Borough. The plumber will also be required to acknowledge awareness of the Borough's Standards governing construction of building sewers. Any changes in the data supplied on the original plumber's application must be supplied, in writing, to the Borough.

I. Items required Prior to Beginning Construction

1. Sewer Connection Permit(s) applicable to the project.
2. Evidence that the final subdivision plan has been filed by the Borough at the county courthouse, Recorder of Deeds office, if applicable.
3. Performance and Payment Bonds or other financial security to assure completion of the sewer extension and to cover the warranty period.
4. Receipt of a letter from the Developer stating the name of the Contractor whom will be installing the Sanitary Sewer Extension.
5. Certificates of public liability and property damage, auto liability, and workers' compensation insurance. The Borough and the Engineer shall be certificate holders and shall be named by endorsement as additional insured.
6. Receipt from the Borough of a copy of the Water Quality Management Permit issued by DEP and PENNDOT Highway Occupancy Permit if applicable.
7. A list of suppliers for the materials to be used in the sanitary sewer construction.
8. Shop drawings of manhole bases, manhole risers, manhole frames and covers, pipe and other necessary construction materials approved by the Borough.
9. Certification from the pipe manufacturer that the pipe meets or exceeds the requirements of the Borough standard specifications.
10. Written approval by the Borough to proceed with construction.

J. Record Drawings

1. All record drawings shall be on an electronic device, include a certificate attesting to the correctness of all information shown on the Drawings. The Borough intends to use the record drawings to provide information as required by Act 187 and incorporate the information into the Borough GIS mapping.
2. Record Drawings shall provide a surveyed location utilizing permanent physical features to locate all clean outs, center of all manhole covers and grinder units. Developers shall provide survey confirmation of all facilities in easements outside of the public right-of-way.
3. Provide two (2) prints, one (1) reproduced Mylar set of record drawings, and one AutoCAD copy on compact disc.

K. Televisual Inspection of Gravity Sewers

1. Gravity sewers shall be internally televised at the completion of construction as a condition of dedication of the sewer line to the Borough. The collection system shall be cleaned and inspected with a mobile television inspection unit, as per Sections 02954 and 02955, in order to certify the integrity of the system. Such inspection shall take place during a wet weather period or when the ground water table is high. The cost to perform the internal inspection and repair of all defects, problems, damages, or items of poor workmanship that maybe found shall be solely the Developer's responsibility. All repairs shall be performed in a workmanlike manner under the direction and inspection of the Borough, prior to the Borough accepting the lines for dedication.

L. Dedication of Sanitary Sewer Extension to the Borough

1. The Developer shall deliver a deed of conveyance transferring Ownership of the sanitary sewer extension to the Borough. Attached to the deed shall be a plat which accurately describes the location of the facilities to be dedicated. The description shall include bearing and distances, which are tied to permanent features shown on a recorded plan of the property. If the Developer is a corporate entity, the deed of conveyance must be accompanied by a corporate resolution authorizing said conveyance. Upon receipt of the executed deed of conveyance from the Developer, the Borough will release the Developer from all obligations to the Borough with the respect to the extension, except that the Developer shall guarantee the extension installation including materials and workmanship for a period of one year from the date of the deed, or in the case of work on PennDot right-of-way, for a period of two years from the date of the deed.

1.4 WATER SYSTEM DESIGN CRITERIA

- A. General: An applicant for extension of water service shall submit three sets of plans providing the following information:
 1. Water Demands:

- a.) Number and type of housing units, with anticipated construction schedule.
 - b.) Average daily water demand.
 - c.) Fire protection demand and duration (hours).
 - d.) Construction elevations (USGS datum).
2. Existing and proposed streets, property and lot lines, and building locations.
 3. Existing and proposed utilities, including locations, sizes of mains, valves, hydrants, blow-offs, and other facilities.
 4. Legend of symbols, scale and date.

B. Water System Design Criteria

The following design criteria shall be used unless exceptions are approved in writing by the Borough. Where special design criteria area required, the Applicant shall consult with the Borough prior to preparation and submission of the plans.

1. Domestic Water Demand for Design of Mains and Other Facilities.

Average Daily Demand: For design of water system components use 265 gallons per residential dwelling unit per day.

For allocation of water to residential developments use 175 gallons per residential dwelling unit per day.

Maximum Daily Demand: 2.5 times the Average Daily Demand of 265 gpd.

Maximum Flow Rate: One residence – 10 gpm

2 to 10 Residences – 10 gpm for first residence, plus 5 gpm for each additional residence.

11 to 50 Residences – 55 gpm plus 2 gpm for each residence over 10.

Over 50 Residences – 135 gpm plus 1 gpm for each residence over 50.

2. Industrial or Special Water Demands: Established for each installation, minimum daily flow and rate of flow shall be in accordance with Borough sewer regulations.

3. **Fire Demands:** In accordance with the most stringent requirements of the National Fire Protection Association (NFPA) and Insurance Service Organization (ISO).

C. Water Pressure

1. **General:** Water pressure should normally be maintained in the range of 35 pounds per square inch (psi) to 100 psi at ground elevation. The required minimum pressure at ground elevation shall be 30 psi during maximum hourly flows and 20 psi during fire flows.
2. **Working Pressure:** The Developer shall determine the maximum and minimum working pressures, which will occur in the proposed main extension or water supply project. The method of calculation shall be indicated.
3. **Design Pressure:** The design pressure for equipment and materials shall be at least equal to the maximum working pressure plus a surge allowance of 50% of maximum working pressure, unless specified otherwise.
4. **Pressure-Regulating Valves:** The Developer shall, at his own expense, install and maintain a pressure-regulating valve meeting Borough Specifications when pressures exceed 100 (psi).
5. **Fire Demands:** Where only hose streams are required, fire flow requirements shall be satisfied while maintaining a 20-psi residual pressure at hydrants in the immediate vicinity of the fire. Where automatic sprinkler systems are involved, residual pressures must be adequate for their proper operation.
6. **Booster Pumping Stations:** If required pressures cannot be obtained by a direct main extension, and with permission of the Borough, a booster pumping station shall be constructed at the expense of the Developer. The design and construction of the booster pumping station shall be subject to Borough approval.

D. Size of Mains

1. Minimum main size is 8-inch diameter. Adequacy of main sizes should be checked based on a total flow requirement of fire demand plus maximum daily demand plus special requirements. A maximum C-value of 130 is permitted for new cement-lined ductile iron pipe.
2. Fire hydrant branches shall not be less than six-inch diameter and no longer than necessary. The maximum permissible length is 50 feet, except in special conditions.

E. Location of Mains

1. General

- a.) Mains shall normally be located within the right-of-way lines of public streets. If it is necessary and demonstrated to the Borough's satisfaction to locate a main on private property, the Applicant shall provide a water main easement in the name of the Borough. The easement shall consist of a minimum 20-foot wide permanent easement centered on the pipeline and an additional 10-foot wide temporary construction easement.
- b.) Distribution main networks shall be looped and dead-end mains shall be avoided. When dead-end mains cannot be avoided, blow-off connections or hydrants shall be provided at the main ends.
- c.) A safe and adequate separation shall be maintained between water mains and all other underground utilities.
- d.) Mains shall be extended to the property limits of the lot or subdivisions, which they serve.
- e.) Water mains in streets shall be located a minimal of 5-feet from curbs and sidewalks.

2. Water Mains Near Sewers

- a.) Water mains shall be laid at least 10 feet horizontally from any existing or proposed drain or sewer line. If local conditions prevent a horizontal separation of 10 feet, the water main shall be laid in a separate trench, or on an undisturbed earth shelf located on one side of the sewer, such that the bottom of the water main is at least 18 inches above the top of the sewer. When it is impossible to obtain the horizontal and vertical separations stipulated above, both the water main and the sewer shall be constructed of ductile iron pressure pipe utilizing push-on joints, mechanical joints, or similar joints employing a rubber gasket to obtain a seal. Both the water main and the sewer shall be pressure tested before backfilling to assure water tightness.
- b.) When a water main crosses sewer or storm drain, the bottom of the water main shall preferably be installed 18 inches above the top of the drain or sewer, and this vertical separation shall extend at least 10 feet horizontally on each side of the sewer. If a water main must cross under a sewer or drain, a full length of water main pipe shall be centered under the sewer. The vertical separation shall be a minimum of 18 inches, and the sewer pipe shall be encased in concrete for a minimum of 10 feet on each side of the crossing in accordance with attached details.
- c.) No water pipe shall pass through, or come into contact with, any part of a sewer manhole.

F. Cross Connections

1. There shall be no physical connection between the distribution system or house plumbing and any pipes, pumps, hydrants, or tanks, which are or may be supplied from any supply not approved by the Borough.

G. Minimum Cover Over Pipes

1. The minimum depth of backfill over pipes shall be 48 inches. When the minimum depth of cover cannot be provided, insulation construction approved by the Borough shall be employed.

H. Location of Valves

1. Isolation valves on water distribution mains shall be provided on each branch of each cross or tee.
2. The isolation valves shall be set at the intersection of the right-of-way boundary with the main where possible or about 6 feet from each pipe intersection. Water distribution main valves shall be provided at intervals of not more than 1,000 feet along a water main. Main valves shall be supplied with adjustable cast iron valve boxes.
3. A valve shall be installed on each hydrant branch pipe between the main and the hydrant and near the end of any main, which may be extended in the future.

I. Air-Release Valves

1. Air-release valves shall be installed at all high points on supply or transmission mains, but will not be required on distribution mains if accumulated air can be released through service lines. Air release valves shall be installed in approved manholes.

J. Blow-Offs

1. In dead-end mains a blow-off valve and pipe or a fire hydrant as directed by the Borough shall be installed for flushing the line. Blow-off shall be copper with a minimum of 2 inches and shall be located so that water runoff will not cause damage or unsafe conditions.

K. Fire Hydrants

1. Fire Hydrants will be required and will be installed at the Applicant's expense. They shall be installed at locations approved by the Borough. Hydrant spacing shall be at a maximum of 400-foot intervals with coverage to all parts of an existing or proposed building.
2. Hydrant Locations shall be along public right-of-way and preferably at street intersections.

3. Hydrant locations in industrial areas shall be spaced accordingly to the latest requirement of the Insurance Service Offices (ISO).

L. Cathodic Protection

1. Water mains installed across or near utilities having cathodic protection shall be suitably protected. The method of protection, which may include insulating couplings, polyethylene encasement, electric connectors, test stations, and other facilities, shall be subject to Borough approval.

M. Customer Metering

1. Each customer shall be metered in accordance with the Borough Rules and Regulations. In the case of a privately owned distribution system, a bulk service meter shall be provided at the connection to the Borough mains.
2. Water meters and connecting hardware shall be furnished at the expense of the Borough and shall remain the property of the Borough. The Owner shall reimburse the Borough for the additional cost of any specialty water meters required by the Owner for a larger service greater than $\frac{3}{4}$ -inch. Meters shall be installed at the expense of the Owner. Meter installations must be approved and sealed by the Borough. Remotes shall be installed at a site convenient to the Borough. Remotes must be sealed by the Borough.
3. All meters shall be installed under the direction of and at a location selected by the Borough. After installation, the location of the meter shall not be changed except by written approval of and under the direction of the Borough.
 - a.) In homes built on a slab or where the Borough determines it is inconvenient to place the meter within the structure of the Owner or Consumer, the Borough may require the installation of the meter within a pit of the type approved by the Borough. The cost of the meter pit shall be borne by the Owner. The meter pit shall be at a location convenient to both the Borough and the Owner. The Owner shall maintain passageway to all Borough equipment.
4. Water meters shall be installed in accordance with Borough standard specifications.
5. The Owner shall at once notify the Borough of any damage to, or of any cessation in registration of the meter as soon as it comes to his knowledge. Meters shall be maintained by the Borough's as far as ordinary wear and tear is concerned; however, the Owner shall be responsible to the Borough for any damage to, or loss of any meter arising out of, or caused by the Owner's or Consumer's negligence or carelessness. The Owner shall permit no one other than an agent of the Borough or otherwise lawfully authorized Person to remove, inspect or tamper with the Borough's meter or other property of the Borough on the Owner's premises. Any costs arising from an Owner's

or Consumer's negligence or carelessness shall be billed to the Owner.

6. The quantity of water recorded by the meter shall be conclusive on both the Owner and the Borough. If the meter has been found to be registering inaccurately or has ceased to register, the meter will be promptly repaired or replaced by the Borough and the quantity of water consumed shall be estimated by the average registration of the water on previous corresponding periods. If an Owner disputes the meter readings, meter accuracy tests may be purchased, or another meter may be installed, at the expense of the Owner.

N. Separate Water Supply

1. The construction of separate public water supply systems will not be permitted except under unusual circumstances and by written approval of the Borough. If the Borough permits an Applicant to design and construct a separate water supply system. The Applicant shall maintain close contact with the Borough to insure that the design satisfies all Borough requirements. In addition, each new water supply system shall satisfy the following requirements:
 - a.) Permits: The project shall comply with all requirements of the Pennsylvania Department of Environmental Protection and the Susquehanna River Basin Commission for public water systems, and the necessary permits shall be obtained by the applicant from each agency.
 - b.) Sources: Two (2) separate or independent sources of supply shall be required for each water supply system. A distribution storage reservoir is not considered a source of supply.
 - c.) Treatment: Water quality and treatment facilities shall comply with the requirements of the Pennsylvania Department of Environmental Protection and the United States Environmental Protection Agency.
 - d.) Distribution Storage Capacity: Useful, or effective, distribution storage capacity shall be at least equal to the sum of: 20 percent of average daily demand as operating storage; 25 percent of average daily demand as emergency reserve; and the required fire reserve storage based on the fire flow and duration requirements listed hereinabove. Only stored water that can be delivered to each customer with adequate residual pressure is considered useful storage.
 - e.) Auxiliary Power: Auxiliary generating or drive equipment shall be provided to insure adequate source capacity during an electric power failure. The size and extent of equipment shall be approved by the Borough.
 - f.) Metering: Approved metering shall be provided for each source of supply.

O. Water Service Lines

1. No water service line shall be constructed or connected to the water system without approval from the Borough.
2. Each Improved Property shall have its own individual service line. Each side of a double house having a solid vertical partition wall shall be considered a separate property requiring individual water connections. Where premises in single ownership consist of more than one building, the Borough reserves the right to determine, under the circumstances of each case, whether each separate building must have its individual water connection or whether all buildings together may use a single connection. Each individual Residential and Non-Residential Unit will have a separate meter.
3. The Borough will exercise the right, in cases where the length of the service line extension exceeds 100 feet and in all cases where deemed advisable, to require the Owner to furnish at his expense, an approved meter pit provided with a suitable cover and constructed in accordance with a plan furnished by the Borough. Said meter pit is to be installed at the property or curb line and is to be used for the housing of the meter required for the service of the premises. In cases where there are multiple unit buildings, meters may be installed for each unit for purposes of accountability.
4. An "Application for Water Service" must be completed and the tapping fee must be paid prior to any connection to the Water System. An application may be obtained by calling (717) 484-4234.
 - a.) It is required that a Lead-Free Plumbing Material Certificate be completed and attached to every Application of Water Service form. The Borough requires that any property requesting connection to the Water System is to be certified that only lead-free plumbing materials were used after January 6, 1991 in the structure intended to be connected to the water system. (Note: Plumbing systems constructed prior to January 1, 1991 are exempt from the connection certification requirement.) If the use of solder containing lead is discovered, the Borough may refuse the connection.
5. All new connections from the existing water main to the curb stop and box shall be made by the Borough at a location established by the Borough.
6. All connections from the curb stop and box to the structure shall be at the expense of the Owner. A qualified plumber shall install all service lines.

7. No water service lines shall be laid in the same trench with gas pipe, sewer pipe or any other utility. Every service line shall be horizontally separated at least 5 feet from a sanitary sewer line; 10 feet from a septic tank, distribution box, disposal field or seepage pit; and 25 feet from a cesspool, by undisturbed or compacted earth.
8. Service lines shall consist of ¾-inch, Type K copper tubing and be installed at least 48 inches below the surface of the ground. All fittings must be compression type. Trenches must remain open until service lines and connections are inspected by a representative of the Borough.
9. A Borough supplied meter must be installed at the Owner's expense at the nearest possible point after the service line enters the structure. No water appliance or tap may precede the meter. All meters and outside remote readers shall be installed under the direction of and at a location selected by the Borough. Owner shall provide ball valves at both sides of the water meter.
10. Only an authorized representative of the Borough may open or close any curb stop or valve belonging to the Borough.
11. The Borough will exercise the right, in cases where it seems necessary, to require the installation of a meter pit at the expense of the Owner.

P. Miscellaneous

1. Vacuum valves; check valves, bulk meters, pressure gauges, etc., shall be installed where required by the Borough.
2. Requirements for a Private System: All connections from the curb stop and box to the structure shall be at the expense of the Owner after obtaining an "Application for Water Service." The Owner shall have a qualified plumber install all service lines from the curb stop and box to the structure. Such line shall be of pipe materials approved by the Borough, shall be installed at least 48 inches below the surface of the ground, and shall be owned and maintained in good condition at the expense of the Owner. Pipe must be Type K copper tubing and fittings must be compression type. No service lines shall be laid in the same trench with gas pipe, sewer pipe or any other utility of a public or private service company, nor within 3 feet of any open excavation or vault. A Borough supplied yoke and meter must be installed at the nearest possible point after the service line enters the structure. No water appliance or tap may precede the meter. All connections and installations must be inspected and approved by the Borough.
3. Maintenance of a Private System: The property Owner shall be responsible for all repairs and maintenance to the private system beyond the curb box and stop to the building and within the building. The Borough shall not be responsible for damage caused by leakage from the private system of the Owner or Consumer.

4. **Individual Service Lines and Connections:** Each improved property shall have its own individual service line. Each side of a double house having a solid vertical partition wall shall be considered a separate property requiring individual water connections. Where premises in single ownership consist of more than one building, the Borough reserves the right to determine, under the circumstances of each case, whether each separate building must have its individual water connection or whether all buildings together may use a single connection. Each individual Residential and Non-Residential Unit shall have a separate meter.
5. **Length of Service Line:** The Borough shall exercise the right, in cases where the length of the service line extension exceeds 100 feet and in all cases where deemed advisable, to require the Owner to furnish at his expense, an approved meter pit provided with a suitable cover and constructed in accordance with a plan furnished by the Borough. Said meter pit is to be installed at the property or curb line and to be used for the housing of the meter required for the service of the premises. In cases where there are multiple unit buildings, meters may be installed for each unit for purposes of accountability.

1.5 BOROUGH'S RIGHT OF INSPECTION

- A. Authorized Borough representatives shall have the right to observe all water system construction being carried out by a Contractor. Should the observed Work be unsatisfactory, the cost of removing, replacing, renewing, and making good the unsatisfactory Work shall be borne by the Contractor. No water main, service pipe, fire hydrant, or other water service facility shall be placed into service until it has been successfully tested in the presence of an authorized Borough representative in accordance with the requirements of these Specifications.

1.6 LIABILITY

- A. The Contractor shall be responsible for any damage, loss, or injury to persons or property that may arise, or be incurred, in or during the conduct or progress of the Work.

1.7 EXPLORATORY TEST PITS

- A. The Borough may require test pits to be dug in advance of excavation when necessary, to determine the location and depth of existing utilities, rock, water levels, or other conditions which might affect the construction.

1.8 WORK AREA TRAFFIC CONTROL AND MAINTENANCE

- A. Traffic in Work areas shall be controlled to protect the public and workmen. Traffic control devices and methods shall conform to applicable Pennsylvania Department of Transportation regulations.
- B. When vehicles must be stopped for short periods, Work shall be performed during other than peak traffic periods. Access to residential and business establishments

shall be kept open, except when Work is being performed at the point of access. Trenches across driveways, side streets, alleys, and entrances shall be maintained after backfilling.

- C. At the end of each work day all trenches and excavations shall be filled or closed up with H-20 rated steel plates.

1.9 COMPLIANCE WITH PROVISIONS OF ACT NO. 287

- A. The Contractor shall comply with all requirements of PA Act 287, as amended by Act 187 of 1996, regarding notification of utilities before doing any excavation.

1.10 SPECIAL REQUIREMENTS

- A. The Contractor shall maintain existing water mains in service. If an existing water main is damaged the Contractor shall expeditiously restore service at his expense.
- B. The Contractor shall not remove backfill material from the lines or Work until after the excavation is backfilled, except with the approval of the Borough. This provision does not relieve the Contractor from his obligation to dispose of excess excavated material.
- C. The Contractor shall protect the Work from damage during storms by any means necessary.
- D. The Contractor shall authorize a competent person to be available to deal with emergencies, which may arise during off working hours, such as evenings, weekends, and holidays.
- E. The Contractor shall keep the police, fire departments, and school districts informed of Work schedules and possible street obstructions.
- F. Before starting construction the Developer must provide 10 days prior notification before undertaking the project.
- G. Prior to the start of construction, the Developer/Contractor shall provide the following to the Borough:
 - 1. Two sets of construction Drawings.
 - 2. Payment of any fees for connections to the system.
 - 3. Copies of any state permits.
 - 4. Applicable Bonds, Letters of Credit, etc.
 - 5. Executed Developer's Agreement and Application for Water Service.

6. Copies of any easements.
 7. Copies of Contractor's insurance.
 8. Five (5) copies of any Shop Drawings.
- H. Preconstruction Conference: At least 10 days prior to construction, but before the Developer's Contractor starts the Work at the site, a conference attended by the Developer's Contractor, Owner, Engineer, and others as appropriate will be held to discuss the procedures for handling Shop Drawings and other submittals, and to establish a working understanding among the parties as to the Work.

1.11 DEVELOPER'S RESPONSIBILITIES

- A. Developer shall supervise and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Specifications. Developer shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Developer shall be responsible to see that the finished Work complies accurately with the Specifications.
- B. Developer shall keep a competent resident superintendent on the Work at all times during its progress. The superintendent shall be the Developer's representative at the site and shall have the Borough to act on Developer's behalf. All communications given to the superintendent shall be as binding as if given to the Developer.
- C. Developer shall provide competent, suitably qualified personnel to survey, lay out the Work, and perform construction as required by the Specifications. Developer shall at all times maintain good discipline and order at the site.
- D. All materials and equipment shall be of good quality and new, except as otherwise provided in the Specifications. If required by the Engineer, Developer shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the instructions of the applicable Supplier except as otherwise provided in the Specifications; but no provision of any such instructions will be effective to assign to Engineer, or any of the Engineer's consultants, agents, or employees, of any duty or Borough to supervise or direct the furnishing or performance of the Work or any duty or Borough to undertake responsibility contrary to the provisions of these Specifications.
- E. The Contractor and the Developer are advised that they will be required to design and conduct their work in compliance with the rules, regulations, and requirements, of the Pennsylvania Department of Environmental Protection.
- F. The Contractor at all times shall observe and comply with all Federal and State Laws and regulations, and local bylaws, ordinances and regulations in any manner affecting the conduct of the work or applying to employees on the Project, as well

as all safety precautions and orders or decrees which have been promulgated or enacted, or which may be promulgated or enacted, by any legal bodies or tribunals having Borough or Township Jurisdiction over the work, materials, equipment, employees or the Contract; such observation and compliance shall be solely and without reliance on superintendence or direction by the Borough. The duty of enforcement of all of said laws, ordinances, regulations, orders, or decrees lies with the body or agency promulgating them, not with the Borough.

1.12 PERMITS AND LICENSES

- A. With the exception of the PennDot Highway Occupancy Permit, a Water Supply Permit if applicable, and the Water Quality Management Permit if applicable, which will be obtained by the Township, the Contractor or Developer shall, unless otherwise specified, procure all necessary permits and licenses, pay all charges and fees therefore, and shall give all notices necessary and incident to the proper and lawful prosecution of the work. Any fees and charges associated with the Highway Occupancy, Water Supply and the Water Quality Management Permit shall be paid by the Developer or Contractor.
- B. The Highway Occupancy, Water Supply, and Water Quality Management Permit applications, if applicable, shall be prepared by the Developer in the name of the Borough and submitted to the Borough along with the application fees. After review of the applications by the Borough, the Developer shall make any corrections, if acquired and submit corrected copies to the Borough. The Borough will forward the applications and fees to the Pennsylvania Department of Transportation and the Department of Environmental Protection.
- C. Payment for personnel from State Agencies, as required to be on hand during the construction of work on Highways under their jurisdiction, shall be borne by the Contractor or Developer.
- D. Where work is to be done by the Contractor, in placing any pipe or other construction under railroad tracks, within the right-of-way of any railroad company, the Contractor shall be governed by the requirements of the railroad company involved, and shall consult with the officials thereof relative to the installation. If the railroad company requires any of their personnel to be on hand during the construction of the work, payment for such personnel shall be borne by the Contractor or Developer.

1.13 RECORD DOCUMENTS

- A. Developer shall maintain a safe place at the site for one record copy of all Drawings, Specifications, addenda, written amendments, change orders, Work directive changes, field orders, and written interpretations and clarifications in good order and annotated to show all changes made during construction. These record documents together with all approved samples and a counterpart of all approved Shop Drawings shall be available to Engineer for reference. Upon completion of the Work, these record documents, samples, and Shop Drawings shall be delivered to Engineer for Owner. All record drawings shall include a certificate attesting to the correctness of all information shown on the Drawings.

The Borough intends to use the prints of the record drawings to provide information as required by Act 287 and amended by Act 172.

- B. Record Drawings shall provide a surveyed location utilizing permanent physical features to locate all laterals, curb boxes, clean outs, and water services. Developers shall provide survey confirmation of all facilities in easements outside of the public right-of-way.
- C. Provide two (2) prints and one (1) reproduced Mylar set of record drawings.

1.14 SHOP DRAWINGS AND SAMPLES

- A. After checking and verifying all field measurements and after complying with applicable procedures specified in the General Requirements, Developer shall submit to Engineer for review and approval, five copies (unless otherwise specified in the General Requirements) of all Shop Drawings, which will bear a stamp or specific written indication that Developer has satisfied Developer's responsibilities under the Specifications with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to enable Engineer to review the information as required.
- B. Engineer will review and approve with reasonable promptness Shop Drawings and samples, but Engineer's review and approval will be only for conformance with the design concept of the project and for compliance with the information given in the Specifications and shall not extend to means, method, techniques, sequences or procedures of construction (except where a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Specifications) or to safety precautions and programs incident thereto. The review and approval of a separate item as such shall not indicate approval of the assembly in which the item functions. Developer shall make corrections required by Engineer, and shall return the required number of corrected copies of Shop Drawings and submit as required new samples for review and approval. Developer shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.
- C. Engineer's review and approval of Shop Drawings or samples shall not relieve Developer from responsibility for any variation from the requirements of the Specifications unless Developer has in writing called Engineer's attention to each such variation at the time of submission and Engineer has given written approval of each such variation by a specific written notation thereof incorporated in or accompanying the Shop Drawing or sample approval; nor shall any approval by Engineer relieve Developer from responsibility for errors or omissions in the Shop Drawings or from responsibility for Developer having complied with the provisions of these Specifications.
- D. Where a Shop Drawing or sample is required by the Specifications, any related Work performed prior to Engineer's review and approval of the pertinent submission will be the sole responsibility of the Developer and may be subject to rejection.

- 1.15 WARRANTY AND GUARANTEE; TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK
- A. Developer warrants and guarantees to Borough and Engineer that all Work will be in accordance with the Specifications and will not be defective. Prompt notice of all defects shall be given to Developer. All defective Work, whether or not in place, may be rejected, corrected, or accepted as specified herein.
 - B. Access to Work: Engineer and other representatives of the Borough, testing agencies and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspection, and testing. Developer shall provide proper and safe conditions for such access.
 - C. Visits to Site: As may be directed by Borough, Engineer will make visits to the site at intervals appropriate to the various stages of construction to observe the progress and quality of the executed Work and to determine, in general, if the Work is proceeding in accordance with the Specifications. Engineer will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Borough a greater degree of confidence that the completed Work will conform to the Specifications. On the basis of such visits and on-site observations as an experienced and qualified design professional, Engineer will keep Borough informed of the progress of the Work and will endeavor to guard Borough against defects and deficiencies in the Work.
 - D. Project Observer:
 - 1. Borough will either appoint a Project Observer or request that Engineer observe the performance of the Work. Inspection shall be provided solely for the purpose and to the extent necessary to insure conformance with the Specification's construction requirements.
 - 2. Engineer will be Borough's representative during the construction period, but does not have the power to bind the Borough to any financial or other legal obligations whatsoever.
 - E. Rejecting Defective Work: Observer or Engineer will have Borough to disapprove or reject Work which Observer or Engineer believes to be defective, and will also have Borough to require special inspection or testing of the Work as provided in paragraph 1.15.H whether or not the Work is fabricated, installed or completed.
 - F. Engineer will not be responsible for Developer's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, and Engineer will not be responsible for Developer's failure to perform or furnish the Work in accordance with the Specifications.
 - G. Engineer will not be responsible for the acts or omissions of Developer or of Developer's Contractor, any Supplier or of any other person or organization performing or furnishing any of the Work.

H. Tests and Inspections:

1. Developer shall give Engineer a forty-eight (48) hour notice of readiness of the Work for all required inspections, tests, or approvals.
 2. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) to specifically be inspected, tested or approved, Developer shall assume full responsibility therefore, pay all costs in connection therewith and furnish Engineer with the required certificates of inspection, testing and approval. Developer shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with Borough's or Engineer's acceptance of a Supplier of materials or equipment proposed to be incorporated in the Work, or of materials or equipment submitted for approval prior to Developer's purchase thereof for incorporation in the Work.
 3. All inspections, tests, or approvals other than those required by Laws or Regulations of any public body having jurisdiction shall be performed by organizations acceptable to the Borough or Engineer.
 4. If any Work (including work of others) that is to be inspected, tested or approved is covered without concurrence of Engineer, it must, if requested by Engineer, be uncovered for observation. Such uncovering shall be at Developer's expense unless Developer has given Engineer timely notice of Developer's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.
 5. Neither observations by Engineer or Observer nor inspections, tests or approvals by others shall relieve Developer from Developer's obligations to perform the Work in accordance with the Specifications.
- I. Uncovering Work: If any Work is covered contrary to the request of the Observer or Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Developer's expense.
- J. If Observer or Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Developer, at Engineer's request shall uncover, expose or otherwise make available for observation, inspection or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, Contractor shall bear all direct, indirect and consequential costs of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction (including but not limited to fees and charges of engineers, architects, attorneys, and other professionals).
- K. Correction or Removal of Defective Work: If required by Observer or Engineer, Developer shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the site and replace it with non-defective Work. Developer shall bear all direct, indirect and consequential costs of such correction

or removal (including but not limited to fees and charges of engineers, architects, attorneys, and other professionals) made necessary thereby.

L. **Placement Into Service:** Following completion of construction required cleaning, testing and disinfection as required of the system, the Borough may allow the system to be placed into operation if there is a demand for service and placement into service will not adversely impact the existing system. The Borough will assume responsibility for operation does not acknowledge final acceptance of the improvements or responsibility for maintenance, repairs or ownership

M. **Interfacing Existing Construction:**

1. Do not permit ground or surface water to enter the existing water or sanitary sewer facilities through the new piping connection.
2. Do not flush, drain or deposit water or debris from the new water and sewer piping or related construction into the existing water or sewer facilities.
3. Install a watertight plug in new sewer piping entering a new manhole. Maintain the plug until all debris and accumulated water have been removed from the new sewer facilities and the new sewer facilities have been passed all specified acceptance tests.

TECHNICAL SPECIFICATIONS
FOR
DEVELOPER INSTALLED WATER AND SEWER
FACILITIES
BOROUGH OF ADAMSTOWN

SECTION 01015

GENERAL CONDUCT OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General requirements for Work conducted and Contractor responsibilities as an incidental part of the project.

1.2 DEFINITIONS

- A. Definitions shall be as set forth in the General Conditions.

1.3 NIGHT AND WEEKEND WORK

- A. No Work shall be done between the hours of 6:00 p.m. and 7:00 a.m. Monday through Friday. No Work shall be done on Saturdays or Sundays. Contractor shall notify Engineer 48 hours in advance and in writing of any Work to be done. An exception to the above shall be for necessary proper care and protection of Work already performed or in the case of an emergency and then only with the permission of the Engineer.

1.4 FIRE

- A. Contractor shall take every precaution to prevent fire. Open burning on the site is not permitted.

1.5 CLEARING

- A. Clear areas required for access to site and execution of Work. Designate trees and shrubs to be removed. All trees greater than a 4-inch diameter at the property owner's request shall be saved, cut in 5-foot lengths, and neatly stacked on the property owner's property. Remove and dispose of debris, tree branches, limbs and shrubs including trees less than 4 inches in diameter.

1.6 RESPONSIBILITY REGARDING EXISTING UTILITIES AND STRUCTURES

- A. The existence and location of underground utilities, process piping or plant conduits indicated on the Drawings are not guaranteed and shall be investigated and verified in the field by the Contractor before starting Work. The Contractor's attention is directed to the existing local, state, and federal regulations. Excavation in the vicinity of existing structures and utilities shall be carefully done by hand.

- B. The Contractor shall be held liable for any damage done by reason of breaking any water, sewer, gas, telephone, electric, process piping, plant conduits, or other utility service. The Contractor shall notify all utility companies and the Borough's operation personnel in advance of construction and cooperate with agents of these companies and the Borough during the progress of the Work. When any lines or services become broken or damaged during the progress of the Work, the Contractor shall cause them to be repaired at once at his own expense. Delays, which would result in adjoining residences or businesses having to go overnight or for needlessly long periods during the day without utilities, or the plant operation to be adversely effected, will not be tolerated. The Borough reserves the right to remedy such delays or neglect by ordering outside parties to make repairs at the expense of the Contractor without written notice.
- C. Care shall be taken not to move, without the consent of the Engineer, any sewers, culverts, water, gas, electric, telephone, or other pipes or poles or structures. In crossing, or in running parallel with or near utility lines, process piping or plant conduits, they shall be securely hung, braced or supported in place until the Work is completed. Whenever it is necessary to interfere with said structures, the Contractor, at his own expense, shall maintain their respective services, and if necessary, lay temporary lines or structures.
- D. The Contractor shall repair all damage done to any structures on property and shall keep them in repair in like kind for a period of one year after the completion of the Work.
- E. Before ordering any material or doing any Work, the Contractor shall verify all measurements at the site and shall be responsible for the correctness of same. The Contractor shall, without extra charge, make slight alterations as may be required to make adjustable parts fit to fixed parts, leaving all materials and Work complete and in proper order.
- F. All dimensions given on the Drawings are to be field checked and verified, and any error inconsistencies are to be communicated to the Engineer before connecting Work.
- G. Water mains, storm drains, sanitary sewers, gas mains, process piping, plant conduits, and other utilities are shown on the Drawings in accordance with the best information available for the information of the Contractor. The Borough assumes no responsibility for accuracy or completeness of information shown. Existing pipe, conduits, mains and services shall be carefully protected and any damage to them caused by the Work shall be immediately repaired to the satisfaction of the Engineer by the Contractor at his expense, using materials of the kinds damaged.
- H. All valve boxes, covers, grates, frames, and surface appurtenances shall be adjusted flush with finished grades. The Contractor shall coordinate with each respective utility such adjustment.

1.7 MAINTENANCE CREW DURING NON-WORKING HOURS

- A. The Contractor shall make available during the normal non-working hours a maintenance crew which shall be available on two hours notice from the Engineer or Borough for the repairs and maintenance of trenches or other Work which have become hazardous to the public or plant operations as a result of trench settlement or other reasons.
- B. If the Contractor fails to make the repairs within a reasonable period of time after being directed by the Borough or Engineer, the necessary repairs or maintenance shall be performed by others and the full costs of the Work charged to the Contractor.
- C. Names, addresses and telephone numbers of responsible maintenance personnel shall be made available to the Borough and Engineer at all times. If the maintenance personnel so assigned fail to respond, the Contractor shall immediately reassign new maintenance personnel.

1.8 FITTING AND COORDINATION OF THE WORK

- A. The Contractor shall be responsible for the proper fitting of all Work and for the coordination of the operations of all trades, subcontractors, or material men engaged upon this Contract. He shall be prepared to guarantee to each of his subcontractors the locations and measurements which they may require for the fitting of their Work to all surrounding Work.

1.9 MUTUAL RESPONSIBILITY OF CONTRACTORS

- A. If, through acts of neglect on the part of the Contractor, any other Contractor or any subcontractor shall suffer loss or damage on the Work, the Contractor shall settle with such other Contractor or subcontractor by agreement or arbitration, if such other Contractor or subcontractor assert any claim against the Engineer and/or the Borough on account of any damage alleged to have been so sustained, the Engineer will notify this Contractor, who shall defend at his own expense any suit based upon such claim, and, if any judgment or claims against the Engineer and/or Borough shall be allowed, the Contractor shall pay or satisfy such judgment or claim and pay all costs and expenses in connection therewith.

1.10 PROJECT SAFETY

- A. Nothing contained in the Drawings and Specifications or in any other document relating to this project shall be construed to require or authorize the Engineer and/or Borough to supervise or be in any way responsible for the Contractor's compliance with any applicable safety regulations or codes or the like. The Engineer and/or Borough shall have no duty to inform the Contractor of any possible safety violations, and should the Engineer and/or Borough voluntarily point out possible safety violations, such actions shall not be construed to mean that the Engineer and/or Borough has assumed any responsibility for the

Contractor's compliance with any applicable safety regulations, codes or the like. The Contractor is solely responsible for project safety.

- B. When the contract requires entry into a confined space, the Contractor shall be familiar with OSHA Regulation 29 CFR Parts 1910 "Permit-Required Confined Spaces for General Industry; Final Rule" dated January 14, 1993, as amended, and shall comply with same during this Contract.
- C. When construction interferes with the normal flow of traffic, it shall be the duty of the Contractor to furnish, erect, place and maintain traffic control signs and devices and maintain traffic during hours of construction and at all other time in accordance with the methods indicated in: (1) Pennsylvania Code, Title 67, Chapter 203, Work Zone Traffic Control; (2) Pennsylvania Code, Title 67, Chapter 211, Official Traffic Control Devices; and (3) Pennsylvania Department of Transportation, Publication 408, Specifications.
- D. It shall also be the responsibility of the Contractor to assume all risks and to be liable for all damages that occur by reason of unsafe construction practices.
- E. All methods, equipment, materials, and their uses shall be in accordance with laws and regulations of the Commonwealth of Pennsylvania, the Federal Occupation and Safety Health Act, and local ordinances. The Work shall be completed with a minimum of inconvenience to the residents and to the traveling public in general.

1.11 NON-DISCRIMINATION

- A. No Contractor or subcontractor, nor any person acting on behalf of such Contractor or subcontractor, shall by reason of race, color, sex, religion, age, or national origin, discriminate against any individual who is qualified and available to perform the Work to which the employment relates.
- B. The Contractor shall adhere to the provisions of Act No. 222 of 1955, as amended by Act No. 19, 1961 and the Regulations of the Pennsylvania Human Relations Commission of 1965 relating to non-discrimination.

1.12 FEDERAL STATUTES AND REGULATIONS

- A. Applicable federal statutes and regulations shall be adhered to during the Contract period.

1.13 WORKMEN'S COMPENSATION

- A. The Contractor shall comply with the provisions of the Pennsylvania Workmen's Compensation Act and any supplements or amendments thereto relative to Workmen's Compensation Insurance, and shall furnish proof to the municipality that he has accepted the provisions of said Act and either insured his liability there under or secured exemption there from prior to award of Contract.

1.14 PERMITS AND LICENSES

- A. The Contractor shall, unless otherwise specified elsewhere herein, procure all necessary permits and licenses, pay all charges and fees, and give all notices necessary and incident to the proper and lawful prosecution of the Work.
- B. If the Pennsylvania Department of Transportation requires any of their personnel to be on hand during the construction of the Work, payment for such personnel shall be borne by the Contractor.
- C. Where Work is to be done by the Contractor by placing any pipe or other construction under railroad tracks, or within the right-of-way of any railroad company, the Contractor shall be governed by the requirements of the railroad company involved, and shall consult with the officials thereof relative to the installation. If the railroad company requires any of their personnel to be on hand during the construction of the Work, payment for such personnel shall be borne by the Contractor.

END OF SECTION

SECTION 01050

FIELD ENGINEERING

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. General Conditions: Basic requirements.
- B. Section 01700 - Contract Closeout: Record documents.

1.2 QUALITY ASSURANCE

- A. Land Surveyor: Registered in the Commonwealth of Pennsylvania, and acceptable to Engineer.

1.3 SUBMITTALS

- A. Submit name, address, and telephone number of surveyor before starting survey Work.
- B. On request, submit documentation verifying accuracy of survey Work.
- C. Submit certificate signed by surveyor certifying that elevations and locations of improvements are in conformance, or non-conformance, with contract documents.

1.4 PROJECT RECORD DOCUMENTS

- A. Maintain a complete and accurate log of control and survey Work as it progresses.
- B. Submit Record Documents under provisions of Section 01700.

1.5 EXAMINATION

- A. Verify locations of survey control points prior to starting Work.
- B. Promptly notify Engineer of any discrepancies discovered.

1.6 SURVEY REFERENCE POINTS

- A. Developer to locate and Contractor to protect survey control and reference points.
- B. Control datum for survey is that established by Developer and indicated on Drawings.

1.7 SURVEY REQUIREMENTS

- A. Establish lines and levels, locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements, including pavements; stakes for grading, fill and topsoil placement; and utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, and ground floor elevations.
- B. Periodically verify layouts by same means.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 RELATED REFERENCES

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions, and Division 1 Specifications apply to this section.

1.2 SUBMITTAL PROCEDURES

- A. Deliver submittals to Borough.
- B. Transmit each item under Engineer-accepted forms. Each transmittal shall be numbered in sequence. Identify project, Contractor, subcontractor, major supplier; identify pertinent Drawing sheet and detail number(s). Identify deviations from Contract Documents. Provide space for Contractor and Engineer review stamps.
- C. Apply Contractor's stamp, signed, or initialed certifying that review, verification of products required, field dimensions adjacent to construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- D. Comply with progress schedule for submittals related to Work progress. Coordinate submittal of related items.
- E. After Engineer review of submittal, revise and resubmit as required, identifying changes made since previous submittal.
- F. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report any inability to comply with provisions.
- G. Provide Manufacturer's Safety Data Sheets (MSDS) for all products and materials.

1.3 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial progress schedules prior to construction. After review by Engineer, revise and resubmit as required. Submit revised schedules when actual schedules become outdated.
- B. Show projected percentage of completion for each item of Work.
- C. Show submittal dates required for Shop Drawings, product data and samples, and product delivery dates.

1.4 SCHEDULE OF WORK

- A. Submit typed schedule on 8" by 11" paper; Contractor's standard form or media-driven printout will be considered on request.
- B. Format the Table of Contents of this document. Identify each line item with number and title of the major Specification sections.

1.5 SHOP DRAWINGS

- A. When required, one reproducible transparency and two opaque reproductions or no more than five copies of the Shop Drawings shall be submitted by the Contractor with such promptness as to avoid delay in the Work. After review of these drawings by the Engineer, the Shop Drawings will be: (1) "Reviewed"; (2) "Reviewed and Noted"; (3) "Returned for Correction"; or (4) "Not as Specified". If the Shop Drawings are "Returned for Correction", the Contractor shall make the required correction and resubmit one reproducible transparency and two opaque reproductions or no more than five copies of the corrected Shop Drawings to the Engineer, and such other copies as may be needed for proper prosecution of the Work. If the Drawings are "Not as Specified", the Contractor shall prepare a new Shop Drawings submission. The Engineer's review of Shop Drawings shall not relieve the Contractor from responsibility for errors or discrepancies in such Drawings. All Shop Drawings shall be identified with the name of the Contractor, and numbered in consecutive order. Two copies of all Shop Drawings shall be retained by the Engineer. One additional copy shall be retained by the Owner.

1.6 PRODUCT DATA

- A. Mark each copy to identify applicable products, models, options, and other data; supplement manufacturers' standard data to provide information unique to this project.

1.7 MANUFACTURERS' INSTRUCTIONS

- A. When required in individual Specification section, submit manufacturers' printed instructions for delivery, storage, assembly, installation start up, adjusting, and finishing in quantities specified for product data.
- B. Identify conflicts between manufacturers' instructions and Contract Documents.

1.8 SAMPLES

- A. Submit full range of manufacturers' standard colors, textures, and patterns for Owner/ Engineer's selection. Allow four weeks for selection of finishes from time of submission.

- B. Submit samples to illustrate functional characteristics of the product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing Work.
- C. Include identification on each sample with full project information.
- D. Submit the number or samples specified in respective Specification section; one will be retained by the Engineer. Review samples, which may be used in the Work are indicated in the Specification section.

1.9 FIELD SAMPLES

- A. Provide field samples of finishes at project as required by individual Specifications section. Install sample complete and finished. Acceptable samples in place may be retained in completed Work.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 RELATED REFERENCES

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions, and Division 1 Specifications apply to this section.

1.2 RELATED SECTIONS

- A. Section 01300 - Submittals.

1.3 QUALITY ASSURANCE

- A. Referenced standards shall be the following:
 - 1. None.

1.4 CLOSEOUT PROCEDURES

- A. When Contractor considers Work has reached final completion, submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection.
- B. In addition to submittals required by the conditions of the Contract, provide submittals required by governing authorities, including PENNDOT and DEP.

1.5 FINAL CLEANING

- A. Execute prior to final inspection.
- B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; and vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment. Clean roofs, gutters, downspouts, and drainage systems.
- C. Clean site; sweep paved areas, rake clean other surfaces.
- D. Remove waste and surplus materials, rubbish, and construction facilities from the project and from the site.
- E. Remove all construction debris from tanks, manholes, pits, etc. Do not allow debris to be washed into treatment process or stream.

1.6 PROJECT RECORD DOCUMENTS

- A. Store documents separate from those used for construction.
- B. Keep documents current; do not permanently conceal any Work until required information has been recorded.
- C. At Contract closeout, submit documents with transmittal letter containing date, project title, Contractor's name and address, list of documents, and signature of Contractor.

1.7 OPERATION AND MAINTENANCE DATA

- A. Provide data for:
 - 1. Water Treatment and Pumping Equipment.
 - 2. Wastewater Treatment and Pumping Equipment.
 - 3. Mechanical Equipment and Controls including heating, ventilating and hoist equipment.
 - 4. Electrical Equipment and Controls including emergency generator.
 - 5. Metering Equipment and Controls.
 - 6. Refer to Section 01300, Submittals, for specifics on operation and maintenance manuals.
- B. Submit three (3) sets prior to final inspection, bound in 8½-inch x 11-inch, 3-ring side binders with durable plastic covers. Operation and maintenance data shall have been previously approved by the Engineer as a part of the acceptance of the equipment.
- C. Provide a separate volume for each system, with a table of contents and index tabs for each volume.
- D. Operation and maintenance instructions, arranged by system. For each system, give names, addresses, and telephone numbers of suppliers and service representatives. Include the following unless otherwise instructed in the Specifications:
 - 1. Installation instructions
 - 2. Appropriate design criteria
 - 3. List of equipment
 - 4. Parts list

5. Recommended list of spare parts
6. Start up procedures
7. Operating instructions
8. Maintenance instructions, equipment
9. Maintenance instructions, finishes
10. Shop Drawings and product data
11. Warranties
12. List of Contacts for maintaining and repair including address and phone numbers

1.8 WARRANTIES AND BONDS

- A. Provide duplicate, notarized copies. Execute Contractor's submittals and assemble documents executed by subcontractors, suppliers, and manufacturers. Provide table of contents and assemble in binder with durable plastic cover.
- B. Submit material prior to final release of escrow. For equipment put into use with Owner's permission during construction, submit within 10 days after first operation listing date of acceptance as the start of the warranty period.

1.9 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, and maintenance materials in quantities specified in each section, in addition to that used for construction of Work. Coordinate with Owner, deliver to project site, and obtain receipt from Owner.

END OF SECTION

SECTION 02025

EXISTING UTILITIES AND STRUCTURES

PART 1 GENERAL

1.1 NOTIFICATION OF UTILITIES

- A. Contractor shall notify all utility companies that construction of the Work will pass through the areas where their services exist. Notifications to the utilities shall be according to Act 187.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Materials for temporary support, adequate protection and maintenance for all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the Work shall be furnished by the Developer at his own expense.

PART 3 EXECUTION

3.1 OBSTRUCTIONS BY OTHER UTILITY STRUCTURES

- A. Where the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, pipes, branch connections to main sewers or drains, the obstruction shall be permanently supported, relocated, removed, or reconstructed by the Developer in cooperation with the owners of such utility structures. Before proceeding, the Developer must reach an agreement with the Engineer on the method to avoid obstruction.
- B. No deviation shall be made from the required line or depth without the consent of the Engineer.

3.2 REPAIRS

- A. Existing pipes or conduits crossing the trench or otherwise exposed, shall be adequately braced and supported to prevent trench settlement from disrupting the line or grade of the pipe or conduit, all in accordance with the directions of the Engineer. Utility services broken or damaged shall be repaired at once to avoid inconvenience to customers. Storm sewers shall not be interrupted overnight. Temporary arrangements, as approved by the Engineer, may be used until any damaged items can be permanently repaired. All items damaged or destroyed by construction and subsequently repaired must be properly maintained by the Contractor.

3.3 RELOCATION

- A. Where it is necessary to relocate an existing utility or structure, the Work shall be done in such a manner as is necessary to restore it to a condition equal to that of the original facility. No such relocation shall be done until approval is received from the owner of the utility or structure being changed.

3.4 SEPARATION OF WATER MAINS, SANITARY SEWER AND STORM SEWERS

- A. General: The following factors should be considered in providing adequate separation:
1. Materials and types of joints for water and sewer pipes;
 2. Soil conditions;
 3. Service and branch connections into the water main and sewer line;
 4. Compensating variations in horizontal and vertical separations;
 5. Space for repair and alterations of water and sewer pipes; and
 6. Off-setting of pipes around manholes.
- B. Parallel Installations: Water mains shall be laid at least 10 feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge of pipe. In cases where it is not practical to maintain a 10-foot separation, the Pennsylvania Department of Environmental Protection (DEP) may allow deviation on a case-by-case basis, if supported by data from the Engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.
- C. Crossings: Whenever water mains must cross building drains, storm drains or sanitary sewers, the water main shall be laid at such an elevation that the bottom of the water main is 18 inches above the top of the drain or sewer. This vertical separation shall be maintained for the portion of the water main located within 10 feet horizontally of any sewer or drain it crosses. The 10 feet is to be measured as a perpendicular distance from the drain or sewer line to the drain line.
- D. Exception: When it is impossible to obtain the proper horizontal and vertical separation as stipulated above, the Engineer is to be notified. If directed by the Engineer, both the water main and sewer line shall be constructed of ductile iron, galvanized steel or protected steel pipe having mechanical joints. Other types of joints of equal or greater integrity may be used at the discretion of the Engineer after consultation with DEP. Thermoplastic pipe may be used provided

mechanical or solvent weld pipes are used. These shall be pressure tested to assure water tightness before backfilling. Where water mains must cross under a sewer, additional protection shall be provided by:

1. A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line.
 2. Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the water line.
 3. That the length of the water line be centered at the point of the crossing so that the joints shall be equidistant and as far as possible from the sewer.
- E. Through the Engineer, DEP shall be consulted when any of the above conditions cannot be met to discuss the use of double casing or concrete encasement of sewer and/or water lines as possible alternatives.

END OF SECTION

SECTION 02110

SITE CLEARING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. All Work within this section includes, but is not limited to, the furnishing of all equipment, labor and materials and performing all operations necessary to the removal of trees and other vegetation, topsoil stripping, and clearing and grubbing.
- B. Comply with state and local code requirements when disposing of trees, shrubs and all other materials removed under this section.

1.2 PROJECT CONDITIONS

- A. Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.
- B. Protection of Existing Improvements: Provide protection necessary to prevent damage to existing improvements indicated to remain in place.
- C. Protect improvements on adjoining properties.

PART 2 PRODUCTS

- A. Not applicable.

PART 3 EXECUTION

3.1 SITE CLEARING

- A. General: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions as required to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. "Removal" includes digging out and offsite disposing of stumps and roots.
- B. Cut minor roots and branches of trees indicated to remain in a clean and careful manner, where such roots and branches obstruct installation of new construction.
- C. Topsoil: Topsoil is defined as friable clay loam surface soil found to a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over two inches in diameter, and without weeds, roots, and other objectionable material.

- D. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.
- E. Remove heavy growths of grass from areas before stripping.
- F. Stockpile topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, are to prevent wind erosion.
- G. Dispose of unsuitable or excess topsoil same as specified for disposal of waste material.
- H. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.
- I. Completely remove stumps, roots, and other debris protruding through ground surface.
- J. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.

3.2 DISPOSAL OF WASTE MATERIALS

- A. All materials obtained as a result of the clearing and grubbing operations shall be the property of the Contractor and shall be disposed of in accordance with the requirements of the applicable governing agencies.
- B. Chipping of brush materials will be permitted, but the resultant chips must be disposed of at an approved location.
- C. Burning of logs, stumps, roots, cuttings, and other material on the site will not be permitted.

END OF SECTION

SECTION 02201

SEWER LINE TRENCHING AND BACKFILL

PART 1 GENERAL

1.1 RELATED REFERENCES

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

1.2 RELATED SECTIONS

- A. Section 02730 - Manholes.
- B. Section 02731 - Sanitary Sewer Pipe.
- C. Section 02732 - Force Mains.
- D. Section 02733 - Low Pressure Sanitary Sewer.

1.3 DESCRIPTION OF WORK

- A. The Work within this section includes, but is not limited to, the furnishing of all equipment, labor and materials and performing all operations necessary to excavate, protect and backfill all trenches in accordance with the Specifications, and applicable Drawings.
- B. The Contractor shall perform all excavation of every description and of whatever substance encountered to the depths required, as specified herein. In performing the Work as specified in this section, the Contractor shall conform to the current regulations of the Pennsylvania Department of Labor and Industry and applicable federal regulations for excavations and construction. All excavated materials not required for backfill shall be removed and wasted or otherwise disposed of as required or specified.
- C. The Contractor will establish benchmarks and other control points. All such points shall be carefully preserved and protected by the Contractor. The Contractor shall be responsible for entirely rectifying Work improperly constructed because of failure of the Contractor to maintain and protect the established control points.

1.4 QUALITY ASSURANCE

- A. Referenced standards shall be the following:
 - 1. Pennsylvania Department of Transportation (PENNDOT) Publication 408 Specifications and its revisions.

2. PENNDOT Publication 203.
3. PENNDOT Chapter 459 (Occupancy of Highway by Utility).
4. Certificate of Compliance, PENNDOT Form CS-4171, shall be submitted for all materials.
5. American Society for Testing and Materials (ASTM).

PART 2 MATERIALS

2.1 CLASSIFICATION OF MATERIALS

- A. PENNDOT 1B Stone (No. 8 Stone-AASHTO): All materials shall conform to PENNDOT Publication 408, Section 703.3.
- B. PENNDOT 2B Stone (No. 57 Stone-AASHTO): All materials shall conform to PENNDOT Publication 408, Section 703.3.
- C. PENNDOT 2 RC Stone (Select Granular Stone-AASHTO): All materials shall conform to PENNDOT Publication 408, Section 703.3.

PART 3 CONSTRUCTION

3.1 REMOVAL AND PROTECTION OF PAVEMENT

- A. The Contractor shall clear the surface and remove all surface materials, of whatever nature, over the line of the trench; and he shall properly separate and classify the material removed; and store, guard, and preserve said material as may be required for use in backfilling, resurfacing, repaving or for other purposes. All rock, earth, sand, curbing, gutter and flagstones, and all sectional paving units which may be removed, together with all materials taken from the trenches, shall be stored in such parts of the street or roadway, or such other suitable place, and in such manner as accepted by the Engineer. The Contractor shall be responsible for any loss of, or any damage to paving materials through his own or his employee's careless removal or neglectful or waste storage, disposal or use of same.
- B. Pavement shall be cut to neat lines equidistant from the centerline of the trench and the edges of the pavement shall be protected and maintained by the Contractor until the repaving is completed. If the pavement edges are not maintained to the satisfaction of the Engineer, the pavement shall be recut when the paving is done. All pavement shall be cut by a mechanical saw.
- C. The Contractor shall also protect the street surfaces outside of the trench limits and shall repair all damage done thereto as a result of his operations.

3.2 REMOVAL AND STORAGE OF MATERIAL

- A. In or along state roads and highways or at any other locations where the working space is limited, the material excavated from the first 100 feet of any opening, or from such additional length as may be necessary, when required by the Engineer, shall be removed from the area as soon as excavated. The material subsequently excavated shall be used to refill the trench, except within state highway rights-of-way or in municipal road paved areas where the material used to refill the trench shall consist of Class 1 backfill material. In no case will the Contractor be allowed to cast excavated material beyond the curb or right-of-way lines, or on sidewalks or lawns.
- B. In case more material is excavated from the trench than can be backfilled over the completed sewer or can be stored on the street or within the limits of the right-of-way, leaving space for the traffic and drainage as herein provided, the excess material shall be removed to some convenient place provided by the Contractor. The Contractor shall bring back as much of the material so removed, as may be required to properly backfill the trench, or if the proper kind; or, if so required by the Engineer, the Contractor shall furnish such other suitable material as may be necessary.
- C. When it is necessary to haul soft or wet material over the streets, the Contractor shall provide suitable tight vehicles to prevent spillage.
- D. All topsoil shall be removed from the limits of trenches before the commencement of trench excavation. After the trenches are backfilled, the topsoil shall be replaced.

3.3 ORDER OF WORK

- A. The Contractor shall submit a progress schedule and shall carry on his Work in strict accordance therewith. Deviations from the progress schedule may be made only with the approval of the Engineer.
- B. Service connections shall be constructed either at the same time as the main sewer or immediately after its completion.
- C. All street paving shall be replaced by the Contractor, after which the street surfaces shall be cleaned as specified herein.
- D. The failure of the Contractor to comply with these requirements concerning installation of service connections and manholes, repaving and cleaning of streets shall be sufficient cause for the Engineer to stop all other Work on the project until these requirements have been met.

3.4 SEWER LINES AND GRADES

- A. Sewer lines and grades shall be laid out and maintained during construction in the following manner.

- B. Before beginning the excavation for any run of main sewer, the Contractor's forces shall set control points for line and grade. In unpaved or unsurfaced areas, these points shall be placed on the top of stakes securely driven into the ground. In paved areas, they may be spikes driven into the paving or crosses cut into the paving, and, in either case, enclosed in a painted circle. Stakes or points shall be sufficiently offset from the centerline so as to be undisturbed during the excavation and pipe laying operations. The offset shall be on the side of the centerline opposite to that on which excavation will be thrown. The first stake or point shall be set 25 feet distant from the manhole having the lower invert; succeeding stakes shall be set 25 feet apart. Elevations of the top of stakes, or if points are used, on the surface of the paving on the centerline of the sewer opposite the points, shall be taken by the Contractor, using a surveyor's level. The Contractor shall record these elevations and compute the depths of cut to the invert of the sewer and mark both the stationing and the computed depths of cut on each stake with keep or on the road surface with paint. The Contractor shall use these depths of cut as guides for the rough excavation, making due allowance for excavating to the lower depth to accommodate the required pipe bedding, and for concrete cradles or concrete encasements. Excavation shall begin at the manhole having the lower invert and proceed upgrade.

3.5 WIDTH AND DEPTH OF TRENCHES

- A. From the sub grade elevation to an elevation at least 12 inches above the top of the outside barrel of the pipe, the banks of trenches in all cases shall be excavated to vertical lines and the trenches shall be not less than 12 inches nor more than 16 inches wider than the outside diameter, at the barrel of the pipe to be laid therein. The trenches shall be excavated true to line so that a clear space not less than 6 inches nor more than 8 inches in width is provided on each side of the barrel of the pipe. If sheeting is required, the foregoing dimensions shall be applicable to the inside faces of the sheeting.
- B. From a point 12 inches above the top of the outside barrel of the pipe to the surface, the banks of trenches in all streets, roads or highways, paved or unpaved, shall be kept as nearly vertical as possible, and in no case shall the width of the trench at the top exceed the outside diameter of the pipe plus 40 inches. If the specified maximum width of the trench cannot otherwise be maintained, the Contractor shall install temporary sheeting. Where sewers are to be constructed in rights-of-way or easements in open country, the specified maximum width of the trench at the top may be exceeded only if construction is kept entirely within the limits of the easements or rights-of-way and can be carried on without damage to adjoining property. The angle of slope shall be the angle at which the trench bank will stand without sliding and in no case shall the angle of slope be steeper than one-half horizontal to one vertical.
- C. In locations other than on easements or rights-of-way, the Engineer may, as warranted by working conditions and where permitted by the Pennsylvania Department of Labor and Industry requirements, waive the requirements that

the maximum width at the top of the trench shall not exceed the outside diameter of the pipe plus 40 inches.

- D. Except at locations where excavation of unsuitable material is required, care shall be taken not to excavate below the depths specified. When the material encountered at sub grade is unstable, or where, in the opinion of the Engineer, the ground does not afford a sufficiently firm foundation, the Contractor shall excavate the trench to such increased depth as may be required by the Engineer and then shall refill the trench to sub grade with crushed stone conforming to PENNDOT's grading and quality requirements for No. 1B coarse aggregate, thoroughly compacted to the satisfaction of the Engineer, or if required by the Engineer, the Contractor shall construct a timber foundation. If earth trenches are excavated beyond the specified depths without written requirements of the Engineer, they shall be backfilled to the proper grade with thoroughly tamped No. 1B crushed stone.

3.6 LENGTH OF TRENCH

- A. No trench shall be opened more than 100 feet in advance of the pipe lines laid. The Contractor shall limit all trench openings to a distance commensurate with all rules of safety.
- B. If the Work is stopped either totally or partially, the Contractor shall provide adequate plates, flashers, etc. to protect the motorist and pedestrian during non-working hours. All open trenches shall be covered during non-working hours.

3.7 PUMPING AND DRAINING

- A. The Contractor shall remove, by pumping or draining, any water which may accumulate in the trenches and other excavations and shall build all dams and do all other Work necessary to keep the trenches or other excavation as free from water as possible. Where it is impractical to completely drain the trench, special pipe or jointing materials may be authorized at no additional expense to the Owner. While the pipelines are being laid, the Contractor shall have sufficient pumping machinery ready for immediate use. All surface waters shall be prevented from entering the open ditches or excavations by proper grading of the surface in the vicinity of the excavation. Erosion and sediment control shall be exercised in accordance with the approved plan. Under no circumstances shall any pumped water be discharged to any sanitary sewer.

3.8 MAINTENANCE OF GUTTERS

- A. The Contractor shall keep the gutters open at all times so the flow, storm or other waters shall not be obstructed. If the material excavated from the trenches must temporarily extend over the gutters, it shall be the duty of the Contractor to plank or bridge over the gutters, without extra compensation, so the flow of water is not impeded. Erosion and sedimentation control shall be exercised in accordance with the approved plan.

3.9 MAINTENANCE OF TRAFFIC

- A. Work shall be conducted so as to cause a minimum of convenience to pedestrian and vehicular traffic and to private and public properties along the line of Work. It shall be the duty of the Contractor, at all times, to maintain crossing, walks, sidewalks, and other roadways open to the traffic and in a satisfactory condition, and to keep all fire hydrants, water valves, fire alarm boxes, and letter boxes accessible for use. Whenever it is necessary to maintain pedestrian traffic over open trenches, a timber bridge at least three feet in width and equipped with side railings shall be provided. When the excavated material will encroach upon sidewalks or private property, planking shall be placed in order to keep the sidewalk or private property clear of excavated material.
- B. In state roads, the material excavated from the trench shall be removed from the site of the Work at the Contractor's expense and to bring back as much of the accepted material as necessary to properly refill the trench; or he shall, at his own cost and expense, furnish such other suitable materials as may be necessary to properly refill the trench.
- C. When it is necessary to haul soft or wet materials over public streets, the Contractor shall provide suitable vehicles and shall conform to all laws and ordinances relevant to such hauling.
- D. Maintenance and protection of traffic on municipal streets and state highways shall be in strict accordance with PENNDOT Publication 203. The Contractor shall adjust the sign locations daily in order to protect that section of highway to be disturbed during that same day.

3.10 ROCK EXCAVATION

- A. Under this Contract, all excavation shall be unclassified; that is, the removal of all material of any nature, kind, type of origin will be considered the same and shall be included in the unit pricing as indicated in the Bid Form.
- B. Unless otherwise accepted by the Engineer, rock shall be fully taken out at least 25 feet in advance of pipe laying to sub grade as defined herein, and to a width not to exceed the specified width of the trench, for the size of pipe to be laid therein.
- C. If rock below the specified grade is shattered due to excessive drilling or blasting, and if, in the opinion of the Engineer, it is unfit for foundation, such shattered rock shall be removed and the area backfilled to the proper grade with concrete or other material acceptable to the Engineer.
- D. Where manholes are excavated in rock, they shall be excavated 1 foot outside the exterior lines of the walls of the manholes and to a depth of 6 inches below the bottom.

- E. All excavated material that is unfit for refilling must be immediately removed from the site of the Work.
- F. Wherever rock is encountered in the excavations for manholes in which blank connections are to be left for future extensions of the sewers, the rock shall be excavated for a distance of not less than 10 feet from the center of the manhole, in the direction of the proposed extension of the sewer, and the excavation shall conform to the lines of the prism required by the dimensions of such extension.

3.11 BLASTING

- A. All blasts shall be properly matted and securely covered. The Contractor shall be solely responsible for injury to persons or property located within or beyond the area or scope of the project that may result from this use of explosives.
- B. All blasting shall be done under the supervision of a licensed blaster and subject to state, federal, (including the Department of Labor and Industry), county or local regulations for blasting. Whenever any pipe main or conduit is encountered in the trench, all material within 5 feet of the same shall be removed by some method other than blasting or as otherwise governed by the Owner of the utility.
- C. The Contractor will be responsible for the depths to which all blasting is performed.
- D. Should any street paving adjoining any trench be damaged in consequence of the Contractor's blasting operations, he shall immediately cease his blasting operations and repair the damaged street paving; also, he shall not again proceed with any blasting until he has submitted to and obtained approval from the Engineer.

3.12 BRACED AND SHEETED TRENCHES

- A. Open cut trenches shall be sheeted and braced as required by any governing federal and state laws and municipal ordinances, and as may be necessary to protect life, property or the Work. The cost of furnishing, placing and removing the sheeting and bracing necessary to protect life, property or the Work shall be provided by the contractor.

3.13 CAUTION IN EXCAVATION

- A. The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined, and he shall be held responsible for the repair of such structures when broken or otherwise damaged because of carelessness on his part.

3.14 PIPE BEDDING

- A. The trench shall be excavated to a depth of 6 inches below the outside diameter of the pipe barrel, or deeper if so specified. The resultant sub grade shall be undisturbed. The bedding shall then be prepared by placing a thoroughly compacted 1B stone in 6-inch uncompacted layers to 12 inches above top of pipe. Bedding shall provide uniform and continuous bearing and support for the pipe at every point between bell holes.

3.15 CONCRETE CRADLE AND CONCRETE ENCASEMENT

- A. The trench shall be excavated to a depth of 6 inches below the outside of the barrel of pipes 24 inches or less and 9 inches below the outside of the barrel of pipes larger than 24 inches in diameter. All of this excavation may be done by machine. Quality of concrete and method of placement is specified elsewhere.

3.16 UNSTABLE OR WET SUBGRADE

- A. Where the bottom of the trench at sub grade is found to be unstable or to include ashes, cinders, any type of refuse, vegetable or other organic material, or large pieces or fragments of inorganic material which, in the opinion of the Engineer, should be removed, the Contractor shall excavate and remove such unsuitable material to the width and depth recommended by the Engineer. Before pipe is laid, the sub grade shall be made by backfilling with 2B stone in 6-inch uncompacted layers, thoroughly tamped and the bedding prepared as hereinbefore specified.

3.17 SPECIAL FOUNDATIONS

- A. Where the bottom of the trench at the sub grade is found to consist of material which is unstable to such a degree that, in the opinion of the Engineer, it cannot be removed and replaced with an accepted material thoroughly compacted in place to support the pipe properly, the Contractor shall construct a foundation for the pipe, consisting of piling, timber or other materials, in accordance with plans prepared by the Engineer.

3.18 EXCAVATION IN FILL

- A. When the pipe is laid in fill, the compacted embankment shall be brought to a height of at least 12 inches above the proposed top of the pipe before the trench is excavated.

3.19 BACKFILL METHODS:

- A. General: Backfilling shall not be done in freezing weather except by permission of the Engineer, and it shall not be made with frozen material. No fill shall be made where the material already in the trench is frozen. Any

consolidation method utilizing water, such as jetting or puddling shall not be permitted.

- B. **Backfill Beneath and to Centerline of Pipe:** All trenches shall be backfilled by hand, from the bottom of the trench to the centerline of the pipe with 1B stone placed and compacted with hand-operated mechanical tampers in loose layers of not more than 6 inches in depth to provide specified compaction around and under the haunches of the pipe. Backfill material shall be deposited in the trench for its full width on each side of the pipe and fittings simultaneously. All backfill material shall be compacted to a minimum density of 95% proctor (ASTM D1577).
- C. **Backfill Over Pipe:** From the centerline of the pipe and fittings to a depth of 1 foot above the top of the pipe, the trench shall be backfilled by hand or accepted mechanical methods. The Contractor shall use special care in placing this portion of the backfill to avoid injuring or moving the pipe. The backfill shall be placed and compacted with hand-operated mechanical tampers in loose layers of not more than 6 inches in depth to provide specified compaction around and over the haunches of the pipe. Backfill in this section of the trench shall be 1B stone unless otherwise specified. Backfill material shall be compacted to a minimum density of 95% proctor (ASTM D1577).

3.20

BACKFILL TO RESTORATION DEPTH

- A. **State Road Rights-of-Way and Borough Paved Roadways:** From 1 foot above the top of the pipe to restoration depth, the trench shall be backfilled by hand or by accepted mechanical methods. Backfill in this section of the trench shall be 2 RC stone. Contractor shall submit, prior to beginning construction, a list of the compaction equipment to be utilized on the project, the recommendations of the equipment manufacturer as to the maximum lift thickness, which can be placed, and the method of compaction. In no case shall lift thickness placed exceed the limits specified by the manufacturer's recommendations or a maximum of 2 feet, whichever is the smaller. However, if the equipment manufacturer's specified compaction is followed and the specified compaction is not obtained, the Contractor shall, at his own expense, remove, replace and retest as many times as is required to obtain the specified compaction. Consolidation shall proceed from the center of the trench to the sides to prevent arching. Backfill material shall be compacted to a minimum density of 95% proctor (ASTM D1557).
- B. **Private Roadways:** From 1 foot above the top of the pipe to restoration depth, the trench shall be backfilled by hand or by accepted mechanical methods. Backfill in this section of the trench shall be 2 RC stone. Contractor shall submit, prior to beginning construction, a list of the compaction equipment to be utilized on the project, the recommendations of the equipment manufacturer as to the maximum lift thickness, which can be placed, and the method of compaction. In no case shall lift thickness placed exceed the limits specified by the manufacturer's recommendations or a maximum of 2 feet, whichever is the smaller. However, if the equipment manufacturer's specified

compaction is followed and the specified compaction is not obtained, the Contractor shall, at his own expense, remove, replace and retest as many times as is required to obtain the specified compaction. Consolidation shall proceed from the center of the trench to the sides to prevent arching. Backfill material shall be compacted to a minimum density of 95% proctor (ASTM D1557).

- C. Lawn, Meadows and Cultivated Fields and proposed Streets: Proposed Streets are those areas whose sewer is installed in a street where paving will not be provided for 1 year from completion of pipe installation. From 1 foot above the top of the pipe to restoration depth, the trench shall be backfilled by hand or by accepted mechanical methods. Backfill in this section of the trench shall be suitable material. Contractor shall submit, prior to beginning construction, a list of the compaction equipment to be utilized on the project, the recommendations of the equipment manufacturer as to the maximum lift thickness that can be placed, and the method of compaction to be used with this equipment to achieve the required compaction. In no case shall lift thickness place exceed the limits specified by the manufacturer's recommendations or a maximum of 2 feet, whichever is the smaller. However, if the equipment manufacturer's specified compaction is followed and the specified compaction is not obtained, the Contractor shall, at his own expense, remove, replace and retest as many times as is required to obtain the specified compaction. Consolidation shall proceed from the center of the trench to the sides to prevent arching. Backfill material shall be compacted to a minimum density of 95% proctor (ASTM D1557).

3.21 CLEAN-UP

- A. During construction, the surfaces of all areas including, but not limited to, roads, streets and driveways shall be maintained on a daily basis to produce a safe, desirable, and convenient condition. Streets shall be swept and flushed after backfilling and recleaned as dust, mud, stones and debris caused by the Work, or related to the Work again accumulates.
- B. In the execution of this Work, the Contractor shall conform to the approved erosion and sedimentation control plan.

3.22 RESTORATION OF UNPAVED AREAS

- A. The Contractor shall crown to such height as required by the Engineer the top of all backfilled excavation in all unpaved areas, where such areas are not used as a way for vehicles.

3.23 RESTORATION OF PAVED AREAS

- A. Unless otherwise directed, temporary paving shall be maintained in all trenches within paved areas for a period of 90 days or as directed by the Engineer, after which permanent paving shall be installed.

3.24 RESPONSIBILITY FOR CONDITION OF EXCAVATION

- A. The Contractor shall be solely responsible for the condition and results of all excavations made by him. All slides and cave-ins shall be removed by the Contractor at whatever time and under whatever circumstances they may occur.
- B. The failure or refusal of the Engineer to suggest the use of bracing or sheeting; or a better quality, grade or section, or larger sizes of steel or timber; or to suggest sheeting, bracing, struts, or shoring to be left in place, shall not in any way or to any extent relieve the Contractor of any responsibility concerning the condition of excavation or any of his obligations, nor impose any liability on the Engineer or the Borough; nor shall any delay, whether caused by any action or want of action on the part of the Contractor, or by any act of the Engineer, Owner or their agents or employees resulting in the keeping of an excavation open longer than would otherwise been necessary, relieve the Contractor from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of his obligations relating to injury of persons or property.

3.25 PROTECTION OF UTILITIES, PROPERTY AND STRUCTURES

- A. The existence and location of underground utilities as indicated on the plans is presented merely to serve as a notification that such utilities do exist in the general proximity of the Work. Any utilities not shown, or not located as shown, shall not be cause for the Contractor to deny responsibility for their protection and/or repair during construction.
- B. The Contractor shall notify all utility companies in advance of construction to include requesting the utilities to be located in accordance with Pennsylvania Act 38, and cooperate with agents of these companies during the progress of the Work. Procedures for emergency action and repairs to utilities shall be established with the utility company prior to commencement of the Work. During the course of his Work, if the Contractor damages any of the aforementioned utilities, he shall immediately follow the procedure of emergency action and repair as established at his own expense.
- C. Whenever the Contractor, during the progress of the excavation, shall uncover service pipes or lines, which because of injury or age are in poor condition, he shall immediately notify the proper Borough in order that steps may be taken for replacement or repair. Locations of repairs, and the procedures of repairs that have been made shall be recorded by the Contractor.
- D. The Contractor shall, at his expense, sustain in their places and protect from direct or indirect injury all pipes, conduits, tracks, walls, buildings and other structures or property in the vicinity of his Work, whether above or below the ground, or that may appear in the trench. He shall at all times have a sufficient quantity of timber and plank, chains, ropes, etc. on the ground and shall use them as necessary for sheeting his excavations and for sustaining or supporting any structures that are uncovered, undermined, endangered,

threatened or weakened, whether such structures are or are not shown on the Drawings.

- E. Pipes and underground conduits exposed as a result of the Contractor's operations shall be adequately supported along their entire exposed length by timber or planking, installed in such a manner that the anchorage of the supporting members will not be disturbed or weakened during the backfilling operation. Backfill of selected material shall be carefully rammed and tamped under and around the supports and all supports shall be left in place as a guard against breakage of the supported structure due to trench settlement.
- F. Where necessary, in order to keep one side of the street or roadway free from any obstruction or to keep the material piled alongside of the trench from falling on private property outside the right-of-way, a safe and suitable fence shall be placed alongside the trench.

3.26

REMOVAL OF OBSTRUCTIONS

- A. Should the position of any pipe, conduit, pole or other structures above or below the ground be such as, in the opinion of the Engineer, to require its removal, realignment or change will be done by the Contractor or will be done by the Owner of the obstructions, however, should this Work be done by the Owner of the obstructions, the Contractor shall uncover and sustain the structures before such removal and before and after such realignment or change as constituting part of the Work of the project.
- B. The Contractor shall break through and reconstruct, if necessary, the invert or arch of any sewer, culvert or conduit that may be encountered, if the said structure is in such a position that in the judgment of the Engineer, as not to require its removal, alignment or complete reconstruction.
- C. The Contractor shall not interfere with any persons, firms or corporations, or with the Owner in protecting, removing, changing or replacing their pipes, conduits, poles or other structures; but he shall suffer said persons, firms or corporations, or the Owner to take all such measures as they may deem necessary or advisable for the purpose aforesaid. At railway or railroad track crossings, any expense to which the Owner of the trackage is put, in shoring up tracks, or in maintaining traffic shall be borne by the developer and/or Contractor whether the same is billed directly to them or to the Owner.

3.27

REPLACEMENT OF STRUCTURES BY CONTRACTOR

- A. The Contractor shall restore (unless otherwise stipulated) all sidewalks, curbs, gutters, shrubbery, fences, poles, sod or other property and surface structures removed or disturbed as part of the Work to a condition equivalent to that before the Work began, furnishing all labor and materials incidental thereof.

- B. Replacement of curbs, sidewalks, gutters, and drainage structure(s) shall be in full accordance with the materials and methods in these Specifications, unless otherwise specified or noted on the Drawings.

END OF SECTION

SECTION 02210

WATER LINE
TRENCHING AND BACKFILLING

PART 1 GENERAL

1.1 SUBMITTALS

- A. All materials to be used for backfill, including common fill and bedding materials, shall be approved by the Engineer prior to placing the materials in the pipe trench. All backfill and bedding materials whether obtained from the trench excavation or from an off-site source must be tested as directed by the Engineer.
- B. Samples of materials shall be submitted to an approved testing agency for analysis. The test results and report stating that the materials meet the requirements of these Specifications and the Specifications of state and local authorities (where applicable) shall be submitted to the Engineer for approval prior to placing the materials in the pipe trench.

1.2 PROFILES AND TOPOGRAPHY

- A. Contours, topography and profiles of the ground shown on the Drawings are believed to be reasonably correct, but are not guaranteed to be absolutely so and are presented only as an approximation.
- B. The Contractor shall accept the construction site with conditions the same as existed at the time of bidding.

PART 2 PRODUCTS

2.1 GENERAL

- A. See Detail Drawings for the locations of trench backfill and bedding materials.

2.1 ORDINARY BACKFILL MATERIAL

- A. Material for backfilling shall be earth materials entirely free from vegetation, trash, lumber, and frozen, soft or organic materials. No stones or rock larger than the sizes listed below will be permitted in the backfill:
 - 1. Common Fill – Type A: No stones or rocks larger than 1 inch
 - 2. Common Fill – Type B No stones or rocks larger than 4 inches
- B. Common fill material may be obtained from the trench excavation provided it has been tested in accordance with the requirements of Section 02210.1.A above and approved by the Engineer. If approved material obtained from the trench

excavation is insufficient to complete the backfill, the Contractor shall obtain the necessary approved common fill materials from an off-site source.

2.3 STONE BACKFILL MATERIAL

- A. Waterlines placed in all existing and proposed streets shall be backfilled and compacted with PENNDOT approved 2RC select stone material.

2.4 BEDDING MATERIAL

- A. Materials used for bedding and the haunch around the water mains shall be PENNDOT 2A modified crush stone material with maximum stone size of 2 inch.
- B. Where unsuitable soil conditions exist, a PENNDOT 3A crushed stone.
- C. may be substituted at the direction of the Engineer.
- D. Refer to Section 15200 for service line bedding.

2.5 FILTER FABRIC

- A. Filter fabric shall be non-woven, synthetic fiber material with sieve design to not permit the select material in the pipe bedding and hunching to migrate into the surrounding soils. The material shall have a minimum thickness of 15 mils, tensile strength of 130 lbs., elongation at break of 62 percent and trapezoidal tear strength of 70 lbs.

PART 3 EXECUTION

3.1 CONSTRUCTION EQUIPMENT

- A. Where mains are located in or adjacent to pavements, all backfilling and materials handling equipment shall have rubber tires. Crawler equipment shall be permitted when there is no danger of damaging pavement. It is the Contractor's responsibility to repair, at his expense, any damages due to the use of any equipment to complete the Work.

3.2 NOISE, DUST AND ODOR CONTROL

- A. The Contractor's construction activities shall be conducted so as to eliminate all unnecessary noise, dust and odors.

3.3 PROTECTION OF TREES

- A. Special care shall be taken to avoid damage to trees and their root system. Machine excavation shall not be used when, in the opinion of the Engineer, it would endanger the tree. In general, where the line of trench falls within the limits of the limb spread, headers are required across the trench to protect the tree.

The operation of all equipment, particularly when employing booms, the storage of materials, and the disposition of excavation shall be conducted in a manner which will not injure trees, trunks, branches or their roots unless such trees are designated for removal.

3.4 TRENCH SUPPORT

- A. Unsupported open cut excavation for mains will not be permitted where trenching may cause danger to life, unnecessary damage to street pavement, trees, structures, poles, utilities, or other private or public property. During the progress of the Work, whenever and wherever it is necessary, the Contractor shall, at his expense, support the sides of the excavation by adequate and suitable sheeting, shoring, bracing or other approved means. Such trench support materials and equipment shall be maintained and remain in place until backfilling operations have progressed to the point where the supports may be withdrawn without endangering property.

3.5 TRENCH EXAVATION AND BOTTOM PREPARATION

A. General Excavation

1. General excavation shall consist of the satisfactory removal and disposal of all materials taken from within the limits of the Work contracted, meaning the material lying between the original ground line and the finished ground line as shown on the Drawings regardless of whether the original ground line is exposed to air or is covered by water. Excavation below existing ground line to enable any required construction or removals is included. It is distinctly understood that any reference to earth, rock, silt, debris or other materials on the Drawings or in the Specifications is solely for the Owner's information and shall not be taken as an indication of classified excavation or the quantity of earth, rock, silt, debris or other material encountered.
2. All excavation shall be made to the lines and grades indicated on the Drawings or established in the field by the Engineer.
3. Excess excavated materials and excavated materials unsuitable for backfilling should be properly disposed of by the Contractor clear of the site. The Contractor shall furnish to the Engineer satisfactory evidence that an appropriate disposal site will be used.

B. Rock Excavation

1. The excavation shall include the removal, hauling, stockpiling, and/or proper disposal of all material required to be excavated which requires systematic blasting, barring and wedging for removal, boulders or loose rock of one cubic yard or more in volume, and material which cannot be loosened or broken down by ripping in a single pass with a hydraulic ripper or other devices and

equipment designed to remove rock.

C. Blasting Rock

1. The Contractor must notify the Engineer, in advance, of his intention to use blasting. The Engineer will require evidence that the proposed blasting will comply fully with existing laws and regulations.
2. No blasting of rock shall be done where limited or prohibited by federal, state and local laws or regulations or in violation of any limitation or restriction contain in any right-of-way or wherever specifically prohibited in any Drawing or other Contract Document; nor will any such blasting be done within 40 feet of any pipe or structure without specific permission from the Engineer. Blasts shall be properly covered and the pipe or structure properly protected. Warning shall be given to all persons in the vicinity. Blasting shall be at the risk of the Contractor who shall be liable for all damages to persons or property. Necessary permits shall be secured and paid for by the Contractor. It is the Contractor's responsibility to perform whatever pre-blast surveys and investigations may be required by the circumstances and/or the federal, state or local laws.

D. Trench Width

1. Widths of trenches shall be held to a minimum to accommodate the pipe and appurtenances. The trench width shall be measured at the top of the pipe barrel and shall conform to the following limits:
 - a. Earth - Minimum: Outside diameter of the pipe + 8 inches
Maximum: Outside diameter of the pipe + 24 inches
 - b. Rock

Nominal Pipe Diameter

12 Inches or Less		16 Inches or Larger	
Minimum:	Outside diameter of the pipe + 16 inches	Minimum:	Outside diameter of the pipe + 24 inches
Maximum:	Outside diameter of the pipe + 24 inches	Maximum:	Outside diameter of the pipe + 24 inches

E. Excessive Trench Width

1. If for any reason the trench width exceeds the maximum trench width defined in Paragraph D, "Trench Width", the Contractor shall provide additional

bedding and backfill material as specified in Sections 02210.2.2 and 02210.2.3 to fill the additional width of trench, at no cost to the Owner.

F. Trench Depth

1. **General:** All trenches shall provide for a minimum of 48 inches of cover over the top of the pipe barrel to the top of the finished grade of the roadway unless otherwise authorized by the Engineer.
2. **Earth:** The trench shall be excavated to the depth required, so as to provide a uniform and continuous bearing and support for the pipe barrel on solid and undisturbed ground at every point between joints, except that it will be permissible to disturb the finished trench bottom over a maximum length of 18 inches near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle. When required, bell holes shall be provided. The finished trench bottom shall be accurately prepared by means of hand tools.
3. **Rock:** Where excavation is made in rock or boulders, the trench shall be excavated 8 inches below the pipe barrel for pipe 12 inches in diameter or less, and 12 inches below the pipe barrel for 16-inch diameter and larger. All loose material shall be removed from the trench bottom. After preparation of the trench bottom, a pipe bed shall be prepared using bedding material as specified in Section 02210.2.2.
4. **Unsuitable Bottom:** When unsuitable material is found below subgrade, as determined by the Engineer, the Contractor shall remove the material to a depth determined by the Engineer, and provide compacted bedding material as specified in Section 02210.4.B.

3.6 TRENCH BACKFILLING

- A. **Backfill to Centerline of Pipe Barrel:** All trench excavation shall be backfilled immediately after pipe is laid. Compacted bedding material as described in Section 02210.2.4 shall be used to backfill the trench from the bottom of the pipe barrel to the centerline of the pipe barrel. The material shall be placed in uniform 6-inch loose layers and each layer compacted so as to eliminate the possibility of settlement, pipe misalignment or damage of joints.
- B. **Backfill to 12 Inches Over Pipe Barrel:** From the centerline of the pipe barrel to an elevation of 12 inches over the top of the pipe barrel, common fill Type A, as described in Section 02210.2A, shall be used as backfill material. Care shall be taken to avoid injuring or moving the pipe.
- C. **Remaining Trench Backfill:** From 12 inches above the pipe barrel to the surface, common fill Type B, as described in Section 02210.2.2A, shall be used as backfill material in designated areas. No material shall be used for backfilling that contains frozen earth, rock, large stones, boulders, or other unsuitable material.

The Contractor may use mechanical equipment to place the backfill. This shall be done in such a manner that the material does not free fall, but shall be so placed that it will flow onto the previously placed material. The Contractor shall consolidate the backfill in such a manner as will ensure the minimum possible settlement and the least interference with traffic. No compacting of the backfill with mechanical equipment, such as wheeled vehicles, will be permitted unless sufficient cover is provided over the pipe to prevent damage to the pipe.

- D. The trench surface shall be regularly attended to during the course of the Contract. The Contractor shall take prompt corrective measures to correct any settlement or wash out. The trench surface shall be maintained in a safe condition and shall not interfere with natural drainage.
- E. Any material required for backfilling the trenches or for filling depressions caused by settlement or wash out shall be supplied and placed by the Contractor at his expense.

3.7 TRENCH MAINTENANCE

- A. The Contractor shall be responsible for the condition of the trenches for a period of 18 months from the date of the final acceptance of the Contractor's Work, or as required by state, county or local authorities, and any materials required for filling depressions caused by settlement or wash out shall be supplied and placed by the Contractor at his expense.

END OF SECTION

SECTION 02220

CASING PIPE INSTALLATION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. The installation of casing pipe shall conform to these Specifications and any state and local highway requirements or any railroad requirements, which may be more restrictive.

1.2 SUBMITTALS

- A. Details of proposed jacking or boring pits shall be submitted to the Engineer showing locations and dimensions and details of sheeting and shoring required.

1.3 RELATED WORK

- A. Excavation, backfilling and compaction for jacking and receiving pits and for open cut installation shall conform to the requirements set forth in Section 02210.

PART 2 PRODUCTS

2.1 MATERIAL

- A. Casing pipe shall be bare wall steel pipe with a minimum yield strength of 35,000 psi with a minimum wall thickness as listed below:

<u>Casing Outside Diameter Inches</u>	<u>Highway Crossings Casing Wall Thickness (Inches)</u>	<u>Railroad Crossings Casing Wall Thickness (Inches)</u>
8.625	0.250	0.250
10.750	0.250	0.250
12.750	0.250	0.250
14	0.250	0.281
16	0.250	0.281
18	0.250	0.312
20	0.312	0.344
24	0.312	0.406
30	0.375	0.469
36	0.500	0.532
42	0.500	0.563
48	0.625	0.625
54	0.625	0.688
60	0.625	0.750
66	0.625	0.813
72	0.750	0.875

- B. Smooth wall steel plates with a nominal diameter of over 54 inches shall not be permitted.
- C. The inside diameter of the casing pipe shall be at least two inches greater than the outside diameter of the carrier pipe joints or couplings for carrier pipe less than 6 inches; and at least 4 inches greater than the outside diameter of the carrier pipe joints or couplings for carrier pipe 6 inches and over in diameter.

PART 3 EXECUTION

3.1 ALIGNMENT AND GRADE

- A. Pipe lines shall be located, where practicable, to cross roadways or tracks at approximately right angles thereto but preferably at not less than 45 degrees and shall not be placed within culverts nor under bridges where there is likelihood of restricting the area required for the purposes for which the bridges or culverts were built, or of endangering the foundations. The casing pipe shall be installed on an even grade for its entire length and shall slope to one end.

3.2 WELDING

- A. Steel casing sections shall be connected by welding. Welding shall conform to AWWA C206.

3.3 PROTECTION AT ENDS OF CASING

- A. Casings shall have both ends blocked up in such a way as to prevent entrance of foreign material, but allowing leakage to pass in the event of a carrier break.

3.4 DEPTH OF INSTALLATION

- A. Casing pipe depth shall be in accordance with highway or railroad requirements. The minimum cover shall be 3 feet 6 inches.

3.5 CASING INSULATORS

- A. The carrier pipe and casing shall be separated by an insulator. The insulator shall be as shown on Detail Drawings utilizing steel casing insulators models C18/C12 with compatible runners (based on pipe diameter) manufactured by Pipeline Seal and Insulator, Inc. (PSI) of Houston, Texas or approved equal. The insulator spacing shall be installed to support the weight of the pipe and contents. As a minimum, an insulator shall be placed a maximum of 1 foot from each side of a joint with a minimum of four (4) insulators per pipe section.

3.6 INSTALLATION

- A. Refer to Detail Drawings for a typical casing installation details.

B. Casing pipes shall be installed by one of the following methods.

1. Jacking

- a. This method shall be in accordance with the current American Railway Engineering Association Specifications, Chapter 1, Part 4, "Jacking Culvert Pipe Through Fills," except that steel pipe shall be used with welded joints. This operation shall be conducted without hand-mining ahead of the pipe and without the use of any type of boring, auguring or drilling equipment.
- b. Bracing and backstops shall be so designed and jacks of sufficient rating used so that the jacking can progress without stoppage (except for adding lengths of pipe).

2. Boring

- a. This method consists of pushing the pipe into the fill with a boring auger rotating within the pipe to remove the soil. When augers or similar devices are used for pipe emplacement the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than $\frac{1}{2}$ inch. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material.
- b. If an obstruction is encountered during installation to stop the forward action of the pipe, and it becomes evident that it is impossible to advance the pipe, operations will cease and the pipe shall be abandoned in place and filled completely with grout.
- c. Bored or jacked installations shall have a bore hole essentially the same as the outside diameter of the pipe. If voids should develop or if the bored hole diameter is greater than the outside diameter of the pipe by more than 1 inch, grouting shall be employed to fill such voids.

END OF SECTION

SECTION 02230

STREAM CROSSING

PART 1 GENERAL

1.1 SCOPE

- A. The Contractor shall furnish all labor, materials and equipment necessary to install the stream crossings as shown on the plans and described herein.
- B. It is the intent of this section to install the stream crossings in such a manner as to protect the mains from erosion and to restore, as much as practicable, the stream banks and bottom to their original condition.
- C. The main will be protected from erosion by concrete encasement around the pipe and by sufficient depth of compacted backfill as shown on Detail Drawings.

1.2 SUBMITTALS

- A. Contractor shall submit approval of permits for performing steam crossing.
- B. Contractor shall provide evidence of acceptance of completed work by regulating agencies as required by permit.

1.3 RELATED WORK

- A. Excavation, backfilling and compaction procedures shall conform to Section 02210.
- B. Concrete placement shall conform to Section 03300.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Excavation, fill and concrete materials shall be as specified in related Work sections.

PART 3 EXECUTION

3.1 STREAM BANK RESTORATION

- A. The stream banks will be restored by backfilling the main trench with mechanically compacted backfill and rip-rap approved by the Engineer, to the original ground surface. The limits of the crossing shall extend from the top of the bank on each side of the stream and as shown on the sketches or as determined

by the Engineer.

- B. Immediately following the completion of a stream crossing, straw bales or silt fence shall be placed along the stream bank on each side within 2 feet of the edge of water and of sufficient length to extend beyond the limits of the excavated trench width. Straw bales or silt fence shall remain in place until after the stream banks have been fine graded, fertilized and seeded, and until such time as the seeding has sufficiently grown to protect the stream banks from erosion.

3.2 STREAM BOTTOM RESTORATION

- A. The stream bottom will be backfilled with approved rip rap.

3.3 CONSTRUCTION PROCEDURE

- A. The Contractor shall use either of the following methods to install the stream crossings.

1. Method 1: The Contractor shall construct an earth embankment from the stream bank to a point beyond the centerline of the stream. The slopes of the earth embankment shall be protected from erosion by covering them with 6 mil polyethylene sheeting. The sheeting shall extend from the stream bottom to an elevation 2 feet above the water level. The main shall then be installed in a trench excavated through the embankment. The embankment and material and any excess trench excavation shall be removed to an off-site disposal area when the pipe is installed to a point beyond the centerline of the stream.

The same procedure shall be used to install the remainder of the stream crossing.

2. Method 2: The Contractor shall construct a cofferdam of sand bags or inflatable bags from the stream bank to a point beyond the centerline of the stream. The main shall then be installed in a trench within the cofferdam. Any excess trench excavation shall be removed to an off-site disposal area. The cofferdam shall then be removed when the pipe is installed to a point beyond the centerline of the stream

The same procedure shall be used to install the remainder of the stream crossing.

- B. At the sole discretion of the Engineer, alternate methods in lieu of those described in the above option may be permitted. The Contractor shall adequately describe any proposed alternate method and submit same to the Engineer and all state and local authorities having jurisdiction of the stream for their review and approval.

END OF SECTION

SECTION 02610

STREET RESTORATION

PART 1 GENERAL

1.1 DESCRIPTION

- A. The Contractor shall provide all labor, tools, material, equipment to replace pavement, curbs, drives, and walks that have been damaged or disturbed during the course of the Work, all as specified herein, as directed by the Engineer, or as required by local, state or federal regulations. Placement will be at least equal to the type of pavement, curb, drive, or walk, which existed before the Work began and to the satisfaction of the Engineer.
- B. During the entire period of construction of the project, all streets, curbs, drives, and walks shall be kept in usable and safe condition for public use. Before final acceptance, and after trench settlement has been corrected to the satisfaction of the Engineer, pavement, curbs, drives, and walks designated by the Engineer shall be replaced with the type of replacement specified herein.
- C. The Contractor, where directed by the Engineer, shall furnish all labor,, tools, material and equipment necessary to spread and roll temporary bituminous pavement, complete, in place, and shall maintain the same all as specified or directed.

1.2 QUALITY ASSURANCE

- A. Referenced standards shall be the current Pennsylvania Department of Transportation (PENNDOT) Publication 408, Specifications and its revisions.
- B. All Township street restoration shall be performed in accordance with Township standards.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Materials of construction for paving, curbing and surfacing shall be furnished in accordance with applicable state and local standards. If there are no applicable standards, the Contractor shall use materials, which will produce a result at least equal to the type which existed before the Work began and to the satisfaction of the Engineer.

PART 3 EXECUTION**3.1 INSTALLATION**

- A. Where necessary to disturb the existing pavement, the pavement will be saw cut, as required by local or state regulations, and the edges of the face of the old pavement or base shall be left vertical. Ragged edges shall be trimmed so as to provide a substantially straight line juncture between the old and new surfaces.
- B. The pavement replacement shall be so placed as to conform in grade to the existing streets, drives or sidewalks.
- C. The type of pavement replacement shall be as shown on the pavement replacement details in accordance with applicable state or local standards. If there are no such applicable standards, replacement will be made to the satisfaction of the Engineer.
- D. Over trenches where temporary pavement is ordered, the Contractor shall roll in place a 2-inch thick minimum course of bituminous material. Over those trenches where temporary pavement has been placed to the surface of the adjacent pavement, such temporary pavement shall be removed prior to the placing of the permanent pavement. The finished temporary surface shall be flush with the adjacent undisturbed surface and the Contractor shall maintain the temporary bituminous surface until the temporary surface is replaced.
- E. Final paving shall be placed over the stabilized base and overlapping each side of the trench a minimum of 12 inches. Final pavement shall not be placed within 30 days after the backfilling has been completed and final base course shall be placed no longer than 120 days after the backfilling has been completed, unless otherwise ordered by the Engineer.

3.2 MAINTENANCE

- A. Following the certification of completion by the Engineer, the Contractor shall maintain the surfaces of curbs and gutters, paved surfaces and sidewalks for a period of eighteen months thereafter, or for such greater period as may be required by state or local authorities. All material and labor required for such maintenance shall be supplied by the Contractor, and the Work shall be done in a manner satisfactory to the Owner at no additional cost to the Owner.

END OF SECTION

SECTION 02730

MANHOLES

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 02201 – Sewer Line Trenching and Backfill.

1.2 QUALITY ASSURANCE

A. Referenced Standards shall be the following:

1. Pennsylvania Department of Transportation (PENNDOT) Publication 408, Specifications and its revisions.
2. American Society for Testing and Materials (ASTM).
3. American Association of State Highway Transportation Officials (AASHTO).

1.3 SUBMITTALS

A. Shop Drawings: Submit detail Shop Drawings of manholes, frames and covers, manhole steps, manhole joint sealing material, and flexible watertight gaskets prior to the start of Work for approval.

PART 2 MATERIALS

2.1 GENERAL

Materials for construction of manholes shall be new and unused and shall conform to the following.

A. Precast Reinforced Concrete Manhole Bases, Risers, Cones or Flat Slab Tops:

1. Concrete and steel reinforcement used in the manufacture of precast manhole bases; risers, cones and flat slab tops shall conform to ASTM C478 (latest revision). Type II cement shall be used in the construction of all manhole components.
2. Manholes shall conform to the design and dimensions shown on the detail Drawings. Cone sections shall be eccentric.
3. Provide two (2) 3/4-inch diameter, threaded inserts for the frame hold down bolts. The inserts shall be cast into the top sections at the manufacturer's plant. Coordinate locations of inserts between the manhole manufacturer and the frame and cover manufacturer.

4. Thru-wall lifting holes are not permitted. Provide factory installed lifting keys or lugs cast integrally in manhole components.
 5. The entire outer surface shall be coated with bitumastic to a minimum thickness of 20 mils. The manhole sections shall be precoated at the factory; however, the Contractor shall be required to complete any patching due to damage during installation.
- B. PVC Coated Precast Concrete Manhole Bases, Risers, Cones or Flat Slab Tops:
1. Air release manholes and manholes to which force mains or low pressure lines discharge to and the next four manholes downstream shall be PVC coated as described below.
 2. PVC coated manholes shall be as manufactured by A-Lok Products, Inc., Tully town, PA, (215) 945-5600, or pre-approved equal. The interior plastic liner for the precast manholes shall be Dura Plate 100. The Dura Plate 100 liner, when installed, shall provide a continuous, impermeable lining which will shield the precast concrete manhole against deterioration caused by corrosive material. The PVC coated manholes shall also meet all of the requirements specified for standard precast concrete manholes.
 3. The design of the liner shall insure that it will conform to the contour of the manhole and form a permanent mechanical bond to the concrete through use of performed horizontal ribs. The liner will be formed in such a manner that the joints between the manhole sections will be afforded protection through the use of a continuous PVC return into the joint for a minimum $\frac{3}{4}$ inch. Provisions will be made to allow the pipe opening to be sealed.
 4. The liner shall be manufactured from PVC resin and shall be white in color. The compound will result in a semi-rigid material suitable for thermoforming to the contour of the manhole. The liner may be fabricated in panels with the panels joined together by a slotted strip of EDPM rubber according to the manufacturer's specifications. All plastic liner sections shall be free of cracks, pinholes or other defects adversely affecting the protective characteristics of the material and shall have a minimum thickness of 65 mils.
 5. The Dura Plate 100 liner will be installed during the precasting process in accordance with the specific instructions of the manufacturer.
 6. The manhole manufacturer shall provide installation instruction to each Contractor prior to initial use of the Dura Plat 100 liner. The manhole will be installed using a joint sealing material as later specified.
 7. The joint sealing material shall be placed on the joint surfaces as recommended by the manufacturer, to provide a watertight seal by filling the annular cavity, while providing sufficient squeeze-out between the PVC returns to protect against corrosion.

8. Flexible, corrosion-resistant, watertight connections between manhole castings and precast concrete cones or flattops shall be installed for all PVC coated manholes. This connection shall be accomplished by Water-Lok Connectors, as manufactured by A-Lok Products, Inc., or approved equal. The connector shall allow flexibility in reaching finished grade and permit up and down movement to accommodate freeze/thaw conditions close to the ground surface without compromising water tightness. This shall be accomplished by utilizing two independent, corrosion-resistant PVC sleeves that telescope within each other to allow adjustment to the correct grade. A seal is created between the two independent sleeves by a system of neoprene o-rings. The top and bottom flanges of the Water-Lok Connector are sealed to their appropriate mating surfaces by a performed butyl gasket material furnished with the assembly. The bolt fastening assembly shall be an anti-floating assembly.
9. All interior concrete surfaces not covered by the PVC liner, including the flow channel and grade rings, shall be coated with two coats of epoxy-amine. Coating of the base shall overlap the liner by a minimum of 2 inches.

2.2 MANHOLE JOINT SEALING MATERIAL

- A. Joints between manhole sections shall be provided with double performed plastic joint sealing material such as Rubber-NECK, or approved equal. The chemical composition of the sealer shall be as follows: Bitumen, ASTM D477; Inert Ash Material, AASHTO T11142 (1974); Volatile Mater, ASTM D667 (1973).

2.3 FLEXIBLE WATERTIGHT GASKETS

- A. Bases shall have flexible watertight gaskets at the point of entry of sewer pipe into the manhole. The rubber materials shall conform to ASTM C443. The gaskets shall be cast into the manhole base to become an integral part of the concrete. The gaskets shall be Press wedge II as manufactured by Press-Seal Gasket Corporation, Dura-Seal II as supplied by Terre Hill Concrete Products, or equivalent.
- B. Cutting of openings in precast manholes in the field will only be permitted where authorized by the Engineer, and these openings shall be of proper size as required for the installation of a gasket type water stop. Non-shrink grout shall be tightly placed into the annular space from both the inside and outside of the wall in such a manner as to completely fill the annular space and provide a watertight installation.

2.4 STANDARD FRAME AND COVER

- A. Manhole frame and cover shall be of soft gray iron equal in design to Pattern No. 1045Z (self sealing cover) as manufactured by East Jordan Iron Works, Inc., or approved equivalent, machined and having the word "SANITARY SEWER" cast in the cover. Frames shall be securely attached to the top of the manhole section by two anchor bolts at 180° Center to Center. Frame and cover shall have an AASHTO H20 highway loading capacity. Joint material between the frame and manhole or grade ring shall be as specified in Manhole Joint Sealing Material.

2.5 WATERTIGHT FRAME AND COVER

- A. Watertight frame and cover shall be of soft gray iron similar in design to Pattern No. 1045ZPT (watertight), as manufactured by East Jordan Iron Works, Inc., or approved equivalent, machined and having the word "SANITARY SEWER" cast the cover. Lid shall be held in place using four stainless steel hex head bolts counter sunk into the lid. Frame shall be securely attached to the top of the manhole section by two anchor bolts at 180° Center to Center. Frame and cover shall have an AASHTO H-20 highway loading capacity. Joint material between the frame and manhole shall be as specified in Manhole Joint Sealing Material.

2.6 MANHOLE STEPS

- A. Contractor shall provide reinforced plastic, or approved equivalent, manhole steps for manholes.
- B. Manhole steps shall be installed at the manufacturer's plant. Installation of manhole steps in the field shall not be permitted. Manhole steps shall be aligned vertically and spaced a maximum distance of 12 inches apart.
- C. Reinforced plastic steps shall consist of ½-inch diameter deformed steep reinforcing bar completely encapsulated in polypropylene plastic. Reinforcing steel bar shall be Grade 60 as per ASTM A615 and the encapsulation material as per ASTM D2146-82, Type II, Grade 43758.

2.7 PRECAST CONCRETE MANHOLE GRADE RINGS

- A. Concrete manhole grade rings for leveling units shall be full circle and shall be manufactured as per ASTM C478 and shall be as thick as necessary to provide the required grade adjustment. Each grade ring shall have two holes cast therein at the manufacturer's plant for the manhole frame hold down bolts. Joint material between grade rings shall be as specified in Manhole Joint Sealing Material.

2.8 MANHOLE INSERTS

- A. *Contractor shall provide manhole inserts for all manholes.*
- B. *The inserts shall be a shallow design as manufactured by Parson Environmental Products, Inc., or approved equivalent.*
- C. *Insert shall be made of High Density Polyethylene as per ASTM D=1248. Class A, Category 5, with a thickness of 1/8".*

2.9 EXTERNAL CHIMNEY SEAL

- A. *Contractor shall install the external seal on manholes as directed by the engineer.*
- B. *The chimney seal shall be as manufactured by Infi-Shield or CANUSA or an approved equivalent.*

- C. *The seal shall be continuous bonds of EPDM (Ethylene Propylene Dene Monomer) rubber with a minimum thickness of 60 mills. There shall be a 2" wide mastic strip at the top and bottom of the band. The Mastic strip shall be non-hardening; butyl rubber sealant with a minimum thickness of 3/16". The seal shall cover the top past of the core and the lip of the casting.*

2.10 INSPECTION

- A. Field Inspection: All pipe and appurtenances shall be installed and tested for defects in material and/or workmanship in the manner specified and in the presence of, and as approved by, the Engineer or Owner.

2.11 HANDLING OF MATERIAL

- A. Replacement of Damaged Material: The Contractor shall replace, at his own expense, all material furnished by him and found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all materials and labor required for replacement of installed material. Any material furnished by the Borough that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor at his own expense.
- B. Responsibility of Safe Storage: The Contractor shall be responsible for the safe storage of material furnished by or to him and accepted by him, and intended for the Work until it has been incorporated in the completed project. The interior of all pipe fittings and other accessories shall be kept free from dirt and foreign matter at all times. All equipment and materials subject to damage from freezing shall be drained and stored in a manner, which will protect them.
- C. Hauling: All materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor. All materials furnished by the Borough shall be picked up by the Contractor at points designated by the Borough and hauled to and distributed at the site.
- D. Pipe, fittings, items of equipment, and other materials of construction shall be loaded and unloaded by lifting with hoists or skidding to avoid shock or damage. Under no circumstances shall such materials be dropped. Materials handled on skid ways shall not be skidded or rolled against materials already on the ground.
- E. At Site of Work: In distributing the material at the site of the Work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench, or as otherwise directed by the Engineer. Under no circumstances should lawns, grass plots or other private property be used for this purpose without the consent of the property owner.

PART 3 CONSTRUCTION**3.1 GENERAL**

- A. Manholes shall, in all cases, be fully and completely built and fitted with their frames and covers as the Work progresses. Manholes shall be constructed in accordance with the following.
1. **Excavation and Backfill:** Excavation and backfill shall conform to the applicable requirements of Section 02201 and the following:
 - a. Excavations for manholes shall be made to a vertical plane 1 foot outside the walls of the manhole. Rigid type pavement if encountered shall be cut to a rectangular shape whose sides do not exceed more than 2 feet of the diameter of the manhole base.
 - b. Spaces outside the manhole shall be backfilled with acceptable material in uniform layers not exceeding 6 inches in depth.
 2. **Precast Concrete Bases:**
 - a. All precast concrete bases shall be installed on a layer of crushed stone, which shall have a minimum depth of 6 inches. The crushed stone shall conform to the quality and grading requirements specified in Section 703.2 of PENNDOT Publication 408, Specifications for 1B, Type C crushed stone aggregate.
 - b. Where rubber gasket pipe seals used for connecting pipe sewer piping to precast concrete bases are of a type in which an annular space remains on the interior and exterior of the wall of the base after the pipe connection has been made, these annular spaces shall be completely filled with performed plastic sealing compound. The sealing compound shall be tightly caulked into the annular spaces in such a manner as to completely fill the annular spaces and provide a completely watertight installation. The sealing compound shall be troweled smooth at the inside face of the manhole base.
 3. **Concrete Channel Fill:**
 - a. The concrete channel fill shall be poured in the field for all manhole bases. Inverts shall be formed directly in the concrete channel fill of the manhole base, and shall be smooth (steel trowel finish) and accurately shaped to a semi-circular bottom conforming to the inside of the adjacent sewer sections. Changes in size and grade shall be made gradually. Changes in the direction of the sewer and entering branches shall have a true curve of as large a radius as the size of the manhole will permit. Steep slopes outside the invert channels shall be avoided.
 - b. Contractor may use a precast invert base. Contractor shall notify Engineer of their intent to use the precast invert base prior to submitting the required Shop Drawings.

4. Manhole Walls:

- a. All precast reinforced concrete riser and top sections necessary to build a completed manhole shall be furnished and the different sections shall fit together readily to permit effective jointing.
- b. Rubber gasket joints between adjacent sections shall be carefully made in accordance with the written instructions of the manufacturer of the precast concrete manhole sections.
- c. Performed plastic sealing compound joints between adjacent sections shall be carefully made in accordance with written instructions of the manufacturer of the performed plastic sealing compound. After the joints have been made, the performed plastic sealing compound shall be troweled smooth across the joint on the inside of the manhole wall.
- d. Pipe connections to manhole walls shall be made in the same manner as specified hereinbefore for pipe connections to precast manhole bases.

5. Frames and Covers: Where required, final adjustment of frame to elevation shall be made by precast concrete manhole grade rings. All joints located between the bottom of the frame and the top manhole section shall have manhole joint sealing material. The interior face of this area shall receive a ½-inch thick-troweled mortar finish. Frames for all manholes shall be bolted to the manhole as shown on the detail drawings. Bolts, nuts and washers shall be of steel and conform to ASTM A307. Bolts shall have sufficient number of proper-sized threads for installation thereof in the insert provided in the top manhole section. The bolts shall be of such length and be provided with a sufficient number of threads above the top of the frame to properly tighten the nuts thereon.

3.2 ACCEPTANCE TESTS

A. General: Test each manhole constructed in the project by the method specified herein. If the manhole is constructed on an existing sewer where sewage flow must be maintained, the test will be waived. Contractor shall notify Engineer 48 hours in advance of testing for scheduling. Conduct tests in presence of and to the complete satisfaction of the Engineer. Should a manhole not satisfactorily pass testing, discontinue manhole construction in the project until that manhole does test satisfactorily. Provide tools, materials (including water), equipment and instruments necessary to conduct the manhole testing specified herein.

B. Vacuum Test:

1. Vacuum Testing Equipment: Use vacuum apparatus equipped with necessary piping, control valves and gauges to control air removal rate from the manhole and to monitor vacuum. Provide an extra vacuum gauge of known accuracy to frequently check testing equipment and apparatus. Vacuum testing equipment and associated testing apparatus are subject to Engineer's approval. Provide seal plate with vacuum piping connections for inserting in manhole frame.

2. Prior to testing, clean manholes thoroughly and seal openings, both to the complete satisfaction of the Engineer. Seal openings using properly sized plugs. Perform testing with frames installed. Include the joint between the manhole and manhole frame in the test. The Contractor may elect to make a test for his own purposes prior to backfilling. However, conduct tests of the manholes for acceptance only after backfilling has been completed.
3. Vacuum Test Procedure: Perform vacuum testing in accordance with the testing equipment manufacturers' written instruction. Draw a vacuum of 10 inches of mercury and close the valves. Consider manhole acceptance when vacuum does not drop below 9 inches of mercury for the following manhole sizes and times:
 - 4-foot diameter- 60 seconds
 - 5-foot diameter- 75 seconds
 - 6-foot diameter- 90 seconds
 - 7-foot diameter- 105 seconds
4. Repair and Retest: Determine source or sources of leaks in manholes failing acceptance limits. Repair or replace defective materials and workmanship, as is the case, and conduct additional manhole acceptance tests and such subsequent repairs and retesting as required until manholes meet test requirements. Materials and methods used to make manhole repairs shall meet with Engineer's approval prior to use. Make repairs, replacements and retests at no increase in Contract price.
5. Acceptance: Observations of successful testing of manholes by the Engineer does not constitute acceptance of the system or any portion thereof. Upon completion of any determined portion of a total system, and successful testing thereof, the Engineer may recommend final acceptance by the Borough.
6. Only upon final inspection by the Authority or Engineer, and upon written acceptance for same, will the system or portion thereof be considered substantially completed. Upon such acceptance, the warranty period as specified for the manholes will commence.

END OF SECTION

SECTION 02731

SANITARY SEWER PIPE

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Section 02201 – Sewer Line Trenching and Backfill.
- B. Section 02730 - Manholes.

1.2 QUALITY ASSURANCE

- A. Referenced Standards shall be the following:
 - 1. American National Standards Institute (ANSI).
 - 2. American Society for Testing and Materials (ASTM).
 - 3. American Water Works Association (AWWA).

1.3 SUBMITTALS

- A. Shop Drawings: Submit manufacturer's descriptive and technical product data for gravity sanitary sewer pipe and fittings prior to start of Work for approval.

PART 2 MATERIALS

2.1 POLYVINYL CHLORIDE PIPE (PVC)

- A. Pipe and Fittings: The pipe and fittings shall be made of virgin Type 1, Grade 1 PVC compounds as defined and described in ASTM D3034 (PSM) for Rigid Poly (Vinyl Chloride) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds. Pipe wall thickness shall conform to SDR 35. Pipe and fittings shall be joined with an integral bell-and-spigot type rubber gasketed joint. Each integral bell joint shall consist of a formed bell with a single rubber gasket. Gaskets shall conform to ASTM F477.

2.2 CEMENT LINED DUCTILE IRON PIPE

- A. Ductile iron pipe shall be in full accordance with ANSI A21.51 or AWWA C151, latest editions, for the material class or pressure designated and ANSI A21.50 or AWWA C150, latest edition, for wall thickness.
- B. Minimum Thickness: The minimum thickness shall be Class 50. Pipe for railroad crossing shall be Class 56.

2.3 CEMENT MORTAR LINING

- A. Cement mortar linings shall be in full accordance with ANSI A21.44 or AWWA C104, latest edition, except the thickness of linings should not be less than the following:

2.4 IRON FITTINGS

- A. Iron fittings shall be ductile or gray iron and be in full accordance with the standard specification set forth in ANSI A21.10 or AWWA C110, latest editions. All fittings shall be minimum Class 150 with cement lining and joints as required for pipe restraint.

2.5 JOINTS

- A. Joints shall be of the push-on type or mechanical joint type in full accordance with ANSI A21.11 or AWWA C111, latest editions, for all pipe except at changes in alignment or other conditions requiring pipe restraint or as noted on the Drawings. Joints requiring pipe restraint shall be Lok-Type or TR Flex as manufactured by U.S. Pipe; Super-Lock as manufactured by Clow; Lok-Fast as manufactured by American Pipe; Locked Mechanical Joint as manufactured by Atlantic State and Griffin; or approved equivalent. Adequate tie rods must be provided to develop full joint restraint and must extend to the adjacent fitting or joint as approved by the National Board of Fire Underwriters No. 24, Standard for Outside Protection. Mechanical joint retainer glands shall not be used. Proposed joint restraint system shall be submitted for Engineer's review and approval.

2.6 HANDLING OF MATERIAL

- A. Replacement of Damaged Material: Any material furnished by the Borough that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor at his own expense.
- B. Responsibility for Safe Storage: The Contractor shall be responsible for the safe storage of material furnished by or to him and accepted by him, and intended for the Work, until it has been incorporated in the completed project. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times. All equipment and materials subject to damage from freezing shall be drained and stored in a manner which will protect them.
- C. Hauling: All materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor. Materials furnished by the Borough shall be picked up by the Contractor at points designated by the Borough and hauled to and distributed at the site.
- D. Pipe, fittings, items of equipment, and other materials of construction shall be loaded and unloaded by lifting with hoists or skidding to avoid shock or damage.

Under no circumstances shall such materials be dropped. Materials handled on skid ways shall not be skidded or rolled against materials already on the ground.

- E. **At Site of Work:** In distributing the material at the site or the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench, or as otherwise directed by the Engineer. Under no circumstances should lawns, grass plots or other private property be used for this purpose without the consent of the property owner.
- F. **Handling of Pipe and Fittings:** Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, jointing materials, etc. shall be carefully lowered into the trench piece by piece by means of a derrick, ropes or other suitable tools or equipment in such a manner as to prevent damage to sewer line materials and/or workmen and in strict accordance with the manufacturer's recommendations. Under no circumstances shall such materials be dropped or dumped into the trench.

PART 3 CONSTRUCTION

3.1 PIPE INSTALLATION

- A. **General:** All pipe shall be laid to a uniform line and grade between manholes, socket ends upgrade, with a firm and even bearing along the barrel of the pipe, close joints and smooth invert. The spigot end of the pipe is to be centered in, shoved tight, and secured against the bell or socket of the previously laid pipe.
- B. The interior of each pipe shall be cleaned of all excess joint and foreign material before the next pipe is laid. The pipe shall be laid in the backfill materials as specified. Pipe laying shall commence at the lowest point and proceed upgrade. At the close of each day's Work and at such other times when pipe is not being laid, the open end of the pipe shall be protected with a close fitting stopper.
- C. **Construction Control:** Base lines and controlling elevations established for the construction of the work shall be preserved and kept uncovered so they can be examined at any time.
- D. The use of laser equipment shall be permitted.
- E. **Pipe Clearance in Rocks:**
 - 1. Ledge rock, boulders and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipe and fittings for pipes 24 inches or less in diameter, and 9 inches for pipes larger than 24 inches in diameter.

2. The specified minimum clearances are the minimum clear distances which will be permitted between any part of the pipe and/or fitting being laid and any part, projection or point of such rock, stone or boulder.

3.2 CONCRETE CRADLE AND ENCASEMENT

- A. Preparation: Prior to the formation of the cradle or encasement, temporary supports consisting of timber wedges and solid concrete bricks or cap blocks shall be used to support the pipe in place. Temporary supports shall have minimum dimensions and shall support the pipe at not more than two locations, one at the bottom of the barrel of the pipe adjacent to the shoulder of the socket and the other near the spigot end.
- B. Placing: After jointing of the pipe has been completed, concrete shall be uniformly poured beneath and on both sides of the pipe as shown on the details. Placement shall be wet enough during placement to permit its flow, without excessive prodding, to all required points around the pipe surface. The width of cradle shall be such as to fill completely the trench width. In case of extremely wide trenches, concrete encasement may be confined above the top of the pipe to a narrower width but in no case shall it be less than the width of trench required for the size of pipe being used.
- C. Before depositing concrete, the space within the limits of the pour shall have been cleared of all debris and water. Water shall not be allowed to rise adjacent to, or flow over, concrete deposited for less than 24 hours. Concrete shall be protected from the direct rays of the sun and kept moist, by a method acceptable to the Engineer, for a period of 7 days or until backfilling is begun. In no case shall backfilling begin within 24 hours of the time of placing and the Engineer shall have strict control of the rate of backfilling.

3.3 DROP CONNECTIONS

- A. The Contractor shall build drop connections where the drop in the invert is 2 feet or more. Drop connections shall be of the same pipe material used to construct the main from which the drop connection is made.

3.4 SERVICE CONNECTIONS

- A. Fittings (wye branches, risers and bends) and service pipe shall be installed in strict accordance with these specifications and any and all practices and precautions required for the street sewers are equally applicable to the building connections from the sewer to the right-of-way line, or to a location designated by the Engineer. The Contractor shall place a 2-inch by 4-inch wooden marker at the end of each sewer lateral. The marker shall be one piece and may not be constructed from two or more smaller pieces. The marker shall extend from the lateral invert to 12 inches above grade.

- B. The Contractor shall submit to the Borough, on a monthly basis, all as-built information which shall include: manhole run, station, length from centerline of sewer, invert elevation at the termination point of lateral, and the address or property owner's name for whom the lateral is provided.
- C. If rock is encountered during the installation of the lateral, the Contractor shall extend the lateral to the required distance as specified elsewhere in these specifications, and he shall provide a minimum "rock-free" distance of 5 feet beyond the end of the lateral. No lateral shall be "butted" against rock.
- D. Standpipe: In general, where the sewer is laid in trench and the depth of the invert is more than 12 feet, or elsewhere as required, service connections will enter the sewer as shown on the detail drawings for "Service Connection - Deep Sewer".
- E. Plugs: The upper free ends of service connection lines and wye or tee branches and pipe outlets (when connections are not made thereto at the time the mains are laid) shall be provided with a carefully fitted plug. The type of plug used and the manner in which it is secured and braced shall be acceptable to the Engineer. After installation, all plugs shall be capable of being secure and completely airtight when subjected to the test procedures specified hereinafter.

3.5 END OF PIPE TO BE PROTECTED

- A. In all cases the mouth of the pipe shall be provided with a circular board or stopper, carefully fitted to the pipe, to prevent earth or other substances from washing into the pipe.
- B. In rock excavation, the mouth of the pipe shall be carefully protected from all blasts, and the excavation shall be fully completed at least 25 feet in advance of laying of the pipe.

3.6 STORM SEWER OBSTRUCTION

- A. When it is necessary to construct a pipe sewer beneath an existing storm sewer in a location where the vertical separation between the top of the pipe sewer piping and the bottom of the storm sewer piping is 3 feet or less, the pipe sewer piping shall be encased in concrete, which encasement shall extend for a distance of not less than 5 feet on each side of the outside surface of the storm sewer piping.

3.7 TESTS

- A. General: Contractor shall notify Engineer 48 hours in advance of testing for scheduling. Conduct tests in presence of and to the complete satisfaction of the Engineer.
- B. Alignment: After the mains have been laid and backfilled, a light will be flashed between manholes or manhole locations to determine whether the alignment of

the sewer is true and whether any pipe has been displaced, broken or otherwise damaged subsequent to laying. This test will again be conducted before final acceptance of the sewer. Each section (manhole to manhole) of sewer shall show a good light circle throughout its length and any and all defects shall be corrected by the Contractor, to the satisfaction of the Engineer.

- C. Air Testing: The Contractor shall test each section of sewer between manholes and all laterals to the limit of this contract using low pressure air. Testing shall not be performed until all backfilling has been completed. The Contractor may, at his option, test the section of sewer for his own purposes, prior to completion of backfilling; however, the requirements of this subsection shall not be deemed to be completed until the lines have been tested after the backfilling has been completed and trench settlement has been minimized. The costs of any testing incurred prior to authorization from the Engineer after backfilling has been completed shall be borne by the Contractor.
- D. A minimum period of two minutes shall be provided to allow equilibrium of the air temperature with pipe wall before test readings shall commence. The rate of air loss shall be determined by measuring the time interval required for the average internal pressure to decrease by 1.0 pounds per square inch of gravity (psig).
- E. The initial test pressure to be developed in the sewer and laterals shall be determined as follows:

- 1. Internal pressure in psig shall be calculated as the sum of 3.5, plus the maximum height in feet between the invert of the sewer and the existing ground surface in the section of sewer to be tested divided by 2.3. (For example, if the maximum height is determined to be 9.2 feet, the added pressure would be 4.0 psig. The initial test pressure in the sewer would then be 7.5 psig. The allowable drop would be to 6.5 psig within the time indicated elsewhere in this subsection.) In no case shall the test pressure in the sewers or laterals be greater than 10 psig or the maximum internal differential joint pressure recommended by the manufacturer of the pipe, whichever is less.
- 2. The pipe shall be considered acceptable if the air loss rate does not exceed 0.0030 cubic feet per minute per square foot of internal pipe surface when tested at the initial pressure previously defined in this subsection. The time for the air pressure to decrease 1.0 psig shall not be less than the time indicated in the following table:

<u>Pipe Diameter</u>	<u>Minutes</u>	<u>Seconds</u>
6" to 12"	6	0
15" to 18"	8	0

- 3. If the above rates of leakage are exceeded, the Contractor shall, at his expense, determine the source of leakage and make all necessary corrections and retest.

4. The Contractor shall submit to the Engineer for approval the detailed test procedure and list of test equipment he proposes to use prior to testing.
- F. Infiltration: After the air testing described in the preceding subsection has been completed by the Contractor, regardless of any indications of the test results made by the Engineer or the Borough, the Engineer and Borough reserve the right to perform field investigations, prior to final written acceptance period specified elsewhere in these Specifications, to establish the leakage of groundwater into the sewer and laterals constructed. The cost of these investigations shall be borne by the Borough.
 - G. Should the leakage exceed 100 gallons per day per inch diameter per mile of pipe for any section, the Contractor shall, at the direction of the Engineer or Borough, and at no cost to the Borough, perform any additional testing or corrective Work required to reduce the infiltration in each manhole run from those lines installed by the Contractor to less than 100 gallons per day per inch diameter of pipe. This leakage applies to each manhole run separately and should not be construed to mean total leakage in the total system. The scope of this corrective Work shall include, but not be limited to, cleaning, televising and testing the sewer and laterals to the limits installed by the Contractor, to include testing and grouting of joints, excavation and replacement of faulty or damaged portions of the Work, and all final restoration.
 - H. Acceptance: Observation of successful testing of sewers by the Engineer does not constitute acceptance of the system or any portion thereof. Upon completion of any determined portion of a total system, and successful testing thereof, the Engineer may recommend final acceptance to the Borough.
 - I. The final inspection will include, but not be limited to, visual inspections, lamping of lines and random air testing of lines. If, during the final inspection, any irregularities are observed, the condition must be corrected at the Contractor's expense prior to acceptance.

END OF SECTION

SECTION 02732

FORCE MAINS

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Section 02201 – Sewer Line Trenching and Backfill.
- B. Section 02730 - Manholes

1.2 QUALITY ASSURANCE

- A. Referenced Standards shall be the following:
 - 1. American Association of State Highway and Transportation Officials (AASHTO).
 - 2. American National Standards Institute (ANSI).
 - 3. American Society for Testing and Materials (ASTM).
 - 4. American Water Works Association (AWWA).

1.3 SUBMITTALS

- A. Shop Drawings: Manufacturer's descriptive and technical Product data for pressure pipe and fittings shall be submitted prior to the start of Work for approval in accordance with Section 01300.

PART 2 MATERIALS

2.1 CEMENT LINED DUCTILE IRON PIPE

- A. Ductile iron pipe shall be in full accordance with ANSI A21.51 or
- B. AWWA C151, latest editions, for the material class or pressure designated and ANSI A21.50 or AWWA C150, latest editions, for wall thickness.
- C. Minimum thickness shall be Class 52. Pipe for railroad crossing shall be Class 56.

- D. Cement mortar linings shall be in full accordance with ANSI A21.4 or AWWA C104, latest edition, except the thickness of linings shall not be less than the following:

3" - 12"	1/8"
14" - 24"	3/16"

- E. Iron fittings shall be ductile or gray iron and be in full accordance with the standard Specification set forth in ANSI A21.10 or AWWA C110, latest edition. All fittings shall be minimum Class 250 with cement lining and joints as required for pipe constraint.
- F. Joints shall be of the push-on type or mechanical joint type in full accordance with ANSI A21.11 or AWWA C111, latest edition, for all pipe except at changes in alignment, valves or other conditions requiring pipe constraint or as noted on the drawings. Joints requiring pipe restraint shall be Lok-Type or TR Flex as manufactured by U.S. Pipe; Super-Lock as manufactured by Clow; Lok-Fast as manufactured by American Pipe; Locked Mechanical Joint as manufactured by Atlantic State and Griffin; or approved equivalent. Adequate tie rods must be provided to develop full joint restraint and must extend to the adjacent fitting or joint as approved by the National Board of Fire Underwriters No. 24, Standard for Outside Protection. Mechanical joint restraint system shall be submitted for Engineer's review and approval.

2.2 PRECAST REINFORCED CONCRETE AIR RELEASE VALVE MANHOLES

- A. Precast Reinforced Concrete Manhole: Manhole shall be as specified in Section 02730.
- B. Frame and Cover: Frame and cover shall be as specified in Section 02730.
- C. Manhole Steps: Steps shall be as specified in Section 02730.
- D. Precast Concrete Manhole Grade Rings: Grade rings shall be as specified in Section 02730.

2.3 AIR RELEASE VALVE

- A. Air release valves shall be installed where called for on the plans. Work shall include the complete assembly with tapping saddle, shutoff valve, air release and vacuum valve, piping, and fittings, all complete and ready for operation. The valve shall function automatically to release to the atmosphere both large and small amounts of air that accumulate in the pipeline. The valve shall also function to admit air into the pipeline under emergency conditions or when it is being drained. The valve shall be of a type having a stainless steel float enclosed in the valve body with a lever for opening and closing the valve. The assembly shall

neither leak nor the valve stick under service conditions. The valves shall be as manufactured by Crispen APCO, GA Industries, or approved equivalent.

- B. The Contractor shall furnish the valve with shutoff valve, blow off valves, quick disconnect couplings and a minimum of 5 feet of hose to permit back flushing after installation without dismantling the valve.

2.4 HANDLING OF MATERIAL

- A. Replacement of Damaged Material: The Contractor shall replace, at his own expense, all material furnished by him and found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all materials and labor required for replacement of installed material. Any material furnished by the Borough that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor at his own expense.
- B. Responsibility for Safe Storage: The Contractor shall be responsible for the safe storage of material furnished by or to him and accepted by him, and intended for the Work, until it has been incorporated in the completed project. The interior of all pipe fittings and other accessories shall be replaced by the Contractor at his own expense.
- C. Hauling: All materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor. Materials furnished by the Borough shall be picked up by the Contractor at points designated and hauled to and distributed at the site.
- D. Pipe, fittings, items of equipment and other materials of construction shall be loaded and unloaded by lifting with hoists or skidding to avoid shock or damage and in strict conformance with the manufacturer's recommendations. Under no circumstances shall such materials be dropped. Materials handled on skid ways shall not be skidded or rolled against materials already on the ground.
- E. At Site of Work: In distributing the material at the site of the Work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench, or as otherwise directed by the Engineer. Under no circumstances should lawns, grass plots, or other private property be used for this purpose without the consent of the property owner.
- F. Care of Pipe Lining: Pipe shall be handled so the lining will not be damaged. If, however, any part of the lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Engineer.
- G. Handling of Force Main Materials into Trench: Proper implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the Work. All pipe, fittings, valves, etc. shall be carefully lowered into the trench piece by piece by means of a derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage

to sewer line materials, protective coatings and linings. Under no circumstances shall such materials be dropped or dumped into the trench.

PART 3 CONSTRUCTION

3.1 PIPE INSTALLATION

- A. General: All pipe shall be laid and maintained to the required lines and grades with fittings and valves at the required locations; spigots centered in bells; and all valves plumb. The pipe shall be laid in the backfill materials as specified. Pipe laying shall commence at the lowest point and precede upgrade.
- B. Construction Control: During the installation of a force main, the pipe shall be laid at a constantly increasing grade to each high point, air release manhole or point of discharge, as shown on the Contract Drawings. The Contractor shall provide sufficient construction control to assure that there are no sags or loss in grade in the force main which could tend to accumulate air other than at the high points shown on the drawings. Failure to comply with this requirement shall necessitate the Contractor to take remedial steps to correct this situation. All such costs shall be borne by the Contractor
- C. Hammer Test: The pipe and fittings shall be inspected for defects and while suspended above grade, be rung with a light hammer to detect cracks.
- D. Cleaning Pipe and Fittings: All lumps, blisters and excess coal tar coating shall be removed from the bell and spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wire-brushed and wiped clean and dry and free from oil and grease before the pipe is laid.
- E. Depth of Pipe: All pipes shall be laid to the depth shown on the contract drawings or a minimum of 3.5 feet from grade to the crown of pipe.
- F. Laying Pipe:
 - 1. Every precaution shall be taken to prevent foreign material from entering the pipe while the pipe is being placed in the trench. During laying operations, no debris, tools, clothing or other material shall be placed in the pipe.
 - 2. Precautions shall be taken to prevent dirt from entering the joint space.
 - 3. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

- G. **Cutting Pipe:** The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner, without damage to the pipe to leave a smooth end at right angles to the axis of the pipe.
- H. **Permissible Deflection of Joints:** If deflection is required, make after joint is assembled. The amount of deflection shall not exceed 50% of the maximum limits as specified in the AWWA C600, latest edition.
- I. **Unsuitable Conditions for Laying Pipe:** No pipe shall be laid in water or when, in the opinion of the Engineer, trench conditions are unsuitable.

3.2 JOINTS

- A. **Mechanical Joint:** The spigot end of the pipe shall be centrally located in the bell so that the rubber gasket is evenly sealed. All loose rust or foreign matter shall be removed from the inside surfaces of the bell and outside surface of the spigot prior to assembly. Bolts shall be tightened uniformly with a ratchet wrench to affect the joint seal. The normal range of bolt torques to be applied are:

<u>Bolt Size (Inches)</u>	<u>Torque - Ft. Lbs</u>
5/8	45-60
3/4	75-90
1	100-120
1-1/4	120-150

- B. If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after thorough cleaning.
- C. **Push-On Type Joints:** The joint shall be assembled as recommended by the manufacturer to affect the joint seal.

3.3 SETTING FITTINGS AND VALVES

- A. **General:** Valves and fittings shall be set and jointed to pipes in the manner hereinbefore specified for cleaning, laying and jointing pipe.
- B. **Valve Pits:** A concrete valve pit shall be provided for every air release and vacuum valve meeting the requirements for a manhole as hereinafter specified. The pits shall be constructed to permit valve repairs and afford protection to the valve and pipe from impact where they pass through the pit walls.

3.4 ANCHORAGE

- A. **Anchorage for Bends:** All bends deflecting 11.25° or more on mains 4 inches in diameter or larger shall be provided with restrained joints to prevent movement. Suitable metal rods shall be used only as shown on the plans or directed by the

Engineer. All dead end valves shall be rodded to main line with $\frac{3}{4}$ inch tie rods if a restrained joint is not utilized. Mechanical joint retainer glands shall not be used.

- B. Reaction Backing: Reaction backing shall be concrete of a mix not leaner than 1 cement, $2\frac{1}{2}$ sand, 5 stone, and having a compressive strength of not less than 2,000 pounds per square inch (psi), at 28 days. Backing shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground in each instance shall be as shown on the plans or directed by the Engineer. The backing shall, unless otherwise shown or directed, be so placed that the pipe and fitting joints will be accessible for repair.
- C. Metal Harness: Metal harness of tie rods of adequate strength to prevent movement shall be used. Steel rods or clamps shall be galvanized and painted with two coats of asphalt type paint.

3.5 CONCRETE CRADLE AND ENCASEMENT

- A. Preparation: Prior to the formation of the cradle or encasement, temporary supports consisting of solid concrete bricks or cap blocks shall have minimum dimensions and shall support the pipe at not more than two locations, one at the bottom of the barrel of the pipe adjacent to the shoulder of the socket and the other near the spigot end.
- B. Placing: After jointing of the pipe has been completed, concrete shall be uniformly poured beneath and on both sides of the pipe. Placement shall be done by the use of suitable equipment. The concrete shall be wet enough during placement to permit its flow, without excess prodding, to all required points around the pipe surface. The width of the cradle shall be such as to completely fill the trench width. In case of extremely wide trenches, concrete encasement may be confined above the top of the pipe to a narrower width, but in no case shall it be less than the width of trench required for the size of pipe being used.
- C. Before depositing concrete, the space within the limits of the pour shall have been cleared of all debris and water. Water shall not be allowed to rise adjacent to, or flow over, concrete deposited for less than 24 hours. Concrete shall be protected from the direct rays of the sun and kept moist, by a method acceptable to the Engineer, until backfilling is begun. In no case shall backfill begin within 24 hours of the time of placement.

3.6 HYDROSTATIC TESTS

- A. Pressure Test: After the pipe has been laid and backfilled as specified, all newly laid pipe or any valves section thereof shall be subjected to a hydrostatic pressure of 150 psi or 50% in excess of the normal working pressure, whichever is greater.
- B. Where any section of a main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least 5 days have elapsed after the concrete reaction backing was installed. If high early strength cement is used

in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least 2 days have elapsed.

- C. Duration of test shall be at least 2 hours.
- D. Procedures: Each section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section, under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. The pump, pipe connections, and all necessary apparatus including gauges shall be furnished by the Contractor. The Contractor will make all taps into the pipe and furnish all necessary assistance for conducting the tests.
- E. Expelling Air Before Test: Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall make the necessary taps at such points before the test is made. After the test has been completed, the Contractor shall insert plugs at the tapping points.
- F. Examination Under Pressure: Any cracks or defective pipes, fittings or valves discovered in consequence of this pressure test, shall be removed and replaced by the Contractor with sound material, and the test shall be repeated until satisfactory to the Engineer.
- G. Leakage Test: A leakage test shall be conducted concurrently with the pressure test. The Contractor will furnish laboratory calibrated test gauge and measuring device, and all necessary assistance to conduct the test.
- H. Leakage Definition: Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valve section thereof, to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.
- I. Permitted Leakage: No pipe installed will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{ND - \sqrt{P}}{7400}$$

in which "L" equals the allowable leakage in gallons per hour; "N" is the number of joints in the length of pipelines tested; "D" is the normal diameter of the pipe, in inches; and "P" is the average test pressure during the leakage test, in pounds per square inch gauge. (The allowable leakage according to the formula is equivalent to 11.65 U.S. gallons per 24 hours per mile of pipe per inch nominal diameter for pipe in 18-foot lengths evaluated on a pressure basis of 150 psi.)

- J. Should any test of pipe laid disclose leakage greater than that specified above, the Contractor shall at his own expense, locate, repair, and replace the defective joints, pipe or fittings until the leakage is within the specified allowance.

3.7 COMMON REQUIREMENTS

- A. **Engineer Presence:** The Engineer shall monitor the pressure and leakage tests. The Contractor shall notify the Engineer of the test day at least 48 hours in advance.
- B. If test fails to meet test requirements, the Contractor shall pay for all additional engineering personnel testing time.
- C. **Weather:** No testing will be authorized unless air temperature is 35°F or higher.
- D. **Field Joints:** All field joints of fittings and valves shall be exposed and examined during pressure and leakage test.
- E. **Acceptance:** Observation of successful testing of force mains or manholes by the Engineer does not constitute acceptance of the system or any portion thereof. Upon completion of any determined portion of a total system, and successful testing thereof, the Engineer may recommend final acceptance to the Borough. Only upon final inspection by the Borough or Engineer and upon written acceptance for same, will the system or portion thereof be considered substantially completed. Upon such acceptance, the warranty period as specified for the force main or manholes will commence.
- F. If, during this final inspection, any irregularities are observed, the condition must be corrected at the Contractor's expense prior to acceptance.

END OF SECTION

SECTION 02733

LOW PRESSURE SANITARY SEWER

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Section 02201 – Sewer Line Trenching and Backfill.
- B. Section 02730 – Manholes.

1.2 QUALITY ASSURANCE

- A. Referenced Standards shall be the following:
 - 1. American Association of State Highway and Transportation Officials (AASHTO).
 - 2. American National Standard Institute (ANSI).
 - 3. American Society for Testing Materials (ASTM).
 - 4. American Water Works Association (AWWA).

1.3 SUBMITTALS

- A. Shop Drawings: Submit manufacturer's descriptive and technical product data for pressure pipe, fittings, etc. prior to the start of Work for approval.

PART 2 MATERIALS

2.1 POLYVINYL CHLORIDE PIPE (PVC)

- A. Under 4 Inches:
 - 1. PVC pipe shall be in strict accordance with ASTM D2241, Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, (SDR-PR).
 - 2. Pipe shall be Certain-Teed, Fluid-Tite, Integral Bell, PVC Pressure Pipe, SDR 21 or approved substitution.

2.2 FITTINGS

- A. For PVC pipe less than 4 inches, compatible PVC fittings as recommended by the pipe manufacturer, shall be used. All PVC fittings shall be of the same class as the piping.

2.3 JOINTS

A. Joints shall be of the push-on type in strict accordance with ASTM D3139.

2.4 POLYETHYLENE PIPE (PE)

A. The PE pipe shall be in strict accordance with ASTM D1248 and D3350 for Type III, Grade P34, Category 5, and Plastic Pipe Institute Material Designation PE-3408.

B. Pipe shall be NiPak, PE-3408, and SDR-11 or approved equivalent.

2.5 FITTINGS

A. The PE pipe less than 4 inches in diameter shall utilize molded PE fittings of the same class as the pipe (SDR-11).

2.6 JOINTS

A. Joints for 2-inch through 4-inch pipe shall be jointed by thermal butt-fusion in accordance with ASTM D2657 and pipe manufacturer's recommendations,

B. Termination to pump basins, valves, fittings, etc. made of other materials shall be flange assemblies. The pipe adjacent to these joints must be rigidly supported for a distance of one foot beyond flange assembly.

C. Joints for 2-inch pipe shall be by socket fusion in accordance with ASTM D2657 and pipe manufacturer's recommendations.

2.7 CLEAN-OUTS

A. Clean-outs shall be constructed of PVC, Schedule 21 material as indicated on the detail Drawings. Ball or plug valves shall be installed at the locations indicated on the detail Drawings.

2.8 VALVES

A. Cast iron ball or plug valves shall be installed on 3-inch and larger low pressure and force main lines at the locations indicated on the Drawings. Valves installed in valve/ clean-out pits shall be actuated with a quarter turn type hand level. Buried valves shall be actuated with an underground actuator through a cast iron valve box.

B. Cast iron valves shall be Dresser, Series 800, X-Centric, or approved equivalent.

2.9 VALVE BOXES

- A. Cast iron valve boxes shall be installed over all buried valves in accordance with AWWA C500-80.

2.10 AIR RELEASE VALVES

- A. Air release valves shall be installed where specified on the plans. The Work shall include the complete assembly with tapping saddle, shutoff valve, air release and vacuum valve, piping and fittings, all complete and ready for operation. The valve shall function automatically to release into the atmosphere both large and small amounts of air that accumulate in the pipeline. The valve shall also function to admit air into the pipeline under emergency conditions or when it is being drained. The valve shall be of a type having a stainless steel float enclosed in the valve body with a lever for opening and closing the valve. The assembly shall neither leak nor the valve stick under service conditions. The valves shall be as manufactured by Val-Matic, APCO, GA Industries, or approved equivalent.
- B. The Contractor shall furnish the valve with shutoff valve, blow off valve, quick disconnect couplings, and a minimum of 5 feet of hose to permit back flushing after installation without dismantling the valve.

2.11 PRECAST REINFORCED CONCRETE AIR RELEASE VALVE MANHOLES

- A. Precast Reinforced Concrete Manhole: Manhole shall be as specified in Section 02730.
- B. Frame and Cover: Frame and cover shall be as specified in Section 02730.
- C. Manhole Steps: Steps shall be as specified in Section 02730.
- D. Precast Concrete Manhole Grade Rings: Grade rings shall be as specified in Section 02730.

2.12 HANDLING OF MATERIAL

- A. Replacement of Damaged Material: The Contractor shall replace, at his own expense, all material furnished by him and found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all materials and labor required for replacement of installed material. Any material furnished by the Borough that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor at his own expense.
- B. Responsibility for Safe Storage: The Contractor shall be responsible for the safe storage of material furnished by or to him, and accepted by him, and intended for the Work until it has been incorporated in the completed project. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign

matter at all times. All equipment and materials subject to damage from freezing shall be drained and stored in a manner, which will protect them.

- C. Hauling: All materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor. Materials furnished by the Borough shall be picked up by the Contractor at points designated and hauled to and distributed at the site.
- D. Pipe, fittings, items of equipment, and other materials of construction shall be loaded and unloaded opposite or near the place where it is to be laid in the trench, or as otherwise directed by the Engineer. Under no circumstances should lawns, grass plots, or other private property be used for this purpose without the consent of the property owner.

PART 3 CONSTRUCTION

3.1 PIPE INSTALLATION

- A. General: All pipe shall be laid and maintained to the required lines and grades with fittings and valves at the required locations; spigots centered in bells; and all valves plumb. The pipe shall be laid in the backfill materials as specified. Pipe laying shall commence at the lowest point and precede upgrade.
- B. Construction Control: During the installation of a force main, the pipe shall be laid at a constantly increasing grade to each high point, air release manhole or point of discharge, as shown on the Contract Drawings. The Contractor shall provide sufficient construction control to assure that there are no sags or loss in grade in the force main which could tend to accumulate air other than at the high points shown on the Drawings.
- C. Caution in Excavation: The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined, and he shall be held responsible for the repair of such structures when broken or otherwise damaged because of carelessness on his part.
- D. Depth of Pipe: All pipe shall be laid to the depth shown on the Contract Drawings or a minimum of 3.5 feet from grade to the crown of pipe.
- E. Handling of Sewer Line Materials Into Trench: Proper implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the Work. All pipe, fittings, valves, etc. shall be carefully lowered into the trench piece by piece by means of a derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage to sewer line materials, protective coatings and linings. Under no circumstances shall such materials be dropped or dumped into the trench.

- F. **Cleaning Pipe and Fittings:** All lumps, blisters and excess coal tar coating shall be removed from the bell and spigot end of each ductile iron pipe, and the outside of the spigot and the inside of the bell shall be wire-brushed and wiped clean and dry and free from oil and grease before the pipe is laid.
- G. **Laying Pipe:** Every precaution shall be taken to prevent foreign material from entering the pipe while the pipe is being placed in the trench. During laying operations, no debris, tools, clothing or other material shall be placed in the pipe.
- H. **Precautions shall be taken to prevent dirt from entering the joint space.**
- I. **At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by the Engineer. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.**
- J. **Cutting Pipe:** The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner, without damage to the pipe to leave a smooth end at right angles to the axis of the pipe.
- K. **Permissible Deflection of Joints:** If deflection is required, make after joint is assembled. The amount of deflection shall not exceed 50% of the maximum limits as specified in the AWWA C600.
- L. **Unsuitable Conditions for Laying Pipe:** No pipe shall be laid in water or when, in the opinion of the Engineer, trench conditions are unsuitable.

3.2 JOINTS

- A. **PVC Pipe:** The joint shall be assembled as recommended by the manufacturer to effect the joint seal.
- B. **PE Pipe:** The joints shall be thermal butt-fusion or socket fusion as recommended by manufacturer to effect the joint seal.

3.3 SERVICE CONNECTIONS

- A. **General:** Service connections to PE and PVC pipe shall be made by tapping through saddles or another method approved by the Engineer. The saddles shall be wide and provide full 360 support against the pipe. U-bolt style saddles shall not be used.
- B. **The saddles shall be as manufactured by Clow Corporation or approved substitution.**

3.4 SETTING FITTINGS AND VALVES

- A. General: Valves and fittings shall be set and jointed to pipes in the manner hereinbefore specified for cleaning, laying and jointing pipe.
- B. Valve Pipes: A concrete valve pit shall be provided for every air release and vacuum valve meeting the requirements for a manhole as hereinbefore specified. The pits shall be constructed to permit valve repairs and afford protection to the valve and pipe from impact where they pass through the pit walls.

3.5 ANCHORAGE

- A. Reaction Backing: Reaction backing shall be concrete of a mix not leaner than 1 cement; 2½ sand; 5 stone; and having a compressive strength of not less than 2,000 psi, at 28 days. Backing shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground in each instance shall be as shown on the plans or directed by the Engineer. The backing shall, unless otherwise shown or directed, be so placed that the pipe and fitting joints will be accessible for repair.
- B. Metal Harness: Metal harness of tie rods of adequate strength to prevent movement shall be used. Steel rods or clamps shall be galvanized and painted with two coats of asphalt type paint.

3.6 CONCRETE CRADLE AND ENCASEMENT

- A. Preparation: Prior to the formation of the cradle or encasement, temporary supports consisting of solid concrete bricks or cap blocks shall be used to support the pipe in place. Temporary supports shall have minimum dimensions and shall support the pipe at not more than two locations, one at the bottom of the barrel of the pipe adjacent to the shoulder of the socket and the other near the spigot end.
- B. Placing: After jointing of the pipe has been completed, concrete shall be uniformly poured beneath and on both sides of the pipe. Placement shall be done by the use of suitable equipment. The concrete shall be wet enough during placement to permit its flow, without excessive prodding, to all required points around the pipe surface. The width of the cradle shall be such as to completely fill the trench width. In case of extremely wide trenches, concrete encasement may be confined above the top of the pipe to a narrower width, but in no case shall it be less than the width of trench required for the size of pipe being used.
- C. Before depositing concrete, the space within the limits of the pour shall have been cleared of all debris and water. Water shall not be allowed to rise adjacent to, or flow over, concrete deposited for less than 24 hours. Concrete shall be protected from the direct rays of the sun and kept moist, by a method acceptable to the Engineer, for a period of 7 days or until backfilling is begun. In no case shall backfill begin within 24 hours of the time of Placement.

3.7 HYDROSTATIC TESTS

A. Pressure Test:

1. After the pipe has been laid and backfilled as specified, all newly laid pipe or any valves section thereof shall be subjected to a hydrostatic pressure of 150 psi or 50% in excess of the normal working pressure, whichever is greater.
2. Where any section of a main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least five days have elapsed after the concrete reaction backing was installed. If high early strength cement is used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least 2 days have elapsed.
3. Duration of test shall be at least 2 hours.

B. Procedures: Each section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section, under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. The pump, pipe connections and all necessary apparatus including gauges, shall be furnished by the Contractor. The Contractor will make all taps into the pipe, and furnish all necessary assistance for conducting the tests.

C. Expelling Air Before Test: Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall make the necessary taps at such points before the test is made. After the test has been completed, the Contractor shall insert plugs at the tapping points.

D. Examination Under Pressure: Any cracks or defective pipes, fittings or valves discovered in consequence of this pressure test, shall be removed and replaced by the Contractor with sound material, and the test shall be repeated until satisfactory to the Engineer.

E. Leakage Test: A leakage test shall be conducted concurrently with the pressure test. The Contractor will furnish laboratory calibrated test gauge and measuring device, and all necessary assistance to conduct the test.

F. Leakage Definition: Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valve section thereof, to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

G. Permitted Leakage:

1. No pipe installed will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{\sqrt{ND \cdot P}}{7400}$$

in which "L" equals the allowable leakage in gallons per hour; "N" is the number of joints in the length of pipelines tested; "D" is the normal diameter of the pipe, in inches, and "P" is the average test pressure during the leakage test, in pounds per square inch gauge. (The allowable leakage according to the formula is equivalent to 11.65 U.S. gallons per 24 hours per mile of pipe per inch nominal diameter for pipe in 18-foot lengths evaluated on a pressure basis of 150 psi.)

2. Should any test of pipe laid disclose leakage greater than that specified above, the Contractor shall at his own expense, locate, repair, and replace the defective joints, pipe, or fittings until the leakage is within the specified allowance.

3.8 COMMON REQUIREMENTS

- A. **Engineer Presence:** The Engineer shall monitor the pressure and leakage tests. The Contractor shall notify the Engineer of the test day at least 48 hours in advance.
- B. If test fails to meet test requirements, the Contractor shall pay for all additional Engineering personnel testing time.
- C. **Weather:** No testing will be authorized unless air temperature is 35°F or higher.
- D. **Field Joints:** All field joints of fittings and valves shall be exposed and examined during pressure and leakage test.
- E. **Acceptance:** Observation of successful testing of force mains or manholes by the Engineer does not constitute acceptance of the system or any portion thereof. Upon completion of any determined portion of a total system, and successful testing thereof, the Engineer may recommend final acceptance to the Borough. Only upon final inspection by the Borough or Engineer and upon written acceptance for it will the system or portion thereof be considered substantially completed. Upon such acceptance, the warranty period as specified for the force main or manholes will commence.
- F. If, during this final inspection, any irregularities are observed, the condition must be corrected at the Contractor's expense prior to acceptance.

END OF SECTION

SECTION 02740

BORING, TUNNELING AND JACKING

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 02201 – Sewer Line Trenching and Backfill.

B. Section 02210 – Water Line Trenching and Backfill.

1.2 QUALITY ASSURANCE

A. Referenced Standards shall be the following:

1. Norfolk Southern: Specifications for Pipeline Occupancy, current publication.
2. National Railroad Passenger Corporation (Amtrak): Requirements and Specifications for Pipeline Occupancy, current publication.
3. Pennsylvania Department of Transportation (PENNDOT) Publication 16, Design Manual, Part 5.
4. PENNDOT Pennsylvania Code, Title 67, Chapter 459, Occupancy of Highways by Utilities.

1.3 SUBMITTALS

A. Shop Drawings: Submit manufacturer's descriptive and technical product data for gravity sanitary sewer pipe and fittings prior to start of Work for approval.

PART 2 MATERIALS

2.1 STEEL CASING PIPE

- A. Steel casing pipe shall have a minimum yield strength of 35,000 pounds per square inch (psi). Joints between sections of pipe shall be fully welded around the complete circumference of the pipe. Coated steel pipe that is bored or jacked into place shall conform to the wall thickness requirements for uncoated steel pipe since the coating may be damaged during installation.
- B. Inside diameter of casing pipe shall be at least 2 inches greater than the largest outside diameter of the carrier pipe joints or couplings for corner pipes less than 6 inches in diameter, and at least 4 inches greater for carrier pipes 6 inches and over in diameter.

2.2 STEEL TUNNEL LINEAR PLATES

- A. Linear plates shall be a minimum of 12 gauge and shall be fabricated from structural quality, hot-rolled, carbon steel sheets or plates conforming to ASTM A569.
- B. Linear plates shall be galvanized and bituminous coated.

2.3 CRADLES

- A. Cradles shall be constructed of womanized lumber and stainless steel straps or bituminous coated cables and shall be similar in design to a 3-way cradle type as manufactured by T. D. Williamson, Inc. of Tulsa, Oklahoma.

2.4 SANITARY SEWER SERVICE CONNECTIONS:

- A. Sanitary sewer service connection piping shall be Schedule 80 PVC pipe conforming to ASTM D1785. No casing pipe shall be used unless approved by the Engineer.

2.5 HANDLING OF MATERIAL

- A. **Replacement of Damaged Material:** The Contractor shall replace, at his own expense, all material furnished by him and found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all materials and labor required for replacement of installed material. Any material furnished by the Borough that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor at his own expense.
- B. **Responsibility for Safe Storage:** The Contractor shall be responsible for the safe storage of material furnished by or to him and accepted by him, and intended for the Work, until it has been incorporated in the completed project. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times. All equipment and materials subject to damage from freezing shall be drained and stored in a manner which will protect them.
- C. **Hauling:**
 - 1. All materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor. Materials furnished by the Borough shall be picked up by the Contractor at points designated and hauled to and distributed at the site.
 - 2. Pipe, fittings, items of equipment, and other materials of construction shall be loaded and unloaded by lifting with hoists or skidding to avoid shock or damage. Under no circumstances shall such materials be dropped. Materials handled on skid ways shall not be skidded or rolled against materials already on the ground.

3. At Site of Work: In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench, or as otherwise directed by the Engineer.

PART 3 CONSTRUCTION

3.1 BORING

A. Highways:

1. Boring consists of pushing the casing or carrier pipe into the fill with a boring auger rotating within the pipe to remove the spoil. When augers or similar devices are used for pipe emplacement, the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so there will be no unsupported excavation ahead of the pipe. The auger and cutting head arrangements shall be removable from within the pipe in the event an obstruction is encountered. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than $\frac{1}{2}$ inch. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material.
2. The use of water or other liquids to facilitate casing emplacement and soil removal is prohibited.
3. Any method which employs simultaneous boring and jacking or drilling and jacking for pipes over 8 inches in diameter which does not have the above approved arrangement will not be permitted. For pipes 8 inches and less in diameter, auguring or boring without this arrangement may be considered for use only as approved by the Engineer.
4. Bored installations shall have a bored hole essentially the same as the outside diameter of the pipe plus the thickness of the protective coating. If voids should develop or if the bored hole diameter is greater than the outside diameter of the pipe (plus coating) by more than approximately 1 inch, grouting shall be employed to fill such voids.
5. PENNDOT does not allow blasting beneath Pennsylvania state highways.
6. The ends of the casing pipe shall be sealed with brick and mortar. Weep holes shall be provided at the ends for drainage. The void between the carrier pipe and the casing pipe shall be filled with clean $\frac{1}{4}$ -inch stone chips.
7. The cradles shall be sized such that the bell of the carrier pipe does not rest on the casing and such that an adequate clearance exists at the top of the cradle for ease of inserting the carrier pipe into the casing. A minimum of two casing cradles per pipe stick is required.

- B. Railroads: Boring operations across railroad rights-of-way shall be in accordance with the applicable railroad company Specifications.

3.2 TUNNELING

A. Highways:

1. These Specifications are intended to cover the installation of tunnel liner plates in tunnels constructed by conventional tunneling methods. For the purposes of these Specifications, tunnels excavated by full face, heading and bench, or multiple drift procedures are considered conventional methods. Liner plates used with any construction procedure utilizing a full or partial shield, a tunneling machine or other piece of equipment which will exert a force upon the liner plates for the purpose of propelling, steering or stabilizing the equipment are considered special cases and are not covered by these Specifications.
2. Installation: Liner plates shall be assembled in accordance with the manufacturer's instructions. Care shall be exercised in trimming the surface of the excavated section so the steel liner plates fit snugly against undisturbed material. Excavation shall not be advanced ahead of the previously installed liner plates any more than is necessary for the installation of the succeeding liner plate. The vertical face of the excavation shall be supported as necessary to prevent sloughing. At any interruption of the tunneling operation, the heading shall be completely bulk headed. Unless otherwise approved by the Engineer, the tunneling shall be conducted continuously, on a 24-hour basis, until the tunnel liners extend at least 3 feet beyond the edge of the shoulder or the distance specified by the permit.
3. A uniform mixture of 1:6 cement grout shall be placed under pressure behind the liner plates to fill any voids existing between the liner plates and the undisturbed material. Grout holes tapped for no smaller than 1½-inch pipe, spaced at approximately 3 feet around the circumference of the tunnel liners, shall be provided in every third ring. Grouting shall start at the lowest hole in each grout panel and proceed upwards simultaneously on both sides of the tunnel. A threaded plug shall be installed in each grout hole as the grouting is completed at that hole.
4. Grouting shall be kept as close to the heading as possible, using grout stops behind the liner plates if necessary. Grouting shall proceed as directed by the Engineer, but in no event shall more than 6 linear feet of tunnel be progressed beyond the grouting.
5. The ends of the tunneling shall be sealed with brick and mortar. Weep holes shall be provided at the ends for drainage of the tunnel.
6. Any plates that are damaged during handling or placing shall be replaced by the Contractor at his own expense.

7. PENNDOT does not allow blasting beneath Pennsylvania state highways.
- B. Railroads: Tunneling operations across railroad rights-of-way shall be in accordance with the applicable railroad company Specifications.

END OF SECTION

SECTION 02820

LAWN RESTORATION

PART 1 GENERAL

1.1 DESCRIPTION

- A. The Contractor shall restore and replace shrubbery, fencing, sod, or other disturbed surfaces or structures to conditions equal to that before the Work began and to the satisfaction of the Engineer.

PART 2 PRODUCTS

2.1 TOPSOIL

- A. Topsoil shall not contain more than 40 percent clay in that portion passing a No. 10 sieve and shall contain not less than 5 percent or more than 20 percent organic matter as determined by loss on ignition of samples oven-dried to constant weight at 212° F.

2.2 FERTILIZER

- A. Fertilizer shall be lawn or turf grade 12-12-12.

2.3 SEED

A. Lawn Areas

1. All areas to be seeded which are lawn areas, whether residential, commercial or office areas, where lawns are, or have been regularly maintained, shall be seeded with the following mixture or a mixture as required by the Soil Conservation District or other governing authority (percentages are by weight).

- 50 percent Kentucky Bluegrass (*Poa pratensis*)
- 30 percent Creeping Red Fescue (*Festuca rubra*)
- 20 percent Annual Ryegrass (*Lolium multiflorum*)

2. Where sod is required, the sod shall be green, freshly cut and of good quality with grass free from all noxious weeds. It shall contain all the dense root system of the grass and shall not be less than 1½ inches thick.

B. All Other Areas: All other areas shall be seeded with the following mixture:

- 90 percent Perennial Ryegrass (*Lolium perenne*)
- 10 percent Alsike Clover (*Trifolium hybridum*)

2.4 MULCH

- A. Mulch shall be straw reasonably free of weed seed and any foreign material which may affect plant growth. Other materials may be used if approved by the Engineer.

PART 3 EXECUTION

3.1 PREPARATION OF SEED BED

- A. Topsoil Areas: If suitable topsoil is available as part of the excavated material it shall be removed, stored and used to backfill the top 4 inches of the excavation. All grass, weeds, roots, sticks, stones, and other debris are to be removed and the topsoil carefully brought to the finished grade by raking.

- B. Non-Topsoil Areas:

1. In lawn areas, as described in Part 2.03, Paragraph A of this section, where there is a deficiency of suitable topsoil, the Contractor shall furnish 4 inches of topsoil to be used as a seed bed.
2. In areas not considered lawn areas, and where approved by the Engineer, the trench backfill may be used as a seed bed. After the backfill has been given a reasonable time to settle, it shall be graded off to the finished grade and harrowed to a depth of 3 inches. All grass, weeds, roots, sticks, stones, and other debris are to be removed and the soil carefully brought to the finished grade by raking.

3.2 FERTILIZING

- A. Fertilizer shall be uniformly applied to all areas to be seeded at the rate of 1 pound per 100 square feet in topsoil or 2 pounds per 100 square feet in non-topsoil. The fertilizer shall be thoroughly disked, harrowed or raked into the soil to a depth of not less than 2 inches. Immediately before sowing the seed, the Contractor shall rework the surface until it is a fine, pulverized, smooth seed bed, varying not more than 1 inch in 10 feet.

3.3 SEEDING

- A. Immediately after the preparation and fertilization of the seed bed, the seed shall be thoroughly mixed and then evenly sown over the prepared areas at the rate of 3 pounds per 1,000 square feet. Seed shall be sown dry or hydraulically. After sowing, the area shall be raked, dragged or otherwise treated to cover the seed to a depth of approximately $\frac{1}{4}$ inch.
- B. Areas with slopes greater than 10 percent shall be sodded.

3.4 MULCHING

- A. Within 24 hours after any given area is seeded, mulching material shall be evenly placed over all seeded areas at the rate of approximately 2 tons per acre, when seeding is performed between March 15 and October 15 of the same year, and at the approximate rate of 3 tons per acre when seeding is performed between October 15 and March 15 of the succeeding year.

3.5 MAINTENANCE

- A. All seeded and sodded areas shall be carefully maintained, tended and watered by the Contractor as necessary to secure a good turf. Settled areas shall be filled, graded and reseeded or resodded. The Contractor shall be responsible for the condition of the seeded and sodded areas for a period of 18 months from the date of final completion.

END OF SECTION

SECTION 02960

SEEDING AND RESTORATION

PART 1 GENERAL

1.1 RELATED SECTIONS

A. None

1.2 QUALITY ASSURANCE

A. Referenced standards shall be the current Pennsylvania Department of Transportation (PENNDOT) Publication 408, Specifications and its revisions.

1.3 SUBMITTALS

A. Mix Designs: Mix designs shall be in accordance with PENNDOT Publication 408, Specifications.

PART 2 MATERIALS

2.1 STOCKPILING TOPSOIL

A. As specified in PENNDOT Publication 408, Section 801.

2.2 FURNISHING AND PLACING TOPSOIL

A. As specified in PENNDOT Publication 408, Section 802.

2.3 PLACING STOCKPILED TOPSOIL

A. As specified in PENNDOT Publication 408, Section 803.

2.4 SEEDING AND SOIL SUPPLEMENTS

A. As specified in PENNDOT Publication 408, Section 804.

2.5 MULCHING

A. As specified in PENNDOT Publication 408, Section 805.

2.6 SODDING

A. As specified in PENNDOT Publication 408, Section 809.

- 2.7 SELECTIVE TREE REMOVAL AND TRIMMINGS
 - A. As specified in PENNDOT Publication 408, Section 810.

PART 3 CONSTRUCTION

- 3.1 STOCKPILING TOPSOIL
 - A. As specified in PENNDOT Publication 408, Section 801.
- 3.2 FURNISHING AND PLACING TOPSOIL
 - A. As specified in PENNDOT Publication 408, Section 802.
- 3.3 PLACING STOCKPILED TOPSOIL
 - A. As specified in PENNDOT Publication 408, Section 803.
- 3.4 SEEDING AND SOIL SUPPLEMENTS
 - A. As specified in PENNDOT Publication 408, Section 804.
- 3.5 MULCHING
 - A. As specified in PENNDOT Publication 408, Section 805.
- 3.6 SODDING
 - A. As specified in PENNDOT Publication 408, Section 809.
- 3.7 SELECTIVE TREE REMOVAL AND TRIMMINGS
 - A. As specified in PENNDOT Publication 408, Section 810.

END OF SECTION

SECTION 02970

EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. The Work within this section includes, but is not limited to, the furnishing of all equipment, labor and materials and performing all operations necessary to construct and maintain erosion and sedimentation control devices and/or systems in accordance with the approved Erosion and Sedimentation Control Plan.

1.2 QUALITY ASSURANCE

- A. Referenced Standards shall be the following:

1. Pennsylvania Department of Transportation (PENNDOT) Publication 408, Specifications and its revisions.
2. Pennsylvania Department of Environmental Protection (DEP) Erosion and Sediment Pollution Control Program Manual.

1.3 SUBMITTALS

- A. Certificates: Contractor shall submit three copies of each manufacturer's certification and PENNDOT Form CS-4171 certifying that the materials meet or exceed Specification requirements.

PART 2 MATERIALS

2.1 ROCK LINING

- A. As specified in PENNDOT Publication 408, Section 850.

2.2 ROCK ENERGY DISSIPATOR

- A. As specified in PENNDOT Publication 408, Section 851.

2.3 PAVED ENERGY DISSIPATOR

- A. As specified in PENNDOT Publication 408, Section 852.

2.4 ROCK BASIN

- A. As specified in PENNDOT Publication 408, Section 853.

- 2.5 **ROCK BARRIER/FILTER**
 - A. As specified in PENNDOT Publication 408, Section 856.
- 2.6 **SEDIMENTATION POND**
 - A. As specified in PENNDOT Publication 408, Section 859.
- 2.7 **SEDIMENT TRAP**
 - A. As specified in PENNDOT Publication 408, Section 860.
- 2.8 **DIVERSION DITCH**
 - A. As specified in PENNDOT Publication 408, Section 864.
- 2.9 **SILT BARRIER/FILTER FABRIC FENCE**
 - A. As specified in PENNDOT Publication 408, Section 865.
- 2.10 **ROCK CONSTRUCTION ENTRANCES**
 - A. As specified in DEP Erosion and Sediment Pollution Control Program Manual.
- 2.11 **STRAW BALE BARRIERS**
 - A. As specified in DEP Erosion and Sediment Pollution Control Program Manual.
- PART 3 CONSTRUCTION**
- 3.1 **ROCK LINING**
 - A. As specified in PENNDOT Publication 408, Section 850.
- 3.2 **ROCK ENERGY DISSIPATOR**
 - A. As specified in PENNDOT Publication 408, Section 851.
- 3.3 **PAVED ENERGY DISSIPATOR**
 - A. As specified in PENNDOT Publication 408, Section 852.
- 3.4 **ROCK BASIN**
 - A. As specified in PENNDOT Publication 408, Section 853.

- 3.5 **ROCK BARRIER/FILTER**
 - A. As specified in DEP Erosion and Sediment Pollution Control Program Manual.
- 3.6 **SEDIMENTATION POND**
 - A. As specified in DEP Erosion and Sediment Pollution Control Program Manual.
- 3.7 **SEDIMENT TRAP**
 - A. As specified in DEP Erosion and Sediment Pollution Control Program Manual.
- 3.8 **DIVERSION DITCH**
 - A. As specified in PENNDOT Publication 408, Section 864.
- 3.9 **SILT BARRIER/FILTER FABRIC FENCE**
 - A. As specified in PENNDOT Publication 408, Section 865.
- 3.10 **ROCK CONSTRUCTION ENTRANCES**
 - A. As specified in DEP Erosion and Sediment Pollution Control Program Manual.
- 3.11 **STRAW BALE BARRIERS**
 - A. As specified in DEP Erosion and Sediment Pollution Control Program Manual.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Concrete for thrust blocking, manhole bases, pipe encasement, curbs, sidewalks, and pavement shall be provided in accordance with this section.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Portland cement shall be Type I or Type III and conform to "Specification for Portland Cement", ASTM C150.
- B. Air entraining agent for approved manufacture shall be added in accordance with manufacturer's directions to the normal Portland cement to entrain 4½ percent air plus/minus 1 percent with all other ingredients and strength as specified. Air-entraining admixtures shall conform to "Specifications for Air-Entraining Admixtures for Concrete", ASTM C260.
- C. Concrete aggregates shall conform to "Specifications for Concrete Aggregates", ASTM C33. Coarse aggregates shall be a maximum of 1½ inches in size in footings and plain concrete. Pea gravel shall be used for sections 3 inches or less in thickness.
- D. Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalies, organic materials or other deleterious substances. In effect, the water used shall be potable water.
- E. Reinforcing bars shall be billet steel grade (60,000 psi minimum yield) and conforming to the requirements of ASTM A615, Grade 60. Reinforcing bars shall be new sock, free from rust, scale or other coating tending to destroy or reduce bond.
- F. Welded wire mesh shall conform to "Specifications for Welded Steel Wire Fabric for Concrete Reinforcements", ASTM A185.
- G. Pre-molded expansion joint material shall be provided where shown on the Drawings or directed by the Water Company. This non-extruding compressible joint material shall conform with the requirements of "Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction", ASTM D1751.

2.2 CONCRETE MIXES

- A. Ready-mixed concrete shall conform to "Specifications for Ready-Mixed Concrete", ASTM C94.
- B. All concrete mixes shall be capable of producing a dense durable concrete. The compressive strength of the concrete shall be able to attain the following minimum strengths within 28 days:
 - 2,500 psi – sidewalks, curbs and pipe encasement
 - 3,000 psi – thrust blocking, manhole bases and road pavement
- C. Water/cement ratio for the concrete shall not exceed a maximum as shown on Table 4.4 of the ACI Standard 318, latest edition, Building Code Requirements for Reinforced Concrete, when strength data from field experience or trial mixtures are not available. A workable concrete with minimum slump of 3 inches and a maximum slump of 5 inches shall be produced not exceeding the water/cement ratio.

PART 3 EXECUTION

3.1 FORMWORK

- A. All forms shall be built mortar tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incidental to the construction operations. Forms shall be constructed and maintained so as to prevent warping and the opening of joints.
- B. The forms shall be substantial and unyielding and shall be so designed that the finished concrete will conform to the proper dimensions and contours. The design of the forms shall take into account the effect of vibration of concrete as it is placed.

3.2 PLACING REINFORCING STEEL

- A. All steel reinforcement shall be accurately placed in the positions shown on the plans and firmly held during the placing and setting of concrete. When placed in the Work, it shall be free from dirt, detrimental rust, loose scale, paint, oil, or other foreign material. Bars shall be tied at all intersections except where spacing is less than 1 foot in each direction when alternate intersections shall be tied.
- B. Distances from the forms shall be maintained by means of stays, blocks, ties, hangers, or other approved supports. Continuous high chairs will not be permitted.
- C. All reinforcement shall be furnished in full lengths indicated on the plans. Splicing of bars, except where shown on the plans, will not be permitted without the approval of the Engineer. Splices shall be staggered as far as possible. Unless

otherwise shown on the plans, bars shall be lapped 36 diameters to make the splice.

- D. Welded wire mesh shall be lapped at least $1\frac{1}{2}$ meshes plus end extension of wires but not less than 12 inches in structural slabs. Welded wire mesh shall be lapped at least $\frac{1}{2}$ mesh plus end extension of wires but not less than 6 inches in slabs on the ground.

3.3 CONVEYING AND PLACING CONCRETE

- A. Concrete shall be conveyed from mixer to the forms as rapidly as practical by approved methods in which will prevent segregation and loss of ingredients.
- B. All concrete shall be placed in the dry. Formwork shall be cleaned of dirt and construction debris, water drained and snow and ice removed. After the forms have been inspected, the concrete shall be deposited in approximately horizontal layers to avoid flowing along the forms. All concrete shall be deposited continuously or in layers of a thickness such that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams and planes of weakness within the sections: a monolithic structure, the component parts of which are securely bonded together, shall be produced. During placing, the concrete shall be compacted by suitable means and shall be worked around the reinforcement and embedded fixtures and into corners and angles of forms, care being taken to avoid overworking which may result in segregation.
- C. Concrete shall not be dropped into forms from a height greater than 5 feet. In depositing from a greater height, a spout shall be used, or the forms shall be provided with openings to limit the height of drop. When special methods of placing are used, the approval of the Engineer shall be obtained.
- D. Concrete shall be directed through chutes to prevent it from striking reinforcement or sides of the form above the level of placement. Avoid segregation and coating of the surfaces with paste which may dry before concrete reaches its level.
- E. If pumping of concrete is chosen by the Contractor as a method of placing concrete, the Contractor shall submit a concrete mix design to the Engineer for approval prior to placing any concrete by pumping.

3.4 THRUST BLOCKING

- A. See the Specifications special conditions for the number and sizes of thrust blocking.
- B. Blocking shall be constructed back against the vertical face of undisturbed earth or sheeting left in place. The concrete shall be prevented from enclosing more than half the circumference of the pipe and shall be kept away from joints or bolts

in the piping.

C. Thrust blocking for hydrants shall be placed to allow the hydrant to drain.

3.5 PLACING CONCRETE IN COLD WEATHER

- A. No concrete shall be placed when the atmospheric temperature is below 35°F without written consent of the Engineer. When directed by the Engineer, the Contractor shall enclose the structure in such a way that the concrete and air within the enclosure can be kept above 60°F for a period of 7 days after placing the concrete.
- B. If high early strength concrete is used, these periods may be reduced, as directed by the Engineer.
- C. The Contractor shall supply such heating apparatus as stoves, salamanders or steam equipment and the necessary fuel. When dry heat is used, means of maintaining atmospheric moisture shall be provided. All aggregates and mixing water shall be heated to a temperature of at least 70° but not more than 60° at the time of placing the forms. In case of extremely low temperatures, the Engineer, may, at their discretion, raise the minimum lifting temperatures for water, aggregates, and mixed concrete.

END OF SECTION

SECTION 11250

INDIVIDUAL GRINDER PUMP STATIONS

PART 1 GENERAL

1.1 RELATED REFERENCES

Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

1.2 RELATED SECTIONS

A. None.

1.3 DESCRIPTION OF WORK

A. The Work within this section includes, but is not limited to, the furnishing of all grinder pump stations for two individual homeowner lots complete with fiberglass basin and cover, all necessary equipment and spare parts, and access hatch.

B. The principal items of equipment shall include simplex grinder pumps, valves, internal piping, control panel with Y2K compliant automatic pump controller, alarm system, and all internal wiring.

C. The grinder stations shall be supplied to homeowners for installation by their plumber.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Section 01400.

B. Design and construct the pumps in accordance with standards of the Hydraulic Institute. The efficiency of the pumps, when operating under conditions of the specified capacities and heads, shall be as near peak efficiency as practicable.

C. Obtain all grinder pumps, equipment, motors, drives, pump controls, and appurtenances from one supplier to maintain common equipment.

1.5 SUBMITTALS

A. Provide submittals in accordance with Section 01300 for each pump unit and two additional copies for the Owner.

B. Manufacturer's Installation Instructions: Indicate installation requirements and special procedures.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit the operation and maintenance data.
- B. Operation Data: Provide operating data for specified equipment.
- C. Maintenance Data: Provide lubrication and periodic maintenance requirements and schedules.
- D. Submit information for each unit and two additional copies for the Owner.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store grinder pump units at the Adamstown wastewater treatment plant.

1.8 WARRANTY

- A. The grinder pump manufacturer shall provide a part(s) and labor warranty on the complete station and accessories, including but not limited to, the panel and redundant check valve, for a period of 12 months after notice of the homeowner's acceptance, but not greater than 24 months after receipt of the shipment.
- B. A written manufacturer's warranty shall be provided to the homeowner for each unit.

1.9 RECORD PROJECT DOCUMENTS

- A. Submit documents.
- B. Record actual locations of pipes, utilities, equipment, and accessories.

PART 2 MATERIALS

2.1 SUBMERSIBLE PUMP

- A. Pump(s) shall be manufactured in the United States and designed for 20 gpm at 30 feet of head. The volute, seal plates and motor housing shall be constructed of high quality, ASTM Class 30 minimum cast iron. The pump(s) shall be painted with air dry enamel. All exposed hardware shall be 300 series stainless steel. Discharge connection shall be a standard 1.25-inch NPT in the vertical position. The grinder stations shall be manufactured by Barnes Pumps, Model SGV.
- B. The 3-1/2-inch pump impeller shall be of the recessed, vortex design. Pumps with standard centrifugal semi-open impeller designs shall not be acceptable. The

impeller shall be of 85-5-5-5 bronze construction and machined for threading to the motor shaft. The impeller shall be capable of being trimmed to meet specific performance characteristics.

- C. The pump shall have a three bearing design consisting of an upper ball bearing, an intermediate ball bearing restrained for the purpose of carrying the thrust loads, and an oil lubricated lower bronze sleeve bearing to carry radial loads and prevent shaft deflection imposed by the pump impeller and grinder operation. Designs reducing the number of bearings or substituting sleeve bearings for ball bearings will not be considered equal. The stator design must be such that it allows for easy removal from its housing for replacement. Shrink or press fits shall not be considered acceptable for stator assembly or replacement. The motor shaft shall be of 416 stainless steel.

D. Grinder:

1. The grinder shall be placed immediately below the pumping elements and shall be direct driven by a single, one-piece stainless steel motor shaft. The grinder impeller assembly shall be securely fastened to the pump motor shaft. The grinder shall be of the rotating type with a stationary hardened and ground chrome steel cutter spaced in accurate close annular alignment with the driven impeller assembly, which shall carry two hardened type 400 series stainless steel cutters. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as to eliminate clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour tank free of deposits or sludge banks which would impair the operation of the pump.
2. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects", such as paper, wood, plastic, glass, rubber and the like, to finely divided particles which will pass freely through the passages of the pump and the 1¼-inch diameter discharge piping.

E. Electric Motor:

1. The motor shall be a capacitor start, capacitor run, 230 volt, single phase, minimum 2 horsepower. The motor shall meet the performance requirements of a NEMA L speed-torque curve. The motor shall be constructed with the open windings operating in a sealed housing which contains clean dielectric oil for heat dissipation from the windings and for lubrication of the bearings. Oil must be able to be disposed of as non-hazardous waste. Air-filled motors shall not be acceptable.
2. Protection against excessive temperature shall be provided by a heat sensor thermostat attached to the stator windings and connected in series with the

contractor coil in the control panel.

3. The pump manufacturers shall provide 25 feet of type SOW power cable. Heat shrink tubes shall be used to connect power cord leads with motor leads. A master heat shrink tube shall be provided and filled with epoxy to seal the outer cable jacket and the individual strands to prevent water from entering the motor housing. A secondary rubber pressure grommet shall be provided as an additional sealing point and strain relief at the point of cable entry. Cable entry designs utilizing terminal boards to connect power cord leads with motor leads shall not be acceptable.

F. Level and Pump Controls:

1. Non-fouling wastewater level detection for controlling pump and alarm operation shall be accomplished by the use of a detection mechanism specifically designed for use in a sewage grinder pump basin and shall be removable from ground level without the use of any tools or need to remove the pump. Switches used in the system shall be magnetic reed switches, hermetically sealed within a water tight protective PVC casing. The level detection mechanism must provide protection from solids, greases, oils, and fats via a specific grease isolator. Level detection, grease control, and solids isolation device(s) shall not require any regular, preventive maintenance. A separate switch shall be used for each function, such as high water alarm and on and off functions. The control assembly shall be specifically approved by a nationally recognized testing laboratory to UL 1951. Conventional mercury, mechanical or swing arm floats will not be acceptable.

G. Mechanical Seal:

1. Motors shall be equipped with double shaft seals to prevent leakage between the motor and pump. The seal shall consist of two type 21 oil-lubricated rotary shaft seals in an oil-filled chamber. The materials of construction shall be carbon for the rotating faces and ceramic for the stationary faces, lapped and polished to a tolerance of one light band, with 300 stainless steel hardware, with all elastomer parts of Buna-N. A single mechanical seal, a lip seal or a single mechanical seal in conjunction with a lip type seal will not be acceptable.

H. Basin Assembly:

1. The basin shall be a 42-inch diameter fiberglass reinforced polyester resin with a minimum 3-inch ballast support flange, and be able to store 250 gallons of liquid between the invert of the influent line and the pump off level. The basin shall be furnished with one flexible inlet flange (shipped loose to facilitate field location) to accept a 4.50-inch outside diameter DWW pipe. The basin shall have a minimum burial that insures all piping to be below frost line. It shall be furnished with a molded fiberglass, grass green cover.

Junction box (when required) shall be NEMA 6 rated and mounted on the under side of the cover. The cover assembly shall provide adequate means of venting the basin. Basin wall must withstand the pressure exerted by saturated soil loading at maximum bury depth. Saturated soil weight is assumed to be 120 lb./cubic foot. The basin wall and bottom will withstand 150% of the anticipated maximum pressure exerted on the basin. All station components must function normally when exposed to these loadings. Basin must be Nationally Recognized Testing Laboratory (NRTL) approved to UL 1951. To counter act flotation, a minimum of one cubic yard of concrete shall be placed around the basin flange.

I. Interior Piping:

1. All discharge piping shall be constructed of 304 series threaded stainless steel and terminate outside the access way bulkhead with a stainless steel, 1¼-inch female NPT fitting. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be water tight. No field penetrations shall be acceptable.

J. Check Valve:

1. The pump discharge shall be equipped with a factory installed, gravity operated, ball check valve built into the discharge piping. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. All working parts exposed to sewage flows shall be either 300 series stainless steel or an approved non-metallic material to ensure corrosion resistance. The valve body shall be cast iron.
2. Each grinder pump station shall also include one separate PVC flapper-type check valve for installation of the 1¼-inch service lateral between the grinder pump station and the sewer main.

K. Shut-Off Valve:

1. The pump discharge shall be equipped with a factory installed, true union, manual ball valve. Ball valves shall be full ported, constructed of stainless steel, cast iron, or PVC, with a rated pressure of 150 psi.

L. Anti-Siphon Function:

1. The pump shall be constructed with a positively primed flooded suction configuration. As added assurance that the pump cannot lose prime even under negative pressure conditions in the discharge piping system, the design shall provide for air relief in the discharge piping just above the main check valve. This device will automatically close when the pump is running and open to atmosphere when the pump is off.

M. Removal System:

1. A single guide rail shall be used to direct the pump into proper alignment with the stationary base elbow and discharge piping. The rail material shall be stainless steel, formed in the shape of a "C"-beam. It shall attach directly to the base elbow on the sump floor and extend up and bolt to the basin side wall. It shall be one piece up to 12 feet in length.

N. Control/Alarm Panel:

1. Each grinder pump station shall include a NEMA 4X, UL 508 listed alarm/disconnect panel suitable for wall or pole mounting. The NEMA 4X enclosure shall be manufactured by thermoplastic to assure corrosion resistance. The enclosure shall include a hinged, pad lockable cover, secured dead front and component knockouts. The enclosure shall not exceed 7.5 inches wide by 8.7 inches high by 3.75 inches deep.
2. The alarm/disconnect panel shall include the following features: audio and visual alarm, push to run switch, elapsed time meter, and high level contact which in addition to energizing the visible and audible alarm, in the case where the failure is a result of the on switch failure, it shall also energize the pump run cycle.
3. The visual alarm lamp shall be a red fluted lens at least 2-5/8 inches in diameter and 1-11/16 inches in height. Visual alarm shall be mounted on top of the enclosure in such a manner as to maintain NEMA 4X rating. For duplex units, in addition to the above, two high level indicator lights shall be mounted behind the access cover. During a high level alarm condition the appropriate light will illuminate to indicate which pump core requires servicing.
4. The audio alarm shall be a printed circuit board in conjunction with an 86 dB horn/buzzer with a quick mounting terminal strip mounted in the interior of the enclosure. The audio alarm shall be capable of being de-activated by depressing a push-type switch encapsulated in a weatherproof silicone boot mounted on the exterior of the enclosure.
5. The entire alarm/disconnect as manufactured shall be UL listed.

O. Serviceability:

1. The grinder pump unit shall have two lifting hooks complete with nylon lift-out harness connected to its top housing to facilitate easy removal when necessary. All plumbing and electrical connections must provide easy tool free disconnect accessibility for pump removal and installation. A push to run feature will be provided for field troubleshooting. All motor control components shall be mounted on a readily replaceable bracket for ease of field

service.

P. OSHA Confined Space:

1. All maintenance tasks for the grinder pump station must be without "Entry" of the grinder pump station. (per OSHA 1910.146 Permit required for confined spaces). Entry means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

Q. Safety:

1. The grinder pump shall be free from electrical and fire hazard as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump station and its tank shall be UL listed to be safe and appropriate for their intended use. The manufacturer shall provide their system UL file number.
2. The grinder pump shall meet acceptable standards for plumbing equipment for use in or near residences; shall be free from noise, odor or health hazards; and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the National Sanitation Foundation Seal.

PART 3 EXECUTION

3.1 FACTORY TEST

- A. Each grinder pump shall be submerged and operated for five minutes (minimum). Included in this procedure will be the testing of all ancillary components such as the anti-siphon valve, check valve discharge line, level sensors, and each unit's dedicated controls. All factory tests shall incorporate each of the above listed items. Actual appurtenances and controls which will be installed in the field shall be particular to the tested pump only. A common set of appurtenances and controls for all pumps will not be acceptable. Certified test results shall be supplied showing the operation of each grinder pump at three different points on its curve. The Engineer reserves the right to inspect such testing procedures with representatives of the Owner, at the grinder pump manufacturer's facility.
- B. All completed stations shall be factory leak tested to assure the integrity of all joints, seams and penetrations. All necessary penetrations such as discharge fittings and cable connections shall be included in this test along with their respective sealing means (grommets, gaskets, etc.).

3.2 DELIVERY

- A. All grinder pump units will be delivered to the Adamstown wastewater treatment plant, 100% completely assembled, including testing, ready for installation. Grinder pump units will be individually mounted on wooden pallets and suitable for storage outdoors.

3.3 START-UP AND FIELD TESTING

- A. The services of the factory authorized technician shall be provided. Technician shall instruct and train installation and maintenance personnel in the proper procedures necessary to facilitate installation, start up, and operation in accordance with manufacturer's instructions. All equipment and materials necessary to perform testing shall be the responsibility of the Owner or installing Contractor. This will include, as a minimum, a portable generator (if temporary power is required) and water in each basin.
- B. Upon completion of the start-up and testing, those responsible for start-up shall file the manufacturer's start-up/warranty authorization form describing the results of tests performed for each grinder pump station with a manufacturer.

3.4 SPARES

- A. The manufacturer shall supply two spare grinder pumps only.
- B. Provide name, address, and telephone number for a local repair facility authorized by pump manufacturer to service the equipment.

END OF SECTION

SECTION 15000

WATER PIPING GENERAL PROVISIONS

PART 1 GENERAL

1.1 DRAWINGS

- A. Contractor shall verify all piping geometry in the field and shall be responsible for ensuring proper alignment and fit of all piping consistent with the intent of the Contract Drawings. Field layout Drawings shall be submitted as required for approval.

1.2 RELATED WORK

- A. None.

PART 2 PRODUCTS

2.1 CONTRACTOR'S RESPONSIBILITY FOR MATERIAL

- A. The Contractor shall carefully examine all material for defects. Material that is known or thought to be defective shall not be installed.
- B. The Engineer reserves the right to inspect all material and to reject all defective material shipped to the job site or stored on the site. Failure of the Engineer to detect damaged material shall not relieve the Contractor from his total responsibility for the completed Work if it leaks or breaks after installation. Lay all defective material aside for final inspection by the Engineer to determine if corrective repairs may be made, or if the material is to be rejected. The Engineer shall determine the extent of the repairs.
- C. The Contractor is to classify defective pipe prior to Engineer's inspection as follows:
 - 1. Damage to interior and/or exterior paint seal coats.
 - 2. Damage to interior cement-mortar linings.
 - 3. Insufficient cement-mortar lining thickness.
 - 4. Poor quality interior paint seal coat.
 - 5. Pipe out of round.
 - 6. Damaged pipe barrel area to a point where pipe class thickness is reduced.
 - 7. Denting or gouges in plain end of pipe.
- D. The Contractor shall be responsible for all material, equipment, fixtures, and devices furnished and such materials, equipment, fixtures, and devices shall comply with the requirements and standards for all state and local laws, ordinances, codes, rules, and regulations governing safety and health.

- E. The Contractor shall be solely responsible for the safe storage of all material furnished to or by him until it has been incorporated in the completed project and accepted by the Owner.
- F. Pipe fittings, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skid ways shall not be skidded or rolled against other pipe. Handling of this material is to be in accordance with AWWA C600-87.
- G. Keep fittings and valves drained and stored before installation in a manner protecting them from damage due to freezing of trapped water.

PART 3 EXECUTION

3.1 INSTALLATION – GENERAL REQUIREMENTS

- A. All pipe shall be laid and maintained to the required lines and depths. Fittings, valves and hydrants shall be at the required locations with joints centered, spigots home and all valve and hydrant stems plumb and otherwise in strict accordance with the Specifications.
- B. All buried steel, lugs, rods, brackets, and flanged joint bolts and nuts shall be given one coat of Koppers #50 coal tar coating prior to backfilling and polyethylene encased if the Specifications require polyethylene encasement of pipe.
- C. No deviation shall be made from the required alignment, depth or grade except with the written consent of the Engineer.
- D. All pipe shall be laid to the depth specified. The depth shall be measured from the final surface grade to the top of the pipe barrel. The minimum pipe cover shall be as shown on the Drawings or as specified in the Specification's Special Conditions.
- E. Do not lay pipe in a wet trench, on sub grade containing frost, and when trench conditions are unsuitable for Work. If all efforts fail to obtain a stable dry trench bottom and the Engineer determines that the trench bottom is unsuitable for trench foundation, he will order, in writing, the kind of stabilization to be constructed.
- F. Thoroughly clean the pipes and fittings before they are installed and this material shall be kept clean until the acceptance of the completed Work. Lay pipe with the bell ends facing in the direction of laying, unless otherwise shown on the Drawings, or as directed by the Engineer. Exercise care to ensure that each length abuts against the next in such a manner that no shoulder or unevenness of any kind occurs in the pipe line.

- G. No wedging or blocking is permitted in laying pipe unless by written order of the Engineer.
- H. Before joints are made, bed each section of pipe the full length of the barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place.
- I. Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded full length of its barrel.
- J. Walking or working on completed pipeline, except as necessary in tamping and backfilling, is not permitted until trench is backfilled 1-foot deep over the top of pipes.
- K. Take up and relay pipe that is out of alignment or grade or pipe having disturbed joints after laying.
- L. Take up and replace with new, such in-place pipe sections found to be defective. Replacement Work shall be at the Contractor's expense.
- M. Take necessary precautions to prevent the floating of the pipeline by the accumulation of water in the trench or the collapse of the pipeline from any cause. Should floating or collapse occur, restoration shall be at the Contractor's expense.
- N. Bedding materials and concrete Work for the pipe bedding and thrust restraint shall be as specified previously in Division 2 and 3, respectively.
- O. Take every precaution to prevent foreign material from entering the pipe while it is being placed. During laying operations, do not place debris, tools, clothing, or other materials in place.
- P. Close all openings in the pipeline with watertight plugs when pipe laying is stopped at the close of the day's Work or for other reasons such as rest breaks or meal periods.
- Q. Place enough backfill over the center sections of the pipe to prevent floating.
- R. Carry out the cutting of pipe only with equipment specifically designed for that purpose such as an abrasive wheel, rotary wheel cutter, guillotine pipe saw or milling wheel saw. The use of chisels or hand saws shall not be permitted. Cut ends and rough edges shall be ground smooth and for push-on connections, the cut end shall be beveled slightly.
- S. In distributing material at the site of the Work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.

- T. If the pipe is to be strung out, it shall be done so in a straight line or in a line conforming to the curvature of the street. Each length of pipe shall be adequately blocked to prevent movement. Stockpiled pipe shall be adequately blocked to prevent movement. No pipe, material or any other object shall be placed on private property, obstruct walkways or driveways, or in any manner interfere with the normal flow of traffic.
- U. In the case of gray and ductile iron pipe, special care shall be exercised during handling, temporary storage or construction to avoid damage to the bells, spigots or flanged ends. If damaged pipe cannot be repaired to the Engineer's satisfaction, it shall be replaced at the Contractor's expense.
- V. The Contractor shall remove all existing pipe, fittings, valves, pipe supports and blocking, and all other items necessary to provide space for making connections to existing pipe and installing all piping which is to be done under this Contract.
- W. The Contractor shall be responsible for maintaining the minimum required distance between the water line and other utility lines in strict accordance with all state and local requirements and all right-of-way limitations.
- X. If polyethylene encasement is required by the Drawing or Specification's Special Conditions, see Section 15130, as applicable, for material and installation requirements.
- Y. Maximum allowable deflection at the joints for push-on joint pipe shall be as follows, providing manufacturer's recommendations are not more stringent:

Size of Pipe	Deflection Angle	Maximum Deflection	
		18-ft. Length	20-Ft. Length
Thru 12"	2½°	9½"	10½"
14" – 36"	1½°	5½"	6"
42" – 48"	1°	3¼"	4"

- Z. In case the curve is too sharp for the allowable deflection, short lengths of pipe may be used upon approval of the Engineer and at no additional cost to the Owner.
- AA. When shown on the Drawings or required by the Specification's Special Conditions, the Contractor shall furnish air relief valve assemblies in accordance with Detail Drawings.
- BB. Particular care shall be exercised so that no high points are established where air can accumulate. In the event that unforeseen field conditions necessitate a change in the pipe profile and, in the opinion of the Engineer, the resulting change requires the installation of an air release valve and manhole, install the same as required by Engineer.

3.2 CONSTRUCTION METHODS TO AVOID CONTAMINATION

- A. Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing such organisms. It is essential that the procedures of this section be observed to assure that a water main and its appurtenances are thoroughly clean for the final disinfection by chlorination.
- B. Precautions shall be taken to protect the interiors of pipes, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's Work or for other reasons, such as rest breaks or meal periods. Rodent-proof plugs may be used where it is determined that watertight plugs are not practical and where thorough cleaning will be performed.
- C. Delay in placement of delivered pipe invites contamination. The more closely the rate of delivery is correlated to the rate of pipe laying, the less likelihood of contamination.
- D. Joints of all pipe in the trench shall be completed before Work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.
- E. If it is not possible to keep the pipe and fittings dry during installation, every effort shall be made to assure that any of the water that may enter the pipe joint spaces contains an available chlorine concentration of approximately 25 mg/l. This may be accomplished by adding calcium hypochlorite granules or tablets to each length of pipe before it is lowered into a wet trench or by treating the trench water with hypochlorite tablets.
- F. Yarning or packing material shall consist of molded or tubular rubber rings or rope of treated paper or other approved materials. Materials such as jute, asbestos or hemp shall not be used. Packing materials shall be handled in a manner that avoids contamination.
- G. No contaminated material or any material capable of supporting prolific growth of microorganisms shall be used for sealing joints. Sealing material or gaskets shall be handled in a manner that avoids contamination. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. It shall be delivered to the job in closed containers and shall be kept clean.
- H. If dirt enters the pipe, and in the opinion of the Engineer the dirt will not be removed by the flushing operation, the interior of the pipe shall be cleaned by mechanical means and then shall be swabbed with a 1 percent hypochlorite disinfecting solution. Cleaning with the use of a pig, swab or "go-devil" should be undertaken only when the Engineer has specified such and has determined that such operation will not force mud or debris into pipe joint spaces.

- I. If the main is flooded during construction, it shall be cleared of the floodwater by draining and flushing with potable water until the main is clean. The section exposed to the floodwater shall then be filled with a chlorinated potable water that, at the end of a 24-hour holding period, will have a free chlorine residual of not less than 25 mg/l. The chlorinated water may then be drained or flushed from the main. After construction is completed, the main shall be disinfected using the continuous feed or slug method.

3.3 VALVE INSTALLATION

- A. Prior to installation, inspect valves for direction of opening, freedom of operation, tightness of pressure containing bolting, cleanliness of valve ports, and especially seating surfaces, handling damage and cracks. Correct defective valves or hold for inspection by the Engineer.
- B. Set and join to the pipe in the manner specified in Section 3.1. Provide valves 12 inches and larger with concrete pads so that the pipe will not be required to support the weight of the valve. Set truly vertical.
- C. Provide all valves with a valve box. Set the top of the valve box neatly to the grade of the surface of the existing ground, unless directed otherwise by the Engineer. Do not transfer shock or stress to the valve and center and plumb the box over the wrench nut of the valve. Do not use valves to bring misaligned pipe into alignment during installation. Support pipe in such a manner as to prevent stress on the valve. See Detail Drawings for a typical valve box installation.
- D. When authorized by the Owner, provide valve marking posts at locations designated by the Engineer all in accordance with Detail Drawings.

3.4 THRUST RESTRAINT

- A. Provide all plugs, caps, tees, and bends (both horizontal and vertical) with concrete reaction backings and/or restrained joint pipe as detailed on the Drawings or as specified in the Specification's Special Conditions.
- B. Place concrete reaction backing between undisturbed solid ground and the fitting to be anchored. Concrete reaction backing to be installed in accordance with Section 03300. The backing, unless otherwise shown or directed, shall be located as to contain the resultant thrust force and so that the pipe and fitting joints will be accessible for repair.
- C. Temporary thrust restraint at temporary caps or plugs shall be the responsibility of the Contractor. Submit details of temporary restraint to the Engineer for approval.
- D. At connections with existing water mains where there is a limit on the time the water main may be removed from service, use metal harnesses of anchor clamps, tie rods and straps; mechanical joints utilizing set-screw retainer glands; or restrained push-on joints. Metal harnessing may be used by the Contractor in lieu

of concrete backing without the approval of the Engineer. Submit details of the proposed installation to the Engineer for approval. For pipe up to 12 inches in size, use a minimum of two ¾-inch tie rods. For pipe 16 inches in size, four ¾-inch tie rods are required and for 20- to 24-inch pipe sizes, six ¾-inch tie rods are required. For larger pipe sizes, consult the Engineer. Install retainer glands in accordance with instructions of the particular manufacturer furnishing the glands

- E. Material for metal harnessing and tie rods shall be ASTM A36 or A307 as a minimum requirement.
- F. Protection of Metal Harnessing: Protect tie rods, clamps and other metal components against corrosion by hand application of a bituminous coating or by encasement of the entire assembly with 8-mil thick, loose polyethylene film in accordance with AWWA C105. Grease all tie rods prior to installing polyethylene.

END OF SECTION

SECTION 15020

DISINFECTING PIPELINES

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall flush and disinfect all pipelines installed.

1.2 WORK BY OWNER

A. The Owner will furnish water for initial testing, flushing and disinfecting pipelines. Additional water required for testing, etc. due to failure of any testing shall be paid for by the Contractor. The Contractor will also perform bacteriological testing under observation by representatives of the Borough.

1.3 PROTECTION

A. Due to the toxicity of chlorine fumes, men performing Work under this section shall be equipped with all safety equipment and shall be attended by other personnel who are in the vicinity where the Work is to be performed.

B. The forward of AWWA B300-87 and B301-87 contain information and additional reference material regarding the safe handling of hypochlorites and liquid chlorine. The Contractor shall familiarize himself with this information prior to performing any disinfection Work.

1.4 RELATED WORK

A. Pipeline installation precautions to avoid contamination are described in Section 15000.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. The Contractor shall furnish chlorine liquid and injection equipment and/or calcium hypochlorite as needed to complete the disinfection of all pipelines.

B. Liquid chlorine contains 100 percent available chlorine and is packaged in steel containers usually of 100 lb., 150 lb. or 1-ton net chlorine weight. Liquid chlorine is to be furnished in accordance with AWWA B301-87.

C. Calcium hypochlorite is available in granular form or in approximately 5-g tablets, and contains approximately 65 percent available chlorine by weight. The

material should be stored in a cool, dry and dark environment to minimize its deterioration.

D. Calcium hypochlorite is to be furnished in accordance with AWWA B300-87.

PART 3 EXECUTION

3.1 PREPARATION

A. With the exception of the tablet method, all pipelines shall be pressure and leak tested, flushed, and cleaned of debris and dirt prior to application of the disinfectant. The tablet method requires the pipeline to be kept completely clean and dry during construction.

3.2 APPLICATION OF DISINFECTANT

A. Methods to be used for disinfection are those detailed in ANSI/AWWA C651-86 (water mains).

3.3 WATER MAINS

A. Three methods of chlorination are described below. Information in the forward of AWWA C651 will be helpful in determining the best method to be used.

1. Tablet Method

- a. The tablet method consists of placing calcium hypochlorite granules and tablets in the water main as it is being installed and then filling the main with potable water when installation is completed. Note: This method may be used only if the pipes and appurtenances are kept clean and dry during construction.
- b. Placing of Calcium Hypochlorite Granules: During construction, calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-foot intervals. The quantity of granules shall be as shown in Table

Warning: 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.

Table 1
Ounces of Calcium Hypochlorite Granules to be
Placed at Beginning of Main and at
Each 500-Foot Interval

<u>Pipe Diameter</u>	<u>Calcium Hypochlorite Granules</u>
4	0.5
6	1.0
8	2.0
12	4.0
16 and Larger	8.0

- c. **Placing of Calcium Hypochlorite Tablets:** During construction, 5-g calcium hypochlorite tablets shall be placed in each section of pipe and also one such tablet shall be placed in each hydrant, hydrant branch and other appurtenances. The number of 5-g tablets required for each pipe section shall be $0.0012d^2L$ rounded to the next higher integer, where D is the inside pipe diameter in inches and L is the length of the pipe section in feet. Table 2 shows the number of tablets required for commonly used sizes of pipe. The tablets shall be attached by a food grade adhesive. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. Attach all the tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of the given pipe length. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section so it can readily be determined that the pipe is installed with the tablets at the top.
- d. **Filling and Contact:** When installation has been completed, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than 1 fps. Precautions shall be taken to assure that air pockets are eliminated. This water shall remain in the pipe for at least 24 hours. If the water temperature is less than 41°F, the water shall remain in the pipe for at least 48 hours. Valves shall be positioned so that the strong chlorine solution in the main being treated will not flow into water mains in active service.

Table 2
Number of 5-g Hypochlorite Tablets
Required for Dose of 25 mg/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

- e. A product of the Permatex Co., Brooklyn, New York, and Kansas City, Kansas.
- f. Based on 3.25-g available chlorine per tablet, any portion of the tablet rounded to the next higher number.

B. Continuous Feed Method: The continuous feed method consists of placing calcium hypochlorite granules in the main during construction (optional), 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.

1. **Placing Calcium Hypochlorite Granules:** The purpose of this procedure is to provide a strong chlorine concentration in the first flow of flushing water that flows down the main. This procedure is recommended particularly where the type of pipe is such that this first flow of water will flow into annular spaces at pipe joints.
2. **Preliminary Flushing:** Prior to being chlorinated, 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. Table 3 shows the rates of flow required to produce a velocity of 2.5 fps in pipes of various sizes.

Note: Flushing is no substitute for preventive measures during construction. Certain contaminants such as caked deposits resist flushing at any feasible velocity.

Table 3
Required Flow and Openings to Flush Pipelines
(40 psi Residual Pressure in Water Main)^a

Pipe Diameter (inches)	Flow Required to Produce 2.5 fps Velocity in Main	Size of Tap on Main ^b (inches)	Hydrant Outlets	
			Number	Size
4	100	15/16	1	2½
6	220	1-3/8	1	2½
8	390	1-7/8	1	2½
10	610	2-5/16	1	2½
12	880	2-13/16	1	2½
16	1,565	3-5/8	2	2½

- a. With a 40 psi pressure in the main with the hydrant flowing to atmosphere, a 2½-inch hydrant outlet will discharge approximately 1,000 gpm and a 4½-inch hydrant nozzle will discharge approximately 2,500 gpm.
 - b. Size of tap on main, with no significant length of discharge piping.
3. Chlorinating the Main: In mains of 24 inches or larger in diameter, an acceptable alternative to flushing is to broom-sweep the main, carefully removing all sweepings prior to chlorinating the main.
- a. Water from the existing distribution system or other approved source of supply shall be made to flow at a constant, measured rate into the newly laid water main. In the absence of a meter, the rate may be approximated by means such as placing a pilot gauge in the discharge or measuring the time to fill a container of known volume.
 - 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 will have not less than 25 mg/l free chlorine. To assure that this concentration is provided, measure the chlorine concentration at regular intervals in accordance with the procedures described in the current edition of the AWWA Standard Methods.
 - c. Table 4 gives the amount of chlorine required for each 100 feet of pipe of various diameters. Solutions of 1 percent chlorine may be prepared with calcium hypochlorite in 8 gallons of water.

Table 4
Chlorine Required to Produce 25 mg/l
Concentration in 100 Feet of Pipe by Diameter

Pipe Diameter (inches)	100 Percent Chlorine (lb)	1 Percent Chlorine Solutions (gal)
4	.013	.16
6	.030	.36
8	.054	.65
10	.085	1.02
12	.20	1.44
16	.217	2.60

- d. During the application of chlorine, valves shall be positioned so that the strong chlorine solution in the main being treated will not flow into water mains in active service. Chlorine application shall not cease until the entire main is filled with heavily chlorinated water. The chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24-hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/l free chlorine.
- e. The preferred equipment for applying liquid chlorine is a solution feed vacuum-chlorinator to mix the chlorine gas in solution water, in combination with a booster pump for injecting the chlorine gas solution water into the main to be disinfected. It is recommended that direct feed chlorinators not be used. (A direct feed chlorinator is one, which operates solely from the pressure in the chlorine cylinder.) Hypochlorite solution may be applied to the water main with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. Feed lines shall be of such material and strength as to withstand safely the corrosion caused by the concentrated chlorine solutions and the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the solution is applied to the main.

C. Slug Method

1. 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.
2. The flushing shall be performed in accordance with the flushing procedure describe in Section B, "Continuous Feed Method."

3. Chlorinating the Main

- a. 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 will not have less than 100 mg/l free chlorine. To assure that this concentration is provided, the chlorine concentration should be measured at regular intervals. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of approximately 100 mg/l for at least 3 hours.
- b. The free chlorine residual shall be measured in the slug as it moves through the main. If at any time it drops below 50 mg/l, the flow shall be stopped, chlorination equipment shall be relocated at the head of the slug, and as flow is resumed, chlorine shall be applied to restore the free chlorine in the slug to not less than 100 mg/l.
- c. As the chlorinated water flows past fittings and valves, related valves and hydrants shall be operated to disinfect appurtenances and pipe branches.

3.4 DISPOSAL OF HEAVILY CHLORINATED WATER

- A. After the applicable retention period, heavily chlorinated water should not remain in contact with pipe for more than 48 hours. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main and de-chlorinated until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use.
- B. The chlorine residual of water being disposed shall be neutralized by treating with one of the chemicals listed in Table 5.
- C. The proposed disposal site to which the de-chlorinated water is to be discharged shall be inspected and approved by the Engineer. A reducing agent shall be applied to the chlorinated water to be wasted to completely neutralize the chlorine residual remaining in the water. (See Table 5 for neutralizing chemicals.) Where necessary, federal, state and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.
- D. Heavily Chlorinated Water will not be discharged prior to being de-chlorinated. De-chlorination methods shall be approved by the Borough or the Authorities Engineer prior to flushing of the water main.

Table 5
Pounds of Chemicals Required to Neutralize Various
Residual Chlorine Concentrations in
1000,000 Gallons of Water

Residual Chlorine Concentration (mg/l)	Sulfur Dioxide (SO ₂)	Sodium Bisulfate (NaHSO ₃)	Sodium Sulfite (NaSO ₃)	Sodium Thiosulfate (Na ₂ S ₂ O ₃ ·5H ₂ O)
1	0.8	1.2	1.4	1.2
2	1.7	2.5	2.9	2.4
10	8.3	12.5	14.6	12.0
50	41.7	62.6	73.0	60.0

3.5 BACTERIOLOGICAL TESTING

- A. After final flushing and before the water main is placed in service, a sample or samples will be collected from the end of the line by the Contractor and shall be tested for bacteriological quality in accordance with "Standard Methods of the Examination of Water and Wastewater." At least one sample shall be collected from the new main and one from each branch. In the case of mains greater than 2,500 feet, samples shall be collected along the length of the line when possible as well as at its end. Samples shall be collected in the presence of a Borough representative.
- B. Bacteriological tests must show complete absence of coliforms. If tests show the presence of coliform, Contractor shall be required to perform additional flushing and disinfection of the pipeline until such time acceptable tests are obtained.

END OF SECTION

SECTION 15000

WATER PIPING GENERAL PROVISIONS

PART 1 GENERAL

1.1 DRAWINGS

- A. Contractor shall verify all piping geometry in the field and shall be responsible for ensuring proper alignment and fit of all piping consistent with the intent of the Contract Drawings. Field layout Drawings shall be submitted as required for approval.

1.2 RELATED WORK

- A. None.

PART 2 PRODUCTS

2.1 CONTRACTOR'S RESPONSIBILITY FOR MATERIAL

- A. The Contractor shall carefully examine all material for defects. Material that is known or thought to be defective shall not be installed.
- B. The Engineer reserves the right to inspect all material and to reject all defective material shipped to the job site or stored on the site. Failure of the Engineer to detect damaged material shall not relieve the Contractor from his total responsibility for the completed Work if it leaks or breaks after installation. Lay all defective material aside for final inspection by the Engineer to determine if corrective repairs may be made, or if the material is to be rejected. The Engineer shall determine the extent of the repairs.
- C. The Contractor is to classify defective pipe prior to Engineer's inspection as follows:
 - 1. Damage to interior and/or exterior paint seal coats.
 - 2. Damage to interior cement-mortar linings.
 - 3. Insufficient cement-mortar lining thickness.
 - 4. Poor quality interior paint seal coat.
 - 5. Pipe out of round.
 - 6. Damaged pipe barrel area to a point where pipe class thickness is reduced.
 - 7. Denting or gouges in plain end of pipe.
- D. The Contractor shall be responsible for all material, equipment, fixtures, and devices furnished and such materials, equipment, fixtures, and devices shall comply with the requirements and standards for all state and local laws, ordinances, codes, rules, and regulations governing safety and health.

- E. The Contractor shall be solely responsible for the safe storage of all material furnished to or by him until it has been incorporated in the completed project and accepted by the Owner.
- F. Pipe fittings, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skid ways shall not be skidded or rolled against other pipe. Handling of this material is to be in accordance with AWWA C600-87.
- G. Keep fittings and valves drained and stored before installation in a manner protecting them from damage due to freezing of trapped water.

PART 3 EXECUTION

3.1 INSTALLATION – GENERAL REQUIREMENTS

- A. All pipe shall be laid and maintained to the required lines and depths. Fittings, valves and hydrants shall be at the required locations with joints centered, spigots home and all valve and hydrant stems plumb and otherwise in strict accordance with the Specifications.
- B. All buried steel, lugs, rods, brackets, and flanged joint bolts and nuts shall be given one coat of Koppers #50 coal tar coating prior to backfilling and polyethylene encased if the Specifications require polyethylene encasement of pipe.
- C. No deviation shall be made from the required alignment, depth or grade except with the written consent of the Engineer.
- D. All pipe shall be laid to the depth specified. The depth shall be measured from the final surface grade to the top of the pipe barrel. The minimum pipe cover shall be as shown on the Drawings or as specified in the Specification's Special Conditions.
- E. Do not lay pipe in a wet trench, on sub grade containing frost, and when trench conditions are unsuitable for Work. If all efforts fail to obtain a stable dry trench bottom and the Engineer determines that the trench bottom is unsuitable for trench foundation, he will order, in writing, the kind of stabilization to be constructed.
- F. Thoroughly clean the pipes and fittings before they are installed and this material shall be kept clean until the acceptance of the completed Work. Lay pipe with the bell ends facing in the direction of laying, unless otherwise shown on the Drawings, or as directed by the Engineer. Exercise care to ensure that each length abuts against the next in such a manner that no shoulder or unevenness of any kind occurs in the pipe line.

- G. No wedging or blocking is permitted in laying pipe unless by written order of the Engineer.
- H. Before joints are made, bed each section of pipe the full length of the barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place.
- I. Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded full length of its barrel.
- J. Walking or working on completed pipeline, except as necessary in tamping and backfilling, is not permitted until trench is backfilled 1-foot deep over the top of pipes.
- K. Take up and relay pipe that is out of alignment or grade or pipe having disturbed joints after laying.
- L. Take up and replace with new, such in-place pipe sections found to be defective. Replacement Work shall be at the Contractor's expense.
- M. Take necessary precautions to prevent the floating of the pipeline by the accumulation of water in the trench or the collapse of the pipeline from any cause. Should floating or collapse occur, restoration shall be at the Contractor's expense.
- N. Bedding materials and concrete Work for the pipe bedding and thrust restraint shall be as specified previously in Division 2 and 3, respectively.
- O. Take every precaution to prevent foreign material from entering the pipe while it is being placed. During laying operations, do not place debris, tools, clothing, or other materials in place.
- P. Close all openings in the pipeline with watertight plugs when pipe laying is stopped at the close of the day's Work or for other reasons such as rest breaks or meal periods.
- Q. Place enough backfill over the center sections of the pipe to prevent floating.
- R. Carry out the cutting of pipe only with equipment specifically designed for that purpose such as an abrasive wheel, rotary wheel cutter, guillotine pipe saw or milling wheel saw. The use of chisels or hand saws shall not be permitted. Cut ends and rough edges shall be ground smooth and for push-on connections, the cut end shall be beveled slightly.
- S. In distributing material at the site of the Work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.

- T. If the pipe is to be strung out, it shall be done so in a straight line or in a line conforming to the curvature of the street. Each length of pipe shall be adequately blocked to prevent movement. Stockpiled pipe shall be adequately blocked to prevent movement. No pipe, material or any other object shall be placed on private property, obstruct walkways or driveways, or in any manner interfere with the normal flow of traffic.
- U. In the case of gray and ductile iron pipe, special care shall be exercised during handling, temporary storage or construction to avoid damage to the bells, spigots or flanged ends. If damaged pipe cannot be repaired to the Engineer's satisfaction, it shall be replaced at the Contractor's expense.
- V. The Contractor shall remove all existing pipe, fittings, valves, pipe supports and blocking, and all other items necessary to provide space for making connections to existing pipe and installing all piping which is to be done under this Contract.
- W. The Contractor shall be responsible for maintaining the minimum required distance between the water line and other utility lines in strict accordance with all state and local requirements and all right-of-way limitations.
- X. If polyethylene encasement is required by the Drawing or Specification's Special Conditions, see Section 15130, as applicable, for material and installation requirements.
- Y. Maximum allowable deflection at the joints for push-on joint pipe shall be as follows, providing manufacturer's recommendations are not more stringent:

Size of Pipe	Deflection Angle	Maximum Deflection	
		18-ft. Length	20-Ft. Length
Thru 12"	2½°	9½"	10½"
14" – 36"	1½°	5½"	6"
42" – 48"	1°	3¼"	4"

- Z. In case the curve is too sharp for the allowable deflection, short lengths of pipe may be used upon approval of the Engineer and at no additional cost to the Owner.
- AA. When shown on the Drawings or required by the Specification's Special Conditions, the Contractor shall furnish air relief valve assemblies in accordance with Detail Drawings.
- BB. Particular care shall be exercised so that no high points are established where air can accumulate. In the event that unforeseen field conditions necessitate a change in the pipe profile and, in the opinion of the Engineer, the resulting change requires the installation of an air release valve and manhole, install the same as required by Engineer.

3.2 CONSTRUCTION METHODS TO AVOID CONTAMINATION

- A. Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing such organisms. It is essential that the procedures of this section be observed to assure that a water main and its appurtenances are thoroughly clean for the final disinfection by chlorination.
- B. Precautions shall be taken to protect the interiors of pipes, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's Work or for other reasons, such as rest breaks or meal periods. Rodent-proof plugs may be used where it is determined that watertight plugs are not practical and where thorough cleaning will be performed.
- C. Delay in placement of delivered pipe invites contamination. The more closely the rate of delivery is correlated to the rate of pipe laying, the less likelihood of contamination.
- D. Joints of all pipe in the trench shall be completed before Work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.
- E. If it is not possible to keep the pipe and fittings dry during installation, every effort shall be made to assure that any of the water that may enter the pipe joint spaces contains an available chlorine concentration of approximately 25 mg/l. This may be accomplished by adding calcium hypochlorite granules or tablets to each length of pipe before it is lowered into a wet trench or by treating the trench water with hypochlorite tablets.
- F. Yarning or packing material shall consist of molded or tubular rubber rings or rope of treated paper or other approved materials. Materials such as jute, asbestos or hemp shall not be used. Packing materials shall be handled in a manner that avoids contamination.
- G. No contaminated material or any material capable of supporting prolific growth of microorganisms shall be used for sealing joints. Sealing material or gaskets shall be handled in a manner that avoids contamination. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. It shall be delivered to the job in closed containers and shall be kept clean.
- H. If dirt enters the pipe, and in the opinion of the Engineer the dirt will not be removed by the flushing operation, the interior of the pipe shall be cleaned by mechanical means and then shall be swabbed with a 1 percent hypochlorite disinfecting solution. Cleaning with the use of a pig, swab or "go-devil" should be undertaken only when the Engineer has specified such and has determined that such operation will not force mud or debris into pipe joint spaces.

- I. If the main is flooded during construction, it shall be cleared of the floodwater by draining and flushing with potable water until the main is clean. The section exposed to the floodwater shall then be filled with a chlorinated potable water that, at the end of a 24-hour holding period, will have a free chlorine residual of not less than 25 mg/l. The chlorinated water may then be drained or flushed from the main. After construction is completed, the main shall be disinfected using the continuous feed or slug method.

3.3 VALVE INSTALLATION

- A. Prior to installation, inspect valves for direction of opening, freedom of operation, tightness of pressure containing bolting, cleanliness of valve ports, and especially seating surfaces, handling damage and cracks. Correct defective valves or hold for inspection by the Engineer.
- B. Set and join to the pipe in the manner specified in Section 3.1. Provide valves 12 inches and larger with concrete pads so that the pipe will not be required to support the weight of the valve. Set truly vertical.
- C. Provide all valves with a valve box. Set the top of the valve box neatly to the grade of the surface of the existing ground, unless directed otherwise by the Engineer. Do not transfer shock or stress to the valve and center and plumb the box over the wrench nut of the valve. Do not use valves to bring misaligned pipe into alignment during installation. Support pipe in such a manner as to prevent stress on the valve. See Detail Drawings for a typical valve box installation.
- D. When authorized by the Owner, provide valve marking posts at locations designated by the Engineer all in accordance with Detail Drawings.

3.4 THRUST RESTRAINT

- A. Provide all plugs, caps, tees, and bends (both horizontal and vertical) with concrete reaction backings and/or restrained joint pipe as detailed on the Drawings or as specified in the Specification's Special Conditions.
- B. Place concrete reaction backing between undisturbed solid ground and the fitting to be anchored. Concrete reaction backing to be installed in accordance with Section 03300. The backing, unless otherwise shown or directed, shall be located as to contain the resultant thrust force and so that the pipe and fitting joints will be accessible for repair.
- C. Temporary thrust restraint at temporary caps or plugs shall be the responsibility of the Contractor. Submit details of temporary restraint to the Engineer for approval.
- D. At connections with existing water mains where there is a limit on the time the water main may be removed from service, use metal harnesses of anchor clamps, tie rods and straps; mechanical joints utilizing set-screw retainer glands; or restrained push-on joints. Metal harnessing may be used by the Contractor in lieu

of concrete backing without the approval of the Engineer. Submit details of the proposed installation to the Engineer for approval. For pipe up to 12 inches in size, use a minimum of two $\frac{3}{4}$ -inch tie rods. For pipe 16 inches in size, four $\frac{3}{4}$ -inch tie rods are required and for 20- to 24-inch pipe sizes, six $\frac{3}{4}$ -inch tie rods are required. For larger pipe sizes, consult the Engineer. Install retainer glands in accordance with instructions of the particular manufacturer furnishing the glands

- E. Material for metal harnessing and tie rods shall be ASTM A36 or A307 as a minimum requirement.
- F. Protection of Metal Harnessing: Protect tie rods, clamps and other metal components against corrosion by hand application of a bituminous coating or by encasement of the entire assembly with 8-mil thick, loose polyethylene film in accordance with AWWA C105. Grease all tie rods prior to installing polyethylene.

END OF SECTION

SECTION 15030

PRESSURE AND LEAKAGE TESTS

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The Contractor shall test all piping, valves, and appurtenances installed under these Contract Documents. Testing shall be performed concurrent with installation. Unless otherwise approved by the Engineer no more than 1,000 feet of pipe shall be installed without being tested.

1.2 SUBMITTALS

- A. The Contractor shall prepare and submit to the Engineer schedules and procedures for testing all parts of the water main installed in accordance with these Contract Documents. The schedule shall be submitted 7 days prior to any testing.

PART 2 PRODUCTS

2.1 EQUIPMENT

- A. The Contractor shall furnish the pump, pipe connections, all necessary apparatus for the pressure and leakage tests. The Contractor shall make all excavations and backfills and furnish all necessary assistance for conducting the tests.

PART 3 EXECUTION

3.1 GENERAL

- A. After the pipe has been laid, thrust backing cured (minimum 5 days) and the trench completely or partially backfilled, the entire pipeline, or any section thereof, shall be subjected to hydrostatic pressure and leak tests in accordance with ANSI/AWWA C600-87, Section 4, Hydrostatic Testing.
- B. The Contractor may, at his option, completely backfill the trench or partially backfill the trench over the center portion of each pipe section to be tested. The Engineer may, however, direct the Contractor to completely backfill the trench if local traffic or safety conditions require such action.
- C. The pipeline shall be subjected to a hydrostatic pressure of no less than 100 psi above the maximum operating pressure or 150 psi. For operating pressures in excess of 200 psi whichever is greater, the pipeline will be subjected to a hydrostatic pressure that is 1.5 times the normal operating pressure, but no more than the design rating of the pipe after installation of a tapping sleeve and valve box but prior to making the tap into the main, the tapping sleeve and valve assembly shall be tested. The required test pressure shall be determined in the

same manner as for pipe but no pressure drop will be allowed during the test. Test pressure must be maintained for two hours for acceptance.

3.2 FILLING AND TESTING

- A. Each segregated section of pipeline shall be slowly filled with water ensuring that all air is expelled. Extreme care must be taken to ensure that all air is expelled from the pipeline during the filling of pipe with water. The line shall stand full of water for 24 hours prior to testing to allow all air to escape. If necessary, tap the main at points of highest elevation so that air can be expelled as the pipe is filled with water. After successful completion of filling and air expulsion, but prior to testing, the corporation stops shall be removed and the taps tightly plugged.
- B. The specified test pressure, measured at the point of lowest elevation, shall then be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. If the elevation of the high point of the pipeline being tested is such that the pressure during testing will be below 85 percent of the required test pressure, the Engineer will require a separate test to be performed on this section of pipeline. In lieu of a separate test, the test pressure measured at the lowest elevation may be increased, within the pressure rating of the pipeline material, such that resulting pressure at the highest point exceeds 85 percent of the required test pressure. The test pressure shall not vary by more than ± 5 psi and the test shall be at least a 2-hour duration.
- C. A leakage test shall be conducted concurrently with the pressure test. Leakage is defined as the quantity of the water measured as make-up water (volumetrically in a container or meter) that must be supplied into the newly laid pipeline to maintain pressure within 5 psi of the test pressure after the air in the pipeline has been expelled and the pipe filled with water.
- D. No pipeline installation shall be accepted by the Engineer if the leakage is greater than that shown in Table 1. The table has been generated from the formula:

$$L = \frac{SD(P)^{1/2}}{133,000}$$

Where L is the allowable leakage in gallons per hour, S equals the length of pipe in feet, D is the nominal pipe diameter in inches, and P is the test pressure in psig.

- E. Should any test disclose damaged or defective materials or leakage greater than that permitted, the Contractor shall at his own expense, locate and repair and/or replace defective materials. The tests shall be repeated until the leakage is within the permitted allowance and is satisfactory to the Engineer.

END OF SECTION

TABLE 1

ALLOWABLE LEAKAGE PER 1,000 FEET OF PIPELINE* (GPH)

Avg. Test Pressure (psi)	Nominal Pipe Diameter (Inches)											
	4	6	8	12	16	20	24	30	36	42	48	
100	0.30	0.45	0.60	0.90	1.20	1.50	1.80	2.25	2.70	3.15	3.60	
125	0.34	0.50	0.67	1.01	1.34	1.68	2.01	2.52	3.02	3.53	4.03	
150	0.37	0.55	0.74	1.10	1.47	1.84	2.21	2.76	3.31	3.86	4.41	
175	0.40	0.59	0.80	1.19	1.59	1.98	2.38	2.98	3.58	4.17	4.77	
200	0.43	0.64	0.85	1.28	1.70	2.12	2.55	3.19	3.82	4.46	5.09	
225	0.45	0.68	0.90	1.35	1.80	2.25	2.70	3.38	4.05	4.73	5.41	
250	0.47	0.71	0.95	1.42	1.90	2.37	2.85	3.56	4.27	4.99	5.70	
275	0.50	0.75	1.00	1.49	1.99	2.49	2.99	3.73	4.48	5.23	5.98	
300	0.52	0.78	1.04	1.56	2.08	2.60	3.12	3.90	4.68	5.46	6.24	
350	0.56	0.84	1.12	1.69	2.25	2.81	3.37	4.21	5.06	5.90	6.74	
400	0.60	0.90	1.20	1.80	2.40	3.00	3.60	4.50	5.41	6.31	7.21	
450	0.64	0.95	1.27	1.91	2.55	3.18	3.82	4.78	5.73	6.69	7.64	

SECTION 15106

DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.1 COORDINATION OF WORK

- A. Connection to existing pipelines may require shutdown of Owner facilities. Construction Work and connections shall be closely coordinated with the Owner through the Engineer. The Engineer, in consult with the Owner, may select the time, including Saturdays, Sundays, and holidays, which, in the opinion of the Engineer, will cause the least inconvenience to the Owner and/or its customers, for connection to existing pipelines, and the Contractor will perform such connections at such times as may be directed by the Engineer.

1.2 RELATED WORK

- A. Section 15000 Water Piping – General Provisions.

1.3 SUBMITTALS

- A. Shop Drawings and manufacturer's literature for all Contractor supplied materials shall be promptly submitted to the Engineer for approval.

PART 2 PRODUCTS

- A. Research has documented that certain pipe materials (such as polyvinyl chloride, polyethylene and polybutylene) and certain elastomers (such as those used in gasket material) may be subject to permeation by lower-molecular weight organic solvents or petroleum products. Products supplied under this section have been selected based on the non-expectation of encountering petroleum products or organic solvents. If during the course of pipeline installation the Contractor identifies or suspects the presence of petroleum products or any unknown chemical substance the Engineer is to be notified immediately. Installation of any further piping in the area of suspected contamination shall be stopped until direction is provided by the Engineer.

2.1 PIPE MATERIAL

A. General

1. Ductile iron pipe shall conform to the latest Specifications as adopted by the American National Standards Institute, Inc. (ANSI) and the American Water Works Association (AWWA). Specifically, ductile iron pipe shall conform to ANSI/AWWA C151/A21.51.

2. The pipe shall be coated outside with a bituminous coating in accordance with ANSI/AWWA C151/A21.51. The pipe interior shall be cement mortar lined and seal coated in compliance with the latest revision of ANSI/AWWA C104/A21.4

A. Pipe Class

1. The class of pipe to be furnished shall be Class 52.

B. Testing

1. Each length of pipe shall be subjected to a hydrostatic proof test as required by ANSI/AWWA C151/A21.51.

C. Joints

1. Mechanical and Push-On

- a. Mechanical and push-on joints including accessories shall conform to ANSI/AWWA C111/A21.11.

2. Flanged

- a. Flanged joints shall conform to ANSI/AWWA C110/A21.10 or ANSI 16.1 for fittings and ANSI/AWWA C115/A21.15 for pipe. Flanged joints shall not be used in underground installations except within structures.
- b. All flanged joints shall be furnished with 1/8-inch thick, red rubber or styrene butadiene rubber gaskets. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in American Standard for Wrench Head Bolts and Nuts and Wrench Openings (ANSI B18.2). For bolts of 1¼ inches in diameter and larger, bolt studs with a nut on each end are recommended. Material for bolts and nuts shall conform to ASTM A107.

2.2 FITTINGS

A. Ductile Iron Fittings

Standard fittings shall be ductile iron conforming to ANSI/AWWA C110/A21.10. Compact ductile iron fittings shall meet the requirements of ANSI/AWWA C153/A21.53.

- a. Working Pressures: Fittings shall be suitable for the following working pressures unless otherwise noted:

Table 1
Standard Ductile Iron Pipe and Fittings

Pressure Pounds per Square Inch

<u>Size</u>	<u>Compact Ductile Iron</u>	<u>Standard Ductile Iron</u>
3" – 24"	250	250
30" – 48"	250	250

- b. Coatings and Linings: The fittings shall be coated with a bituminous coating in accordance with ANSI/AWWA C110/A21.10 and lined inside with cement mortar and seal coated in accordance with ANSI/AWWA C104/A21.4.

B. Joints

1. Mechanical and Push-On

- a. Mechanical and push-on joints including accessories shall conform to ANSI/AWWA C111/A21.11.

2. Flanged

- a. Flanged joints shall meet the requirements of ANSI/AWWA C115/A21.15 or ANSI 16.1. Flanged joints shall not be used in underground installations except within structures.
- b. All flanged joints shall be furnished with a minimum 1/8-inch thick red rubber or styrene butadiene rubber gasket. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in ANSI B18.2. For bolts of 1¾ inches in diameter and larger, bolt studs with a nut on each end are recommended. Material for bolts and nuts shall conform to ASTM A107.

3. Restrained

- a. When restrained joints are required for pipe and fittings, they shall be of the boltless push-on type which provides joint restraint independent of the joint seal. Restrained system shall be suitable for the following working pressures:

Table 2
Standard Restrained Joints Pipe and Fittings

<u>Size</u>	<u>Pressure</u> <u>Pounds per Square Inch</u>
4" – 12"	250
14" – 24"	350
30" – 50"	250

PART 3 EXECUTION

3.1 INSTALLATION

A. The provisions specified in Section 15000 shall be strictly followed in addition to the following requirements:

1. Push-On Joint

- a. The surfaces with which the rubber gasket comes in contact shall be thoroughly cleaned just prior to assembly. The gasket shall then be inserted into the groove in the bell. Before starting joint assembly, a liberal coating of special lubricant shall be applied to the gasket and the spigot end. With the spigot centered in the bell, the spigot end is pushed home.

2. Mechanical Joints

- a. All components shall be cleaned and lubricated with soapy water prior to assembly. Slip the follower gland and gasket over the pipe plain end making sure the small side of the gasket and lip of the gland face the bell socket. Insert the plain end into the socket. Push gasket into position with fingers, gasket should be evenly seated. Slide gland into position, insert bolts and tighten by hand. Bolts are then tightened alternately (across from one another) to the following normal torques:

Table 3
Mechanical Joints

<u>Bolt Size</u>	<u>Range of Torque</u> <u>In Foot-Pounds</u>
5/8"	40 – 60
3/4"	60 – 90
1"	70 – 100
1 1/4"	90 – 120

3. Restrained Joints

- a. **Ball and Socket:** Assemble and install the ball and socket joint according to the manufacturer's recommendations. The joint shall be thoroughly cleaned and lubricated. Check the retainer ring fastener.
- b. **Push-On:** Assemble and install the push-on joint according to the manufacturer's recommendations. The joint shall be thoroughly cleaned and lubricated. Check the retainer ring fastener.
- c. During "pushing home" of any style piping, timber shall be placed between the jacking device (backhoe bucket, pipe jack, etc.) and the pipe being driven home.

END OF SECTION

SECTION 15130

PIPING SPECIALTIES

PART 1 GENERAL

1.1 SCOPE

- A. The section covers furnishing and installation of miscellaneous piping specialties as shown on the Drawings or in the Specification's Special Conditions or as required to fulfill the intent of the project.

PART 2 PRODUCTS

2.1 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement shall conform to ANSI/AWWA C105/A21.5.
- B. Polyethylene material will deteriorate rapidly when exposed to direct sunlight. Store all polyethylene encasement out of the sunlight. If during the installation period it is anticipated that the polyethylene encasement will be exposed to sunlight for more than two weeks (i.e., an open trench), Type C (black) polyethylene material must be used.

2.2 VALVE BOXES

- A. All valves shall be provided with valve boxes. Valve boxes shall be of the standard, adjustable, cast iron extension type, 3-piece, 5¼-inch shaft, screw type, and of such length as necessary to extend from valve to finished grade. The valve box shall be hot coated inside and out with coal tar or asphaltic compound.
- B. Valve boxes shall be *Tyler, 6850 Series* or an approved equivalent.

2.3 RODS, BOLTS, LUGS, AND BRACKETS

- A. All steel rods, bolts, lugs, and brackets shall be ASTM A36 or A307 carbon steel as a minimum requirement. After field installation, all steel surfaces shall have one coat of Koppers #50 coal tar coating applied before backfill.

2.4 **PIPE RESTRAINTS**

- A. *All retainer glands shall be wedge action type.*
- B. *Working pressure shall be 350 psi for pipe sizes 4" through 12" and 250 psi for pipe sizes 18" through 24".*
- C. *Acceptable Manufacturer: Ford UFR, 1400 Series.*

PART 3 EXECUTION

3.1 INSTALLATION

- A. See pipe installation Specifications for general installation.
- B. Piping shall be encased in polyethylene to prevent contact with surrounding backfill and bedding material in areas shown or designated by the Engineer. Polyethylene material shall be installed in accordance with ANSI/AWWA C105/A21.5.
- C. Service taps for polyethylene encased pipe shall follow the procedures described in AWWA C600-87 Section 7.1
- D. Valve boxes shall be supported so that no load can be transmitted from the valve box to the valve. See the sketch at the end of this section. Tops shall be set at established grade.
- E. Valves shall be set at the required locations with joints centered, spigots home and valve stems plumb unless otherwise directed by the Owner.
- F. Tapping sleeves and valve assemblies require pressure testing prior to making the tap. Refer to Section 15030 for specific requirements.

END OF SECTION

SECTION 15150

GATE VALVES

PART 1 GENERAL

1.1 SCOPE

- A. The Contractor shall furnish, install and test all gate valves shown on the Drawings and/or in the Specification's Special Conditions.

1.2 SUBMITTALS

- A. Shop Drawings and manufacturer's literature shall be submitted to the Engineer for approval.

1.3 RELATED WORK

- A. Section 15000 – Water piping – General Provisions.

PART 2 PRODUCTS

2.1 SMALL GATE VALVES

- A. All gate valves 4 inches through 12 inches shall be iron body, *resilient-seated*, nut-operated, non-rising stem, gate valves suitable for buried service. The valves shall be designed for an operating pressure of 200 psi and test pressures to 400 psi. Valves shall be designed to operate in the vertical position. Valves shall comply fully with AWWA C509. Valve ends shall be mechanical joint in accordance with AWWA C111. Stem seals shall be double O-ring stem seals. 2-inch Square operating nuts conforming to AWWA C509 shall be used. Valves shall *open left* in accordance with the Owner's standard.

- B. Valves shall be epoxy coated with AWWA C550 on the interior and exterior.

- C. Fasteners shall be stainless steel.

2.1 LARGE GATE VALVES

- A. Gate valves larger than 12 inches NPS shall be iron body, *resilient-seated*, nut-operated, non-rising stem, gate valves suitable for buried service. All valves shall have openings through the body of the same circular area as that of the pipe to which they are attached. All valves furnished shall *open left* in accordance with the Owner standard.

- B. Testing of valves shall be in accordance with AWWA C500 Section 28. Certified copies of all tests shall be provided prior to shipment. The Engineer reserves the

right to observe all tests.

- C. Valves shall have mechanical joint ends unless otherwise designated on the plans or approved by the Engineer.
- D. Valves shall be epoxy coated in accordance with AWWA C550 on the interior and exterior.
- E. Fasteners shall be stainless steel.
- F. All valves shall be designed for a working pressure of 150 psi and 300-psi test pressure unless otherwise noted on the plans or directed by the Engineer. The Contractor shall make all valves tight under their working pressures after they have been placed and before the main is placed in operation. Any defective parts shall be replaced at the Contractor's expense.
- G. Acceptable manufacturers are: *American Flow Control, Series 2500 or approved equivalent.*

PART 3 EXECUTION

3.1 INSTALLATION

- A. Installation requirements contained in Section 15000 shall be strictly followed.

END OF SECTION

SECTION 15170

TAPPING SLEEVES, SADDLES AND VALVES

PART 1 GENERAL

1.1 SCOPE

- A. The Contractor shall furnish, install and test all tapping sleeves and valves and tapping saddles as shown on the Drawings and /or in the Specification's Special Conditions.

1.2 RELATED WORK

- A. Section 15000 – Water piping – General Provisions.

1.3 SUBMITTALS

- A. Shop Drawings and manufacturer's literature shall be submitted to the Engineer for approval in accordance with Section 01300.

PART 2 PRODUCTS

2.1 GENERAL

- A. All tapping sleeves, saddles and valves shall be designed for a working pressure of 250 psig for 12-inch and smaller and 150 psig for sizes larger than 12 inches. Test pressure shall be twice the working pressure.

2.2 TAPPING SLEEVES AND VALVES

- A. The Contractor shall verify the type of existing pipe and the outside diameter of the pipe on which the tapping sleeve is to be installed.
- B. Tapping sleeves shall be ductile iron or cast iron dual compression type. The sleeves shall be made in two halves, which can be assembled and bolted around the main.
- C. The horizontal tapping valve shall conform to the applicable requirements of AWWA C509. The tapping valves shall have flanged inlets with mechanical joint outlets, enclosed bevel gears, bypass valves, rollers, tracks, and scrapers.
- D. Coat exterior surface of tapping sleeve with two coats of bitumastic paint.
- E. Acceptable Manufacturers: American Darling, Mueller or an approved equivalent.

2.3 TAPPING SADDLES

- A. Tapping saddles shall consist of ductile iron outlet castings, attached to the pipeline with high strength steel straps. Casting shall be sealed to pipeline with a neoprene gasket. Saddles shall meet applicable parts of AWWA C800.
- B. Saddles shall be rated at 250 psi with ductile iron body with hot dip and zinc galvanizing, flattened steel strap, stainless steel nuts.
- C. Acceptable Manufacturers: Mueller H-10400 and H-10500 Series or an approved equivalent.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General provisions provided in Section 15000 shall be strictly followed. Installation of the tapping sleeves, tapping saddle, and tapping valve is to be in accordance with the manufacturer's instructions. The tapping procedure is to be in accordance with the tapping machine manufacturer's instructions.

3.2 PRELIMINARY TESTING

- A. After installation of the tapping sleeve and valve assembly but prior to making the tap, the assembly shall be pressure tested hydrostatically in accordance with Section 15030. The test shall be made with the valve open using a tapped mechanical joint cap. No leakage is acceptable. The test pressure shall be maintained for 15 minutes minimum.

END OF SECTION

SECTION 15180

FIRE HYDRANTS

PART 1 GENERAL

1.1 SCOPE

- A. The Contractor shall furnish all labor, material, tools and equipment required to install fire hydrants at the location shown on the plans or where designated by the Borough.

PART 2 PRODUCTS

2.1 MATERIAL

- A. Fire hydrants shall be compression type with a 5¼-inch main valve opening three ways and a 6-inch mechanical joint inlet.
- B. The hydrant shall have two 2½-inch hose nozzles and one 4½-inch pumper nozzle complete with nozzle cap and chains. Nozzles shall have full flow openings and be field replaceable.
- C. The hydrant shall be a dry top design with an O-ring sealed reservoir and post type dry barrel design. Hydrant shall be the traffic type with stainless steel safety stem coupling.
- D. The hydrant shall conform to AWWA C502.
- E. The hydrant shall have a 1½-inch pentagon nut and provided with National Standard threads on nozzles. Hydrant shall open counterclockwise (left).
- F. The hydrants shall be *American Flow Corp, Model B-62-B* painted red (no substitutes allowed).

PART 3 EXECUTION

3.1 INSPECTION PRIOR TO INSTALLATION

- A. Fire hydrants shall be inspected at the time of delivery to the Contractor. Each hydrant shall be cycled to full open and full closed positions to ensure that no internal damage or breakage has occurred during shipment and handling. All external bolts shall be checked for proper tightness.
- B. After inspection, the hydrant valves shall be closed and the outlet nozzle caps replaced to prevent the entry of foreign matter. Stored hydrants shall be protected from weather elements with the inlets facing downward.

3.2 INSTALLATION

- A. Hydrants shall be located as shown on the plans or as directed by the Engineer. The location shall provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians. When placed behind the curb, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than 18 to 24 inches, depending on local requirements, from the gutter face of the curb. All hydrants shall stand plumb with the pumper nozzle facing the curb. Hydrants having two hose nozzles 90° apart shall be set with each nozzle facing the curb at an angle of 45°. Hydrants shall be set to the established grade, with nozzles at least 18 inches above the ground as shown or as directed by the Engineer. Unless otherwise shown, each hydrant shall be connected to the main with a 6-inch branch connection controlled by an independent 6-inch gate valve.
- B. When hydrant installations have a greater than normal exposure to damage due to vehicular traffic (parking lot installations, unusual driving situation, etc.), the Engineer may authorize hydrant protection using steel pipe bollards. Hydrants requiring such protection are to be designated by the Engineer and installed by the Contractor in accordance with Section 15000 of these Specifications. Bollards shall be located as necessary adjacent to the hydrant and in such a manner as not to interfere with the ability to connect hoses or operate the hydrant. Additionally, the bottom of the bollard and encasement shall be located above the hydrant supply piping and valve to prevent the possibility of damage to the piping should the bollard be displaced during vehicular contact.
- C. Unless otherwise directed by the Engineer, a drainage pit 2 feet in diameter and 2 feet deep shall be excavated below each hydrant. The pit shall be filled and compacted with coarse gravel or broken stone mixed with coarse sand, under and around the base of the hydrant to a level 6 inches above the waste opening. No hydrant drainage pit shall be connected to a sewer.
- D. The drainage pit shall be lined and covered with geotextile fabric and the fabric shall completely isolate the gravel or stone so that no fill material or adjacent earth comes in contact with pit material.
- E. In situations where the groundwater table is above the drain opening of the hydrant barrel, the Engineer is to be notified. Then, if directed by the Engineer, the drain opening shall be plugged using a method acceptable to the hydrant manufacturer. In this situation the drainage pit is not required but special markings on the hydrant, acceptable to the Owner, are required to indicate that the drain opening has been plugged. Prior to project acceptance, if the Contractor operates a hydrant having a plugged drain connection, the Contractor is required to pump the barrel dry after each use.
- F. A reaction or thrust backing shall be provided at the base of each hydrant and shall not obstruct the drainage outlet of the hydrant. The size and shape of concrete thrust backing and the number and size of tie rods shall be approved by the Engineer. The material to be used for thrust backing shall be as specified in

Section 03300. Requirements for tie rods are specified in Section 15000.

G. Please refer to the Detailed Drawings for a typical fire hydrant assembly.

3.3 TESTING

A. After installation and before backfilling (and after pressure testing the water main, if it has been installed) test the hydrant as follows:

1. Pressure Test

- a. Open the hydrant fully and fill with water; close all outlets.
- b. To prevent caps from being blown off dry-barrel hydrants and to prevent other possible damage, vent air from the hydrant by leaving one of the caps slightly loose as the hydrant is being filled. After all air has escaped, tighten the cap before proceeding.
- c. Apply line pressure.
- d. Check for leakage at flanges, nozzles and operating stem.
- e. If leakage is noted, repair or replace components or complete hydrant until no leaks are evident.

2. Drainage Test for Dry-Barrel Hydrants

- a. Following the pressure test, close hydrant.
- b. Remove one nozzle cap and place pylon or hand over nozzle opening.
- c. Drainage rate should be sufficiently rapid to create a noticeable suction.
- d. After backfilling, operate the hydrant to flush out any foreign material.
- e. Tighten nozzle caps, then back them off slightly so that they will not be excessively tight; leave tight enough to prevent removal by hand.

END OF SECTION

SECTION 15190

AIR RELEASE AND BLOW-OFF OUTLETS

PART 1 GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install air release and blow-off outlets at the locations or as directed by the Borough. The outlet details shall be as shown on the Detail Drawings.

1.2 SUBMITTALS

A. Shop Drawings and manufacturer's literature for equipment to be supplied shall be submitted to the Engineer for approval in accordance with Section 01300.

1.3 RELATED WORK

A. Section 15000 – Water Piping – General Provisions.

B. Section 02730 – Precast Concrete Manhole.

PART 2 PRODUCTS

2.1 COMBINATION AIR/VACUUM RELEASE VALVES

A. The Contractor shall provide APCO Model No. 145C as manufactured by Valve and Primer Corporation, Schaumburg, Illinois. Bodies shall be cast iron with stainless steel floats.

2.2 CURB BOXES

A. Curb boxes shall be standard, 2½ inch, cast iron, screw type, complete with lid and head bolt, adjustable from 36 inches to 54 inches. Size to be suitable for a 2-inch valve.

B. Lids shall be marked with the word "water" and provided with a brass hold down screw.

C. Acceptable Manufacturers: Tyler Pipe, 6500 Series, and Mueller.

2.3 COPPER PIPE

A. Copper pipe shall be Type K, as specified, meeting the requirements of ASTM B88.

2.4 CORPORATION STOPS

- A. Corporation stops shall be of the brass ball valve type manufactured in accordance with AWWA C800. The inlet connection shall have standard AWWA tapered threads unless otherwise required by the Borough. All valves shall be compression type. The size shall be 2 inches and shall match the size of specified copper pipe material.
- B. Acceptable Manufacturer and Model Number:
 - 1. Mueller – H-9968 Series.

2.5 CURB STOPS

- A. Curb stops shall be bronze body construction, ball valves, with double O-ring stem seals. Curb stops shall conform with AWWA C800. All valves shall be compression type. Valves shall be full port design with a quarter turn check. Size shall be 2 inches.
- B. Acceptable Manufacturer and Model Number:
 - 1. Mueller – H-10284 Series.

2.6 MISCELLANEOUS SERVICE LINE FITTINGS

- A. Miscellaneous service line fittings such as couplings, adaptors, saddles, bends, plugs, etc. shall conform to AWWA C800.
- B. All fittings shall be of the compression type. No soldered connections are permitted.
- C. Acceptable Manufacturer: Mueller.

PART 3 EXECUTION

3.1 INSTALLATION

- A. See Detail Drawings showing typical installation details for air/vacuum release valve assemblies and air blow-off assemblies, respectively.

3.2 INSTALLATION OF CORPORATION STOPS

- A. Tapping of all water mains shall be performed by experienced craftsmen familiar with installation of water service lines.
- B. All taps shall be made with a suitable tapping machine (Mueller, Ford, Hays or Dresser type) using the proper combined drill and tap. Hand held drilling

equipment is not acceptable.

- C. Corporation stops shall be inspected for damaged threads and proper operation of the ball valve prior to installation.
- D. Should the water main wall thickness or material be unsuitable for direct tapping, a tapping saddle shall be used.
- E. Proper installation of the corporation stop should allow between two and three threads to extend beyond the inside wall of the main. If necessary a test tap shall be made with the boring bar marked to the proper depth. The corporation shall not be threaded completely into the pipe such that it becomes shouldered with the main. Lubricants of any type shall not be used when installing the corporation.
- F. Taps made to the polyethylene encased water main shall be made using the procedure outlined in AWWA C600-87 Section 7.1.

3.3 INSTALLATION OF LINE AND FITTINGS

- A. Copper pipe shall be installed between the tap connection and the curb stop or air release valve location making only gradual changes in grade or alignment as required. Sharp bends (greater than 15°) in any direction are not allowed unless approved by the Engineer.
- B. Curb stops shall be installed with the operating nut in the vertical position and the curb box centered over the nut. Curb boxes are to be installed and adjusted to be flush with finished grade. Curb boxes shall have lids installed and locked.
- C. Excavation, backfilling and surface restoration shall be completed in accordance with Division 2 of these Specifications.
- D. After completion of copper pipe installation, but prior to backfilling, the corporation stop shall be opened slowly to fill the line. When the line is full and all air has been removed completely, open the corporation. All piping, fittings and taps shall be visually checked for leaks.

END OF SECTION

SECTION 15200

SERVICE LINES

PART 1 GENERAL

1.1 SCOPE

- A. Where shown on the Drawings and/or in the Specification's Special Conditions, the Contractor shall furnish and install service lines originating at the water main and terminating at a curb stop connection. This section does not include service lines or meter installations beyond the curb stop. Refer to the detailed drawings for a typical service line installation.

1.2 RELATED WORK

- A. Section 15000 – Water Piping – General Provisions.

PART 2 PRODUCTS

2.1 COPPER SERVICE LINE MATERIAL

- A. Copper pipe shall be *Type K*, as specified, meeting the requirements of ASTM B88. Pipe size (¾-inch, 1-inch, 1½-inch, 2-inch) to be reviewed by the Borough.

2.2 CURB BOXES

- A. Curb boxes shall be standard, 2½ inch, cast iron, screw type, complete with lid and head bolt, adjustable from 36 inches to 54 inches. Size to be suitable for a 2-inch valve.
- B. Lids shall be marked with the word "water" and provided with a brass hold down screw.
- C. Acceptable Manufacturers: *Tyler, 6500*.

2.3 CORPORATION STOPS

- A. Corporation stops shall be of the brass, ball valve type manufactured in accordance with AWWA C800. The inlet connection shall have standard AWWA tapered threads unless otherwise required by the Borough. All valves shall be compression type. The sizes shall range from ½ inch to 2 inches and shall match the size of specified service line material.

- B. Acceptable Manufacturer and Model Number:

1. *Ford – F1000, Grip Joint*.

2.4 CURB STOPS

A. Curb stops shall be bronze body construction, ball valves, with double O-ring stem seals. Curb stops shall conform with AWWA C800. All valves shall be compression type. Valves shall be full port design with a quarter turn check. Sizes shall be from ¾ inch to 2 inches and shall match the service line size.

B. Acceptable Manufacturer and Model Number:

1. *Ford – B44, Grip Joint.*

2.5 MISCELLANEOUS SERVICE LINE FITTINGS

A. Miscellaneous service line fittings such as couplings, adaptors, saddles, bends, plugs, etc. shall conform to AWWA C100.

B. All fittings shall be of the compression type. No soldered connections are permitted.

C. Acceptable Manufacturers: Mueller and Ford Meter Box Company.

2.6 POLYETHYLENE ENCASEMENT

A. Copper service line material (pipe, valves, stops, etc.) installed on mains with polyethylene encasement or other type protective wrap shall be encased in polyethylene. Encasement material and installation shall be per Section 15131 and ANSI/AWWA C105/A21.5.

PART 3 EXECUTION

3.1 INSTALLATION OF CORPORATION STOPS

A. Tapping of all water mains shall be performed by experienced craftsmen familiar with installation of water service lines.

B. All taps shall be made with a suitable tapping machine (Mueller, Ford, Hays or Dresser type) using the proper combined drill and tap. Hand-held drilling equipment is not acceptable.

C. Corporation stops shall be inspected for damaged threads and proper operation of the ball valve prior to installation.

D. The main shall be tapped at 45° above the horizontal centerline as shown on the Detail Drawings.

E. Should the water main wall thickness or material be unsuitable for direct tapping, a tapping saddle shall be used.

- F. Proper installation of the corporation stop should allow between two and three threads to extend beyond the inside wall of the main. If necessary a test tap shall be made with the boring bar marked to the proper depth. The corporation shall not be threaded completely into the pipe such that it becomes shouldered with the main. Lubricants of any type shall not be used when installing the corporation.
- G. Taps made to polyethylene encased water main shall be made using the procedure outlined in AWWA 6600-87, Section 7.1.

3.2 INSTALLATION OF SERVICE LINE AND FITTINGS

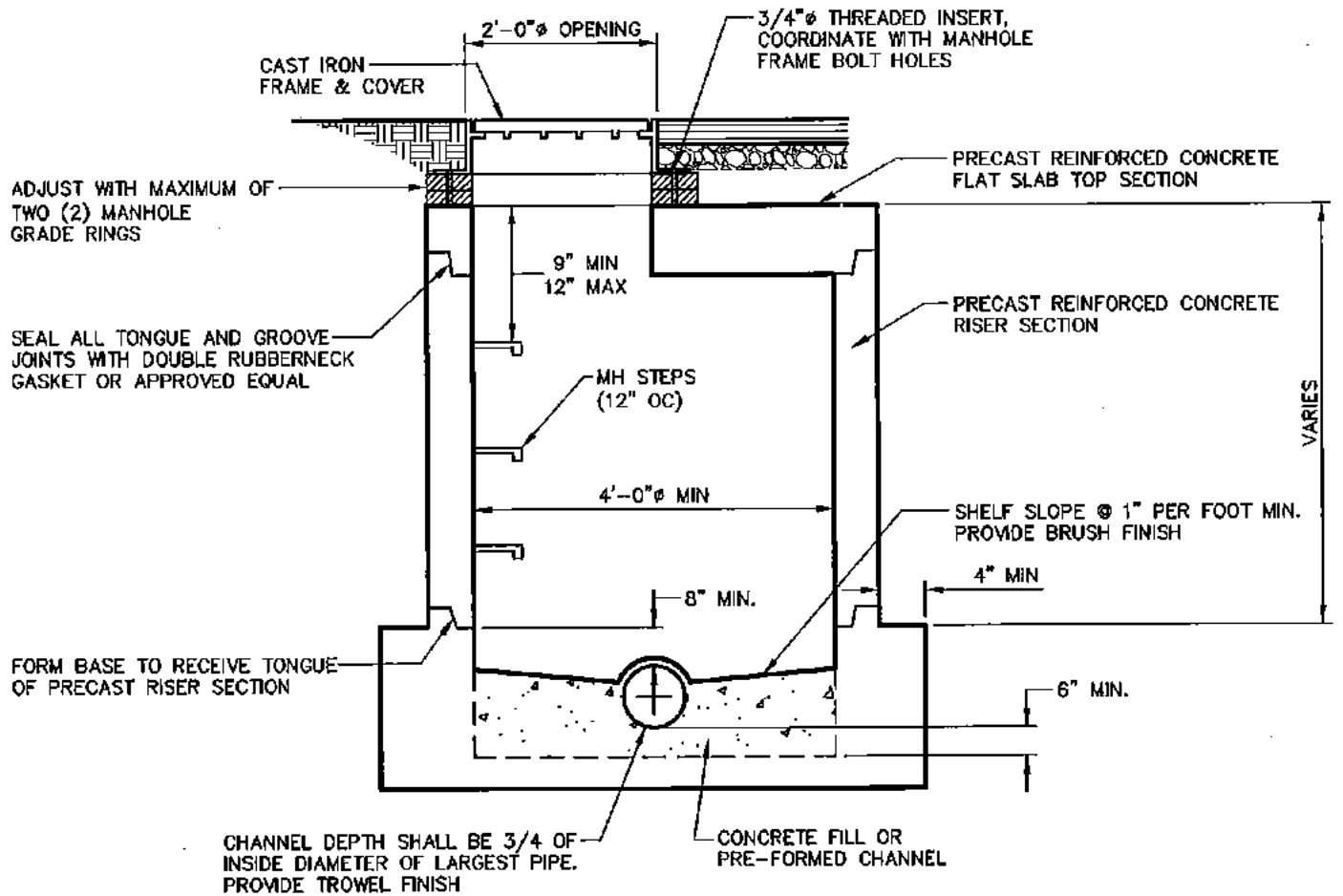
- A. Service lines shall be installed between the tap connection and the curb stop location making only gradual changes in grade or alignment as required. Sharp bends (greater than 15°) in any direction are not allowed unless approved by the Borough.
- B. Service lines shall be placed in soil bedding free of rocks 1-inch or larger in size or using quartz sand.
- C. Curb stops shall be installed with the operating nut in the vertical position and the curb box centered over the nut. Curb boxes are to be installed plumb and adjusted to be flush with finished grade. Curb boxes shall have lids installed and secured.
- D. No water service lines shall be laid in the same trench with gas pipe, sewer pipe, or any other utility. Every service line shall be horizontally separated at least 5 feet from a sanitary sewer line; 10 feet from a septic tank, distribution box, disposal field or seepage pit; and 25 feet from a cesspool by undisturbed or compacted earth.
- E. Service lines shall be installed at least 48 inches below the surface of the ground. Trenches must remain open until service lines and connections are inspected by a representative of the Borough.
- F. Excavation, backfilling and surface restoration shall be completed in accordance with Division 2 of these Specifications.
- G. Only an authorized representative of the Borough may open or close any curb stop or valve belonging to the Borough.
- H. After completion of the service line installation, but prior to backfilling, the corporation stop shall be opened slowly to fill the line. When the line is full and all air has been removed completely, open the corporation and close the curb stop. All piping, fittings, and taps shall be visually checked for leaks.
- I. The Borough will exercise the right, in cases where it seems necessary, to require the installation of a meter pit at the expense of the Owner.

END OF SECTION

HANDOVER ENGINEERING
ASSOCIATES, INC.

*WATER
AND
SEWER
DETAILS*

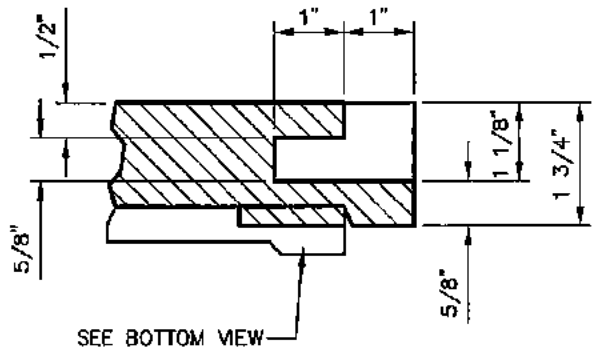
1. PRECAST CONCRETE MANHOLE
2. SHALLOW MANHOLE
3. MANHOLE W/ INSIDE DROP CONNECTION
4. STANDARD FRAME & COVER
5. WATERTIGHT FRAME & COVER
6. BREAK-IN CONNECTIONS TO EXISTING MANHOLES
7. FORCE MAIN CONNECTION
8. SANITARY SEWER HOUSE CONNECTION
9. DEEP SEWER LATERAL CONNECTION
10. DUAL SANITARY SEWER LATERAL
11. SANITARY SEWER SERVICE CONNECTION – BORE
12. SERVICE LATERAL CONNECTION
- 12A. TYPICAL TRENCH FOR WATER AND SEWER PIPE
13. LOW PRESSURE FORCE MAIN CLEANOUT
14. LATERAL CONNECTION – LOW PRESSURE
15. LOW PRESSURE SEWER TRENCH
16. DROP MANHOLE CONNECTION—LOW PRESSURE FORCE MAIN
17. WASTEWATER AIR RELEASE VALVE
18. SIMPLEX GRINDER PUMP
19. DUPLEX GRINDER PUMP
20. WATERLINE SERVICE CONNECTION
21. WATER METER INSTALLATION
- 21A. WATER METER INSTALLATION FOR SPRING TOWNSHIP RESIDENTS
22. GATE VALVE INSTALLATION
23. FIRE HYDRANT
24. WATERLINE AIR RELEASE VALVE MANHOLE
25. WATERLINE BLOWOFF VALVE
26. SANITARY SEWER REPLACEMENT
27. STORM SEWER REPLACEMENT
28. TYPICAL METER PIT FOR LARGE METERS
29. CONCRETE ENCASEMENT
30. CONCRETE CRADLE
31. REINFORCED CONCRETE SLOPE ANCHORS
32. CLAY DIKE
33. CASING CONDUIT
34. WATERLINE TRENCH BACK FILL AND RESTORATION (UNPAVED AREAS)
35. WATERLINE TRENCH BACK FILL AND RESTORATION (PAVED AREAS)
36. MANDREL DIMENSIONS
37. STREAM CROSSING DETAIL
38. HORIZ. THRUST BLOCKING
39. VERTICAL THRUST BLOCKING



NOTES:

1. MANHOLE SHALL HAVE BITUMASTIC COATING ON EXTERIOR WALLS.
2. MAINTAIN POSITIVE GRADE THROUGH MANHOLE.
3. ALL OPENINGS AROUND PIPES SHALL BE FINISHED WITH NON-SHRINK GROUT.
4. CONTRACTOR MAY USE PRECAST INVERT BASES.

REVISIONS	SHALLOW MANHOLE	PROJECT NO. ADAM00-08
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	SHEET NO. 2
	HANDOVER ENGINEERING ASSOCIATES, INC.	200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444



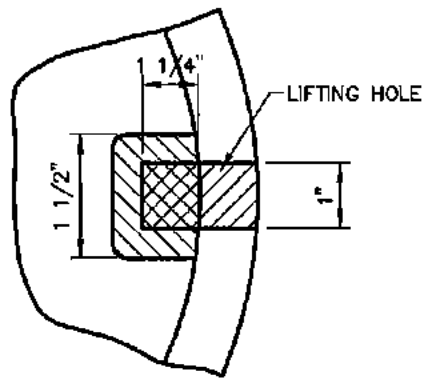
SEE BOTTOM VIEW

SECTION



LIFTING HOLE
(SEE DETAILS)

PLAN

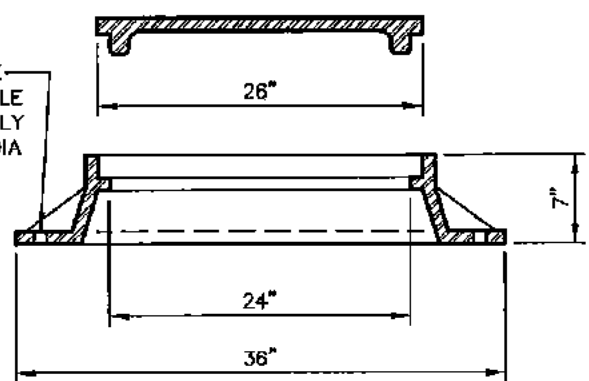


LIFTING HOLE

BOTTOM VIEW

LIFTING HOLE DETAILS

FRAME BOLT HOLE -
1" DIA. CORED HOLE
2 REQ'D - EQUALLY
SPACED ON 32" DIA
BOLT CIRCLE

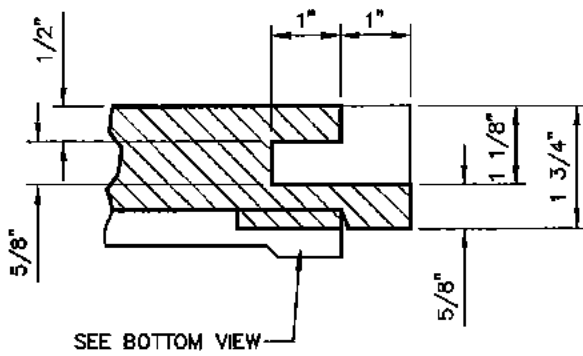


SECTION

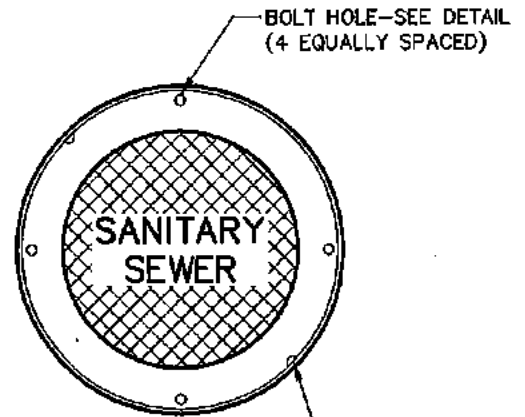
NOTES:

1. ALL MANHOLE FRAME AND COVER DIMENSIONS SHALL BE CONSIDERED MINIMUM. UNLESS OTHERWISE NOTED, WITH THE EXCEPTION OF THE BOLT HOLE AND CORED HOLE DIMENSIONS.
2. ALL MANHOLE FRAMES AND COVERS SHALL BE FOR HEAVY DUTY TRAFFIC.
3. ALL COVERS SHALL BE SELF SEALING AND GASKETED WITH A MACHINE GROOVE AND NEOPRENE COMPRESSION GASKET.

REVISIONS 02.01.05 	STANDARD FRAME & COVER	PROJECT NO. ADAM00-08
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	
	HANDOVER ENGINEERING ASSOCIATES, INC.	
	200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444	SHEET NO. 4

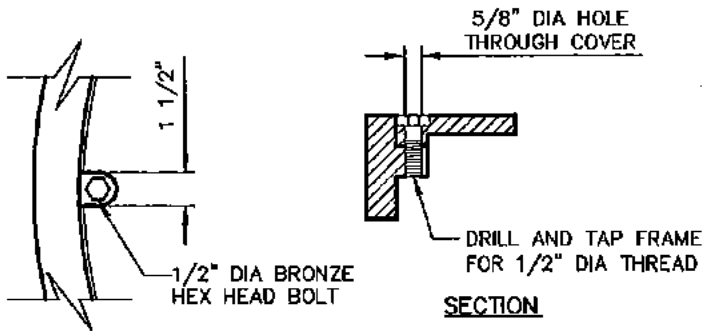


LIFTING HOLE DETAIL



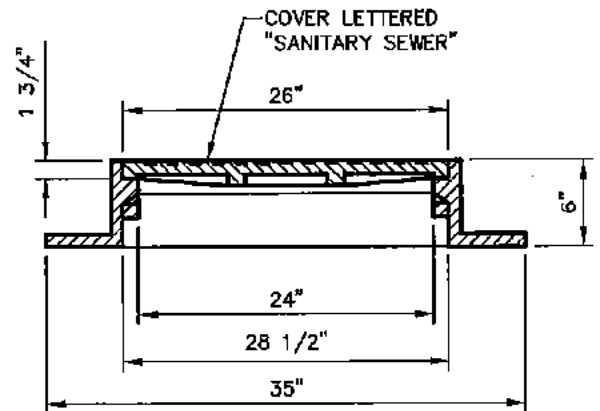
PLAN

LIFTING HOLE
(SEE DETAIL)



PLAN

COVER TO FRAME BOLT HOLE

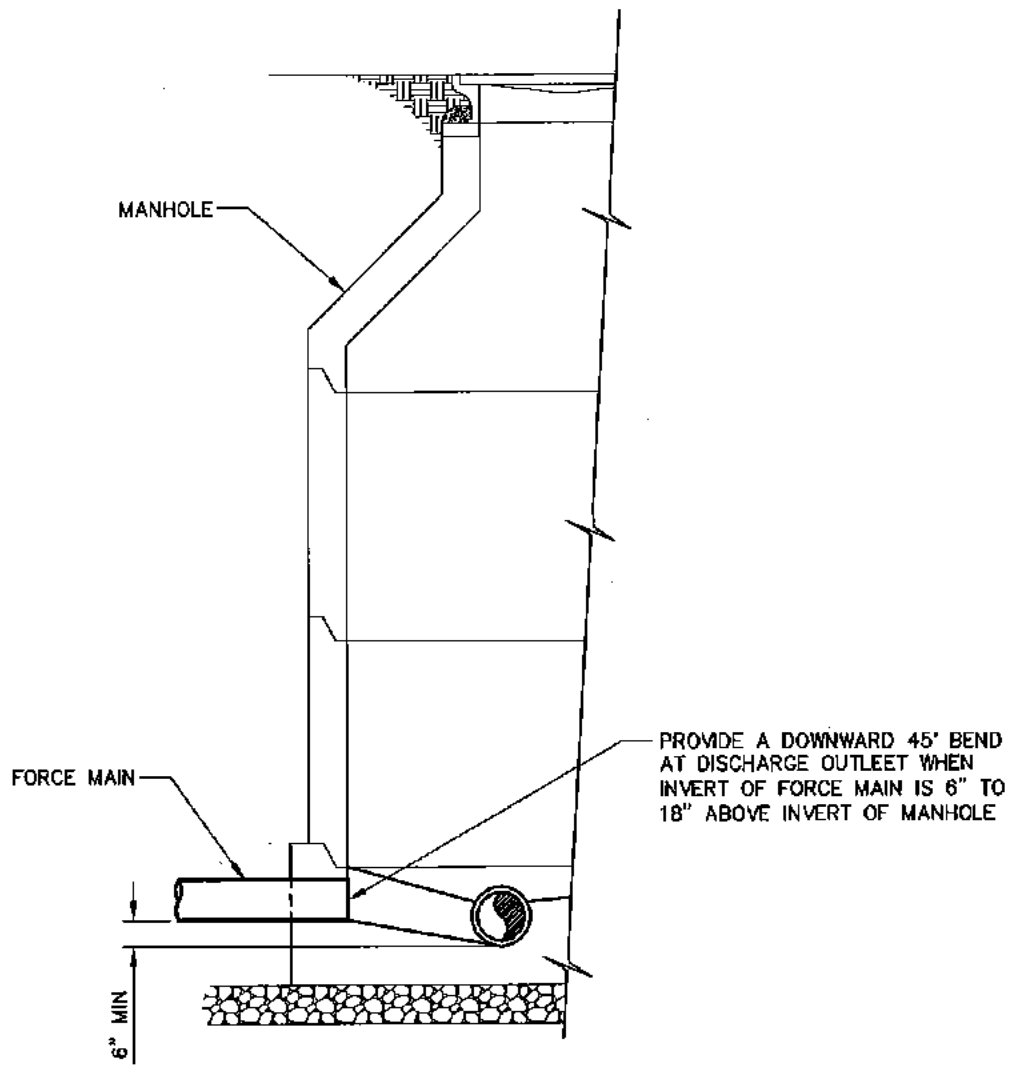


SECTION

NOTES:

1. ALL MANHOLE FRAME AND COVER DIMENSIONS SHALL BE CONSIDERED MINIMUM, UNLESS OTHERWISE NOTED, WITH THE EXCEPTION OF THE BOLT HOLE AND CORED HOLE DIMENSIONS.
2. ALL MANHOLE FRAMES AND COVERS SHALL BE FOR HEAVY DUTY TRAFFIC.
3. ALL COVERS SHALL BE SELF SEALING AND GASKETED WITH A MACHINE GROOVE AND NEOPRENE COMPRESSION GASKET.

REVISIONS	WATERTIGHT FRAME & COVER	PROJECT NO.
02.01.05	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	ADAM00-08
		SHEET NO.
		5
	HANDOVER ENGINEERING ASSOCIATES, INC.	20C SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444

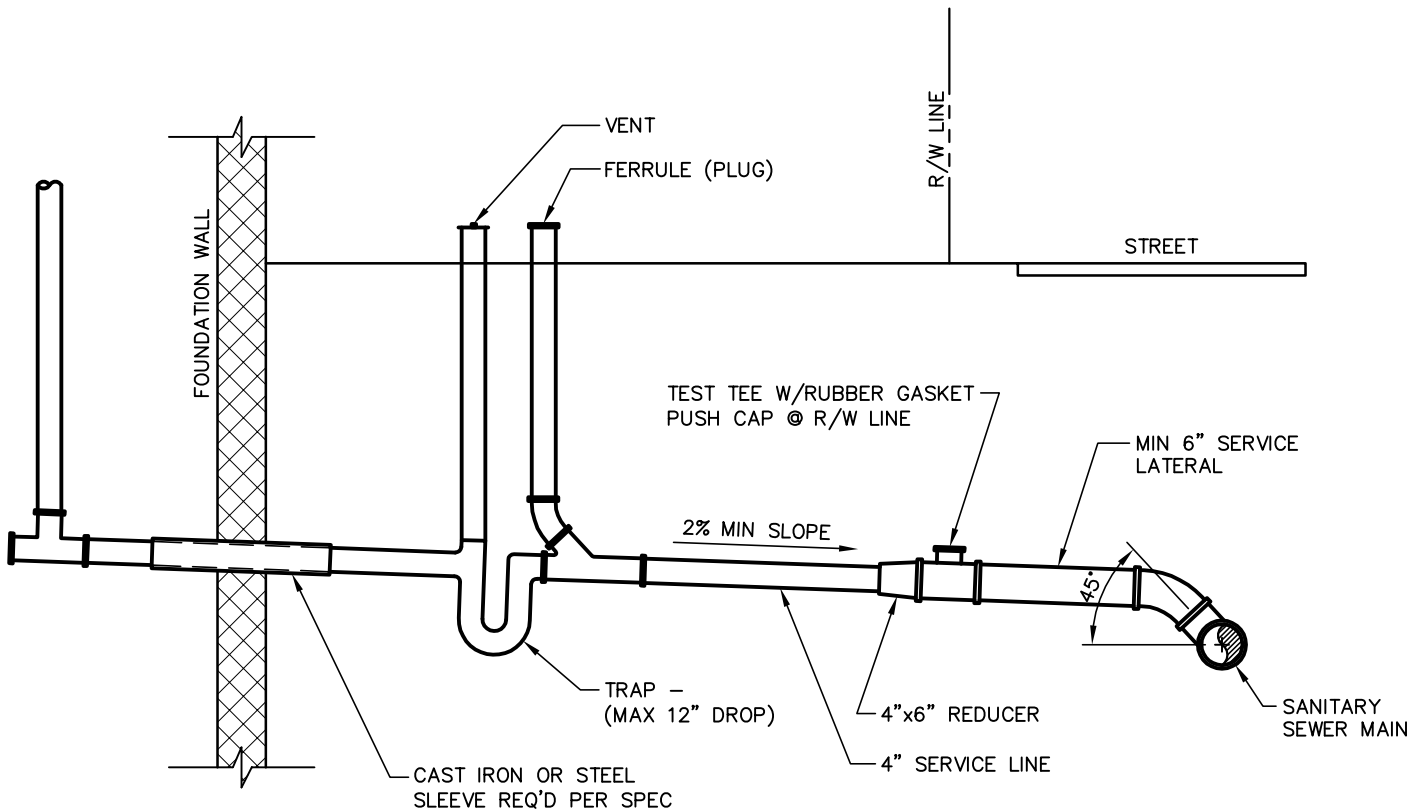
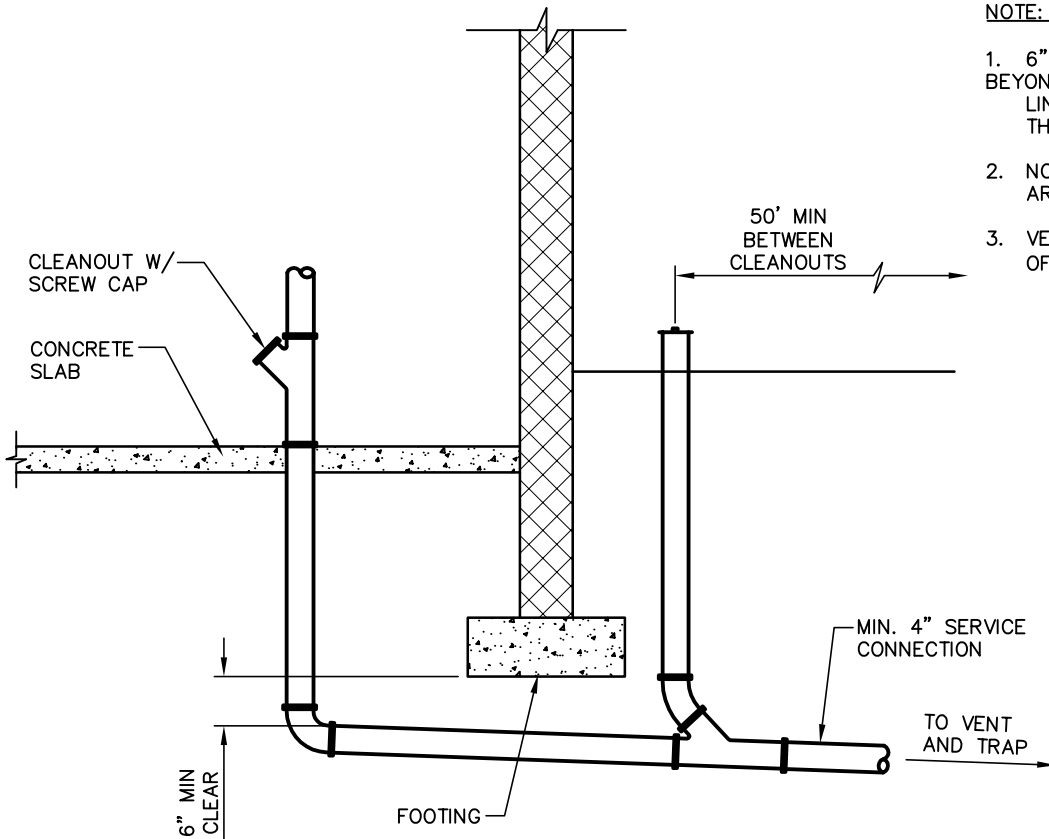


NOTE:
 FORCE MAIN TERMINAL MANHOLES SHALL BE LINED FOR HYDROGEN SULFIDE PVC PROTECTION BOROUGH TO DETERMINE NUMBER OF DOWNSTREAM MANHOLES TO BE LINED BASED ON PUMP STATION OPERATION.

REVISIONS 	FORCE MAIN CONNECTION	PROJECT NO. ADAM00-08
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	
	SHEET NO. <div style="font-size: 2em; font-weight: bold;">7</div>	
HANDOVER ENGINEERING ASSOCIATES, INC.		200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444

NOTE:

1. 6" STUB WITH CAP SHALL EXTEND 1'-0" BEYOND RIGHT-OF-WAY LINE, EASEMENT LINE OR EXISTING UTILITY; WHICHEVER IS THE FARTHEST.
2. NO LATERAL CONNECTIONS TO MANHOLES ARE PERMITTED.
3. VENT AND CLEANOUT SHALL BE A MIN. OF 6" ABOVE GRADE.



REVISIONS
02.01.05
11.21.11

SANITARY SEWER HOUSE CONNECTION

STANDARD SPECIFICATIONS

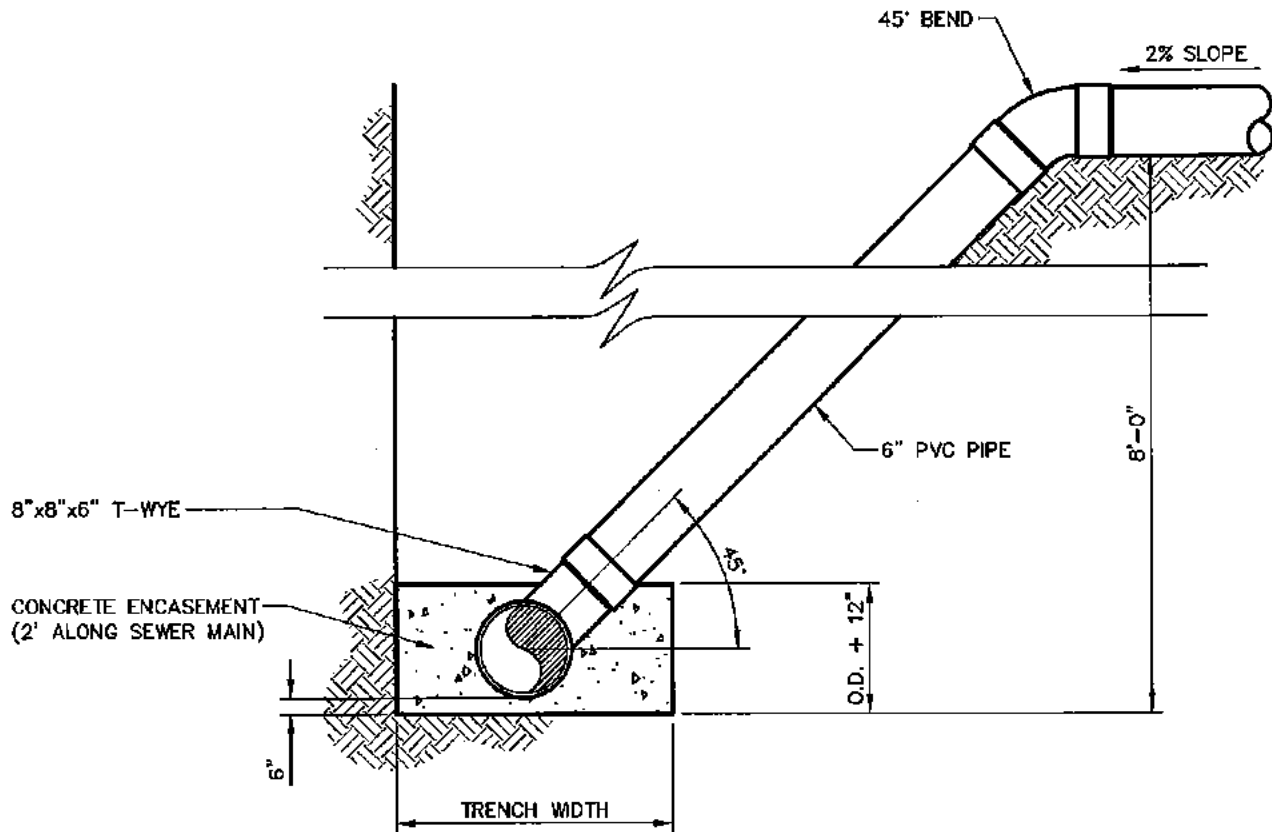
FOR

ADAMSTOWN BOROUGH

HANDOVER ENGINEERING
ASSOCIATES, INC.

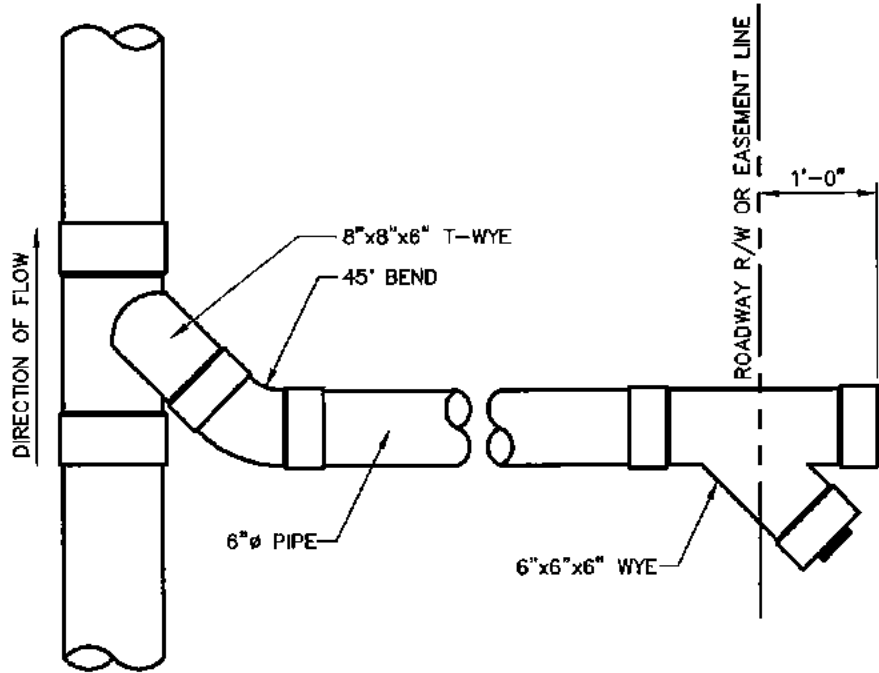
20C SNYDER LANE
EPHRATA, PA 17522-9101
(717) 721-7444

PROJECT NO.	ADAM00-08
SHEET NO.	8



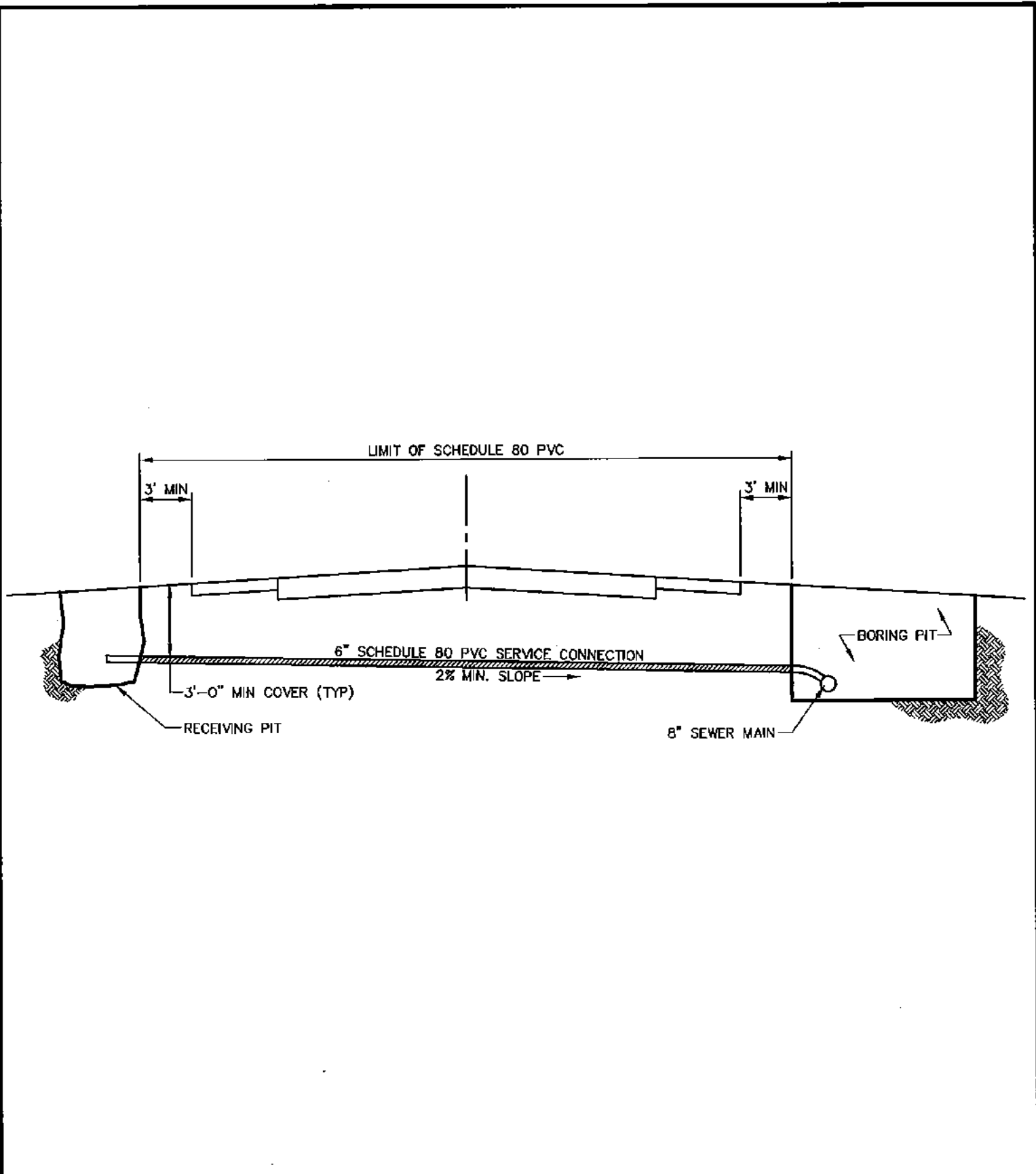
SECTION

REVISIONS	DEEP SEWER LATERAL CONNECTION	PROJECT NO.
	STANDARD SPECIFICATIONS FOR	ADAM00-08
	ADAMSTOWN BOROUGH	SHEET NO.
	HANDOVER ENGINEERING ASSOCIATES, INC.	9
	200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444	

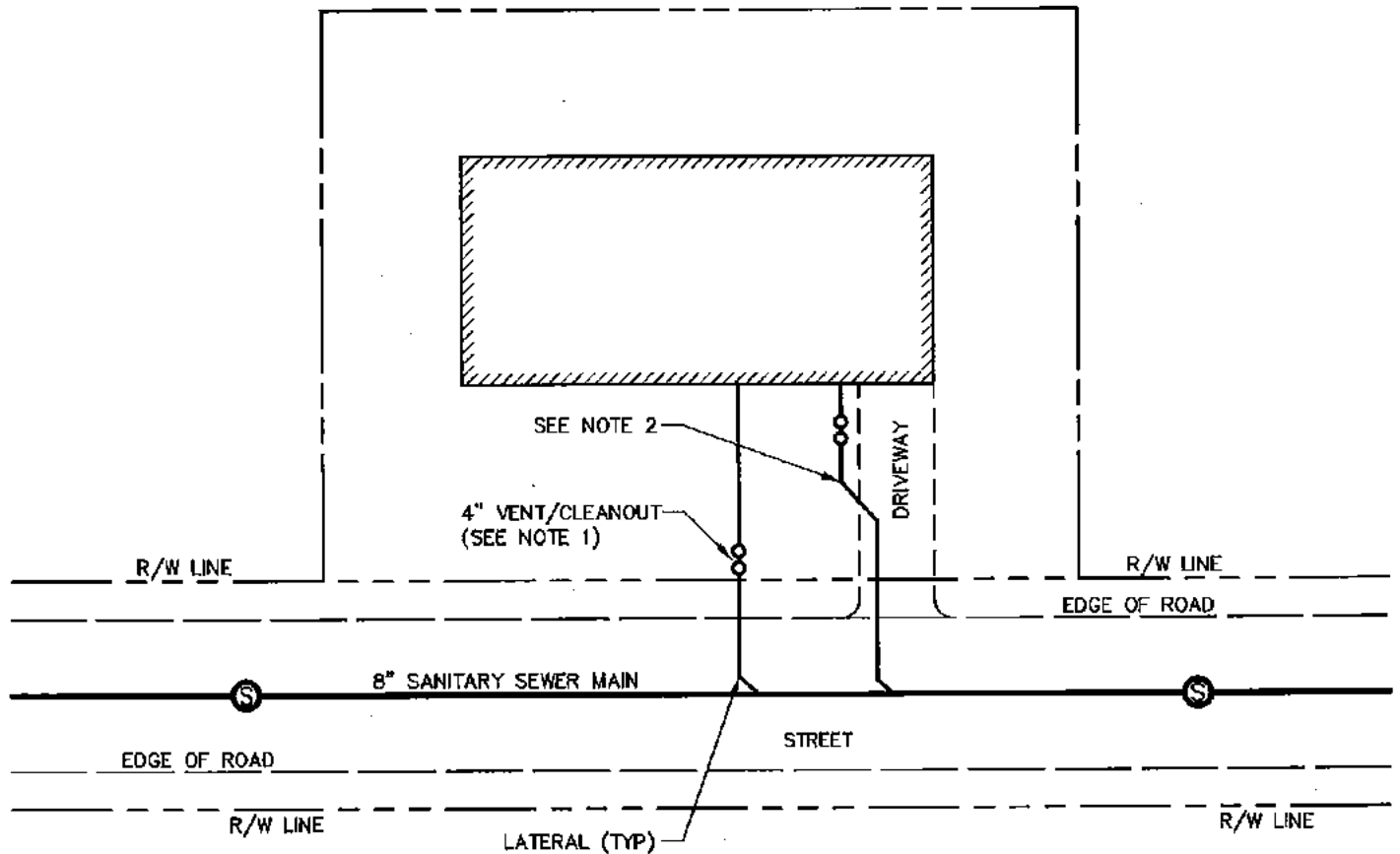


REVISIONS	DUAL SANITARY SEWER LATERAL	PROJECT NO.
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	ADAM00-08
	HANDOVER ENGINEERING <small>ASSOCIATES, INC.</small>	SHEET NO. 10

200 SNYDER LANE
 EPHRATA, PA 17522-9101
 (717) 721-7444



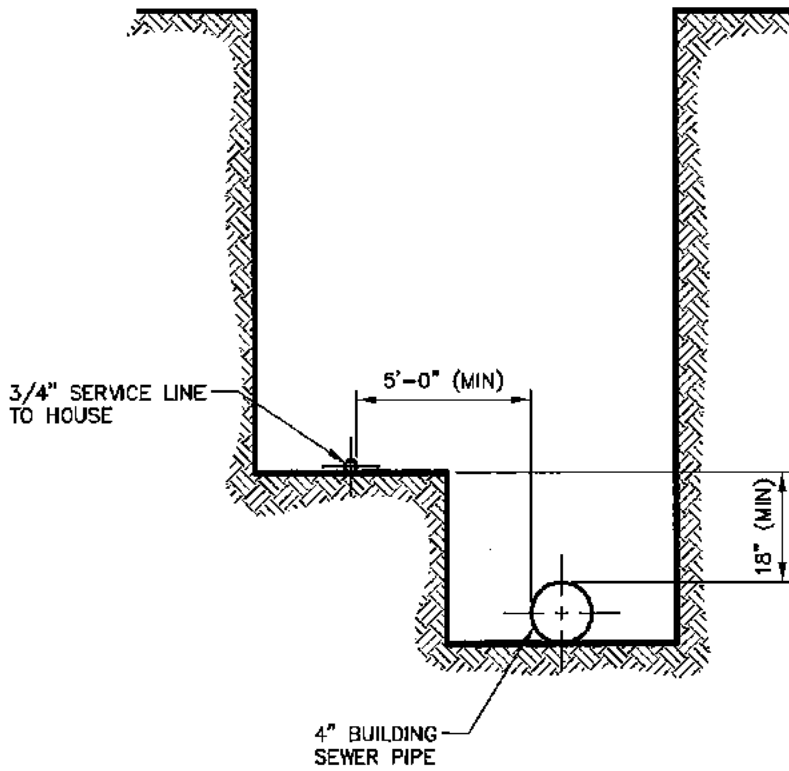
REVISIONS	SANITARY SEWER SERVICE CONNECTION - BORE	PROJECT NO.
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	ADAM00-08
	HANDOVER ENGINEERING ASSOCIATES, INC.	SHEET NO. 11
	200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444	



NOTES:

1. ALL VENTS AND CLEANOUTS SHALL BE LOCATED IN THE YARD AREA AND NOT IN THE DRIVEWAY.
2. IF SEWER LATERAL IS LOCATED UNDER DRIVEWAY, ADD FITTINGS AND PIPE AS REQUIRED TO LOCATE VENTS AND CLEANOUT IN YARD AREA.
3. VENTS AND CLEANOUTS SHALL BE A MIN. OF 6" ABOVE FINISHED GRADE.

REVISIONS	SERVICE LATERAL LOCATION	PROJECT NO.
02.01.05	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	ADAM00-08
		SHEET NO.
		12
		HANDOVER ENGINEERING
		200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444
	<small>ASSOCIATES, INC.</small>	



REVISIONS

02.01.05

TYPICAL TRENCH FOR WATER & SEWER SERVICE CONNECTION

**STANDARD SPECIFICATIONS
FOR
ADAMSTOWN BOROUGH**

PROJECT NO.

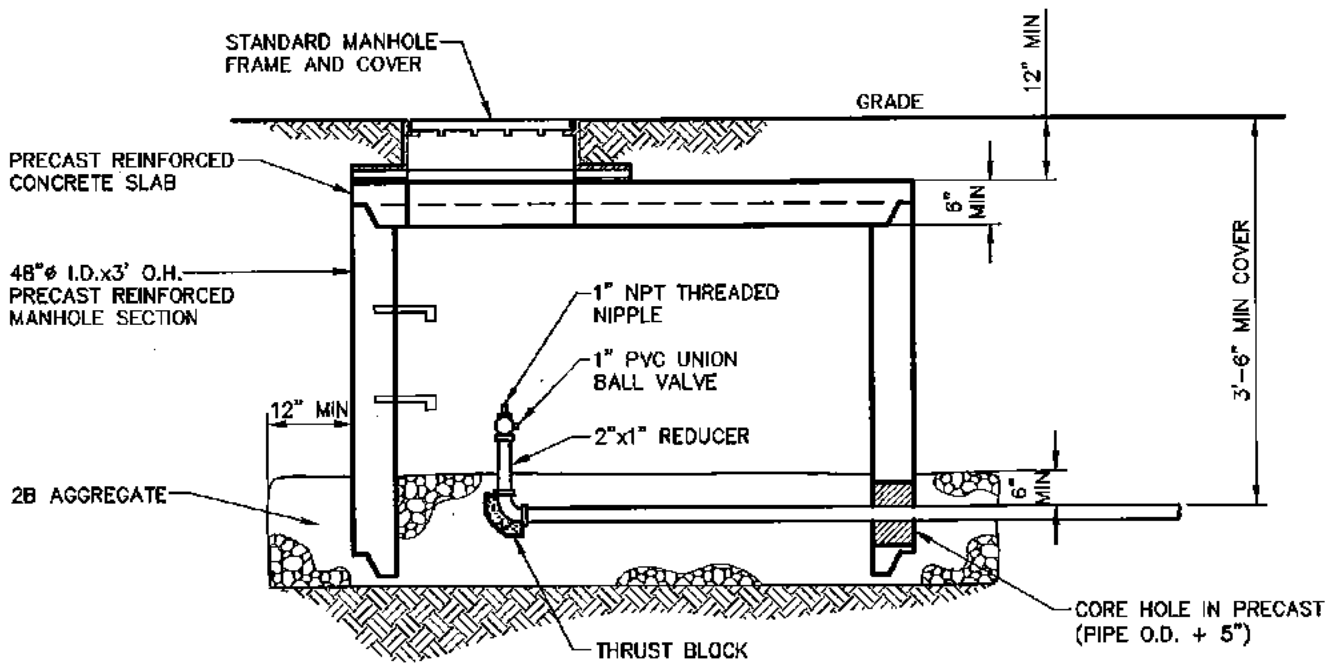
ADAM00-08

SHEET NO.

12A

HANDOVER ENGINEERING
ASSOCIATES, INC.

200 SNYDER LANE
EPHRATA, PA 17522-9101
(717) 721-7444

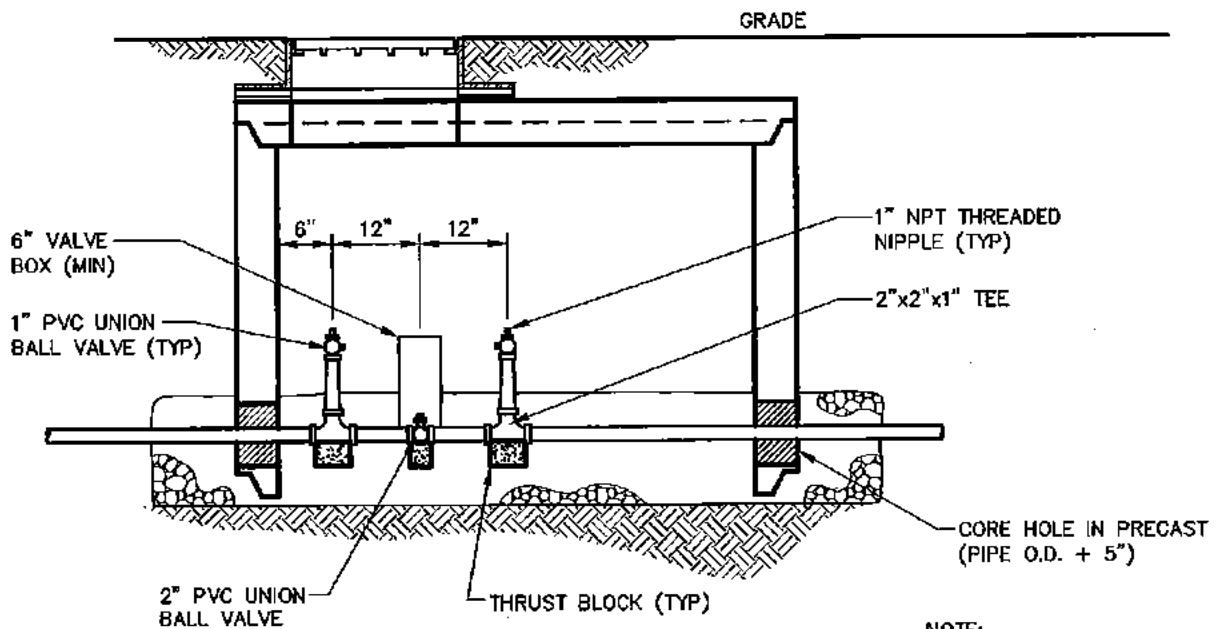


NOTES:

1. CONSTRUCTION SHALL CONFORM TO SHALLOW MANHOLE DETAILS EXCEPT AS NOTED.
2. KEEP VALVES UNDER MANHOLE COVER FOR EASY ACCESS.

TERMINAL CLEANOUT

NOT TO SCALE

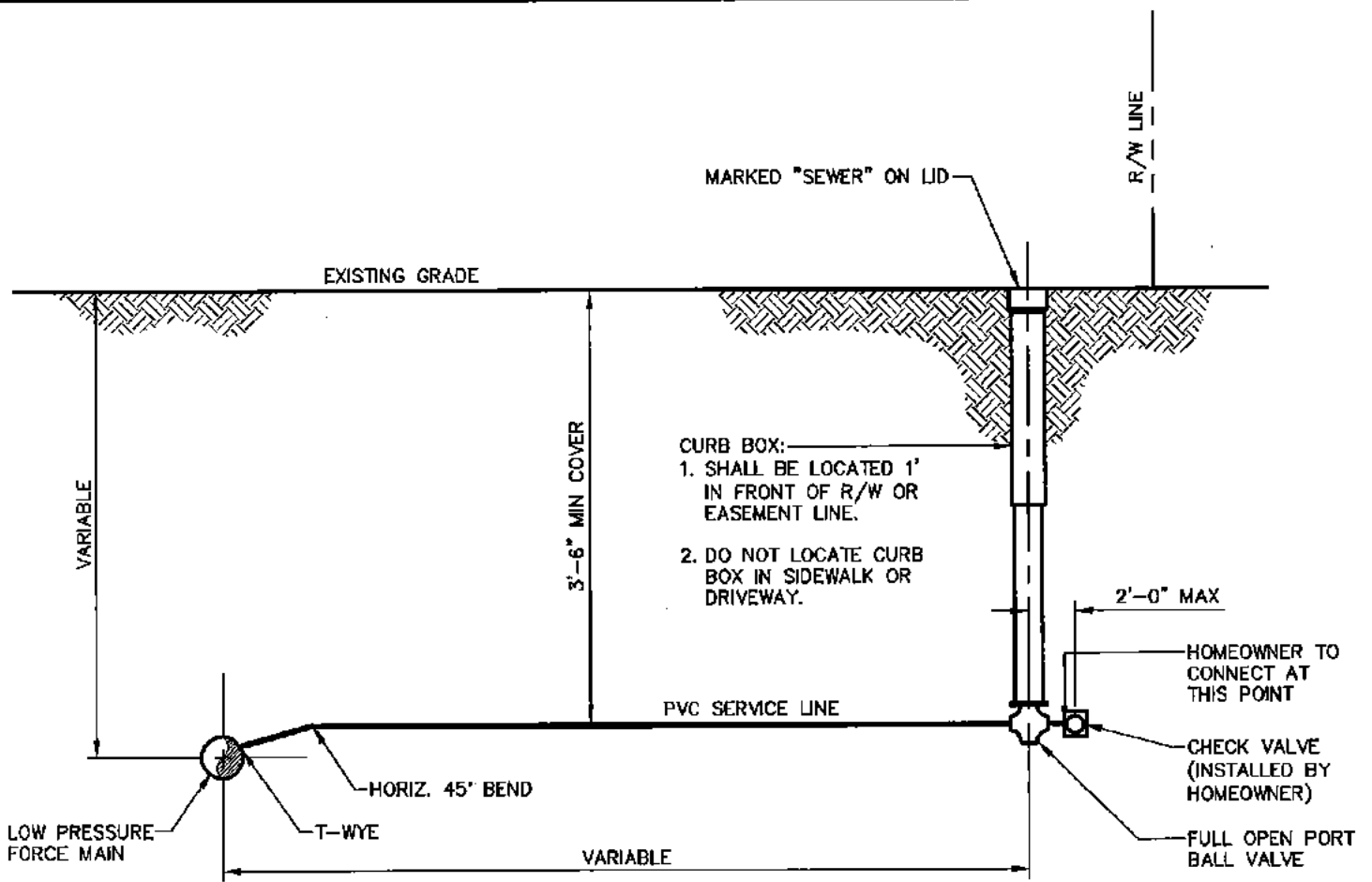


IN-LINE CLEANOUT

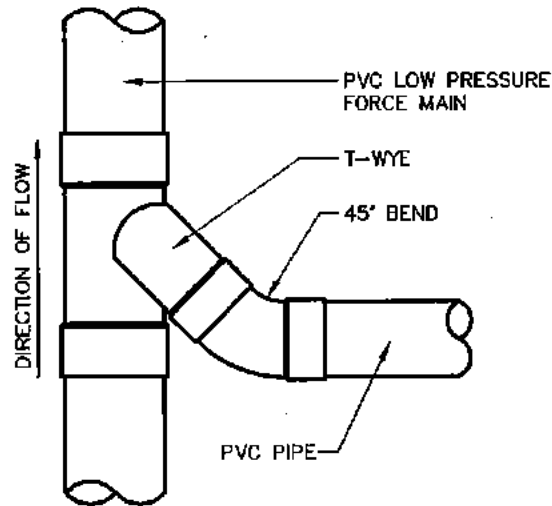
NOT TO SCALE

NOTE:
MANHOLE DETAILS SAME AS TERMINAL CLEANOUT

REVISIONS	LOW PRESSURE FORCE MAIN CLEANOUT	PROJECT NO.
	STANDARD SPECIFICATIONS FOR	ADAM00-08
	ADAMSTOWN BOROUGH	SHEET NO.
HANDOVER ENGINEERING ASSOCIATES, INC.		13
<small>200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444</small>		

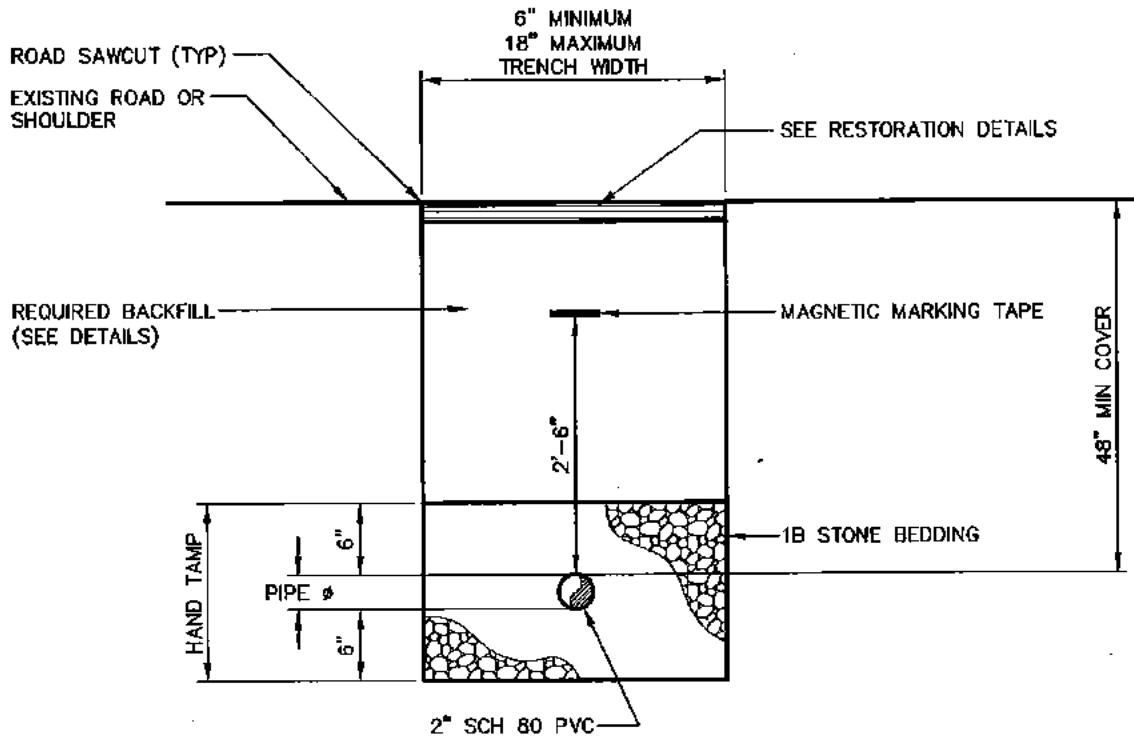


PROFILE

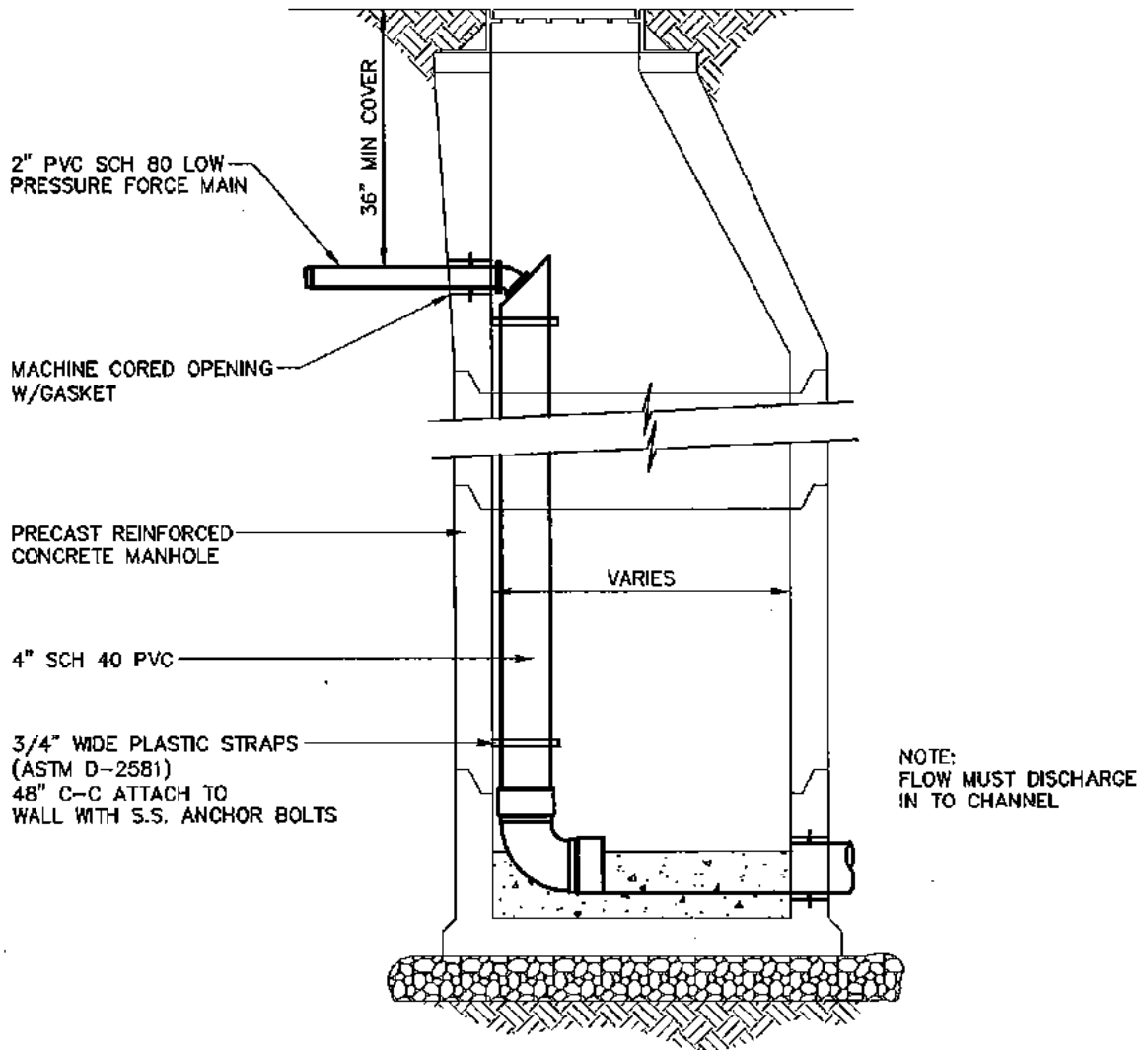


PLAN VIEW

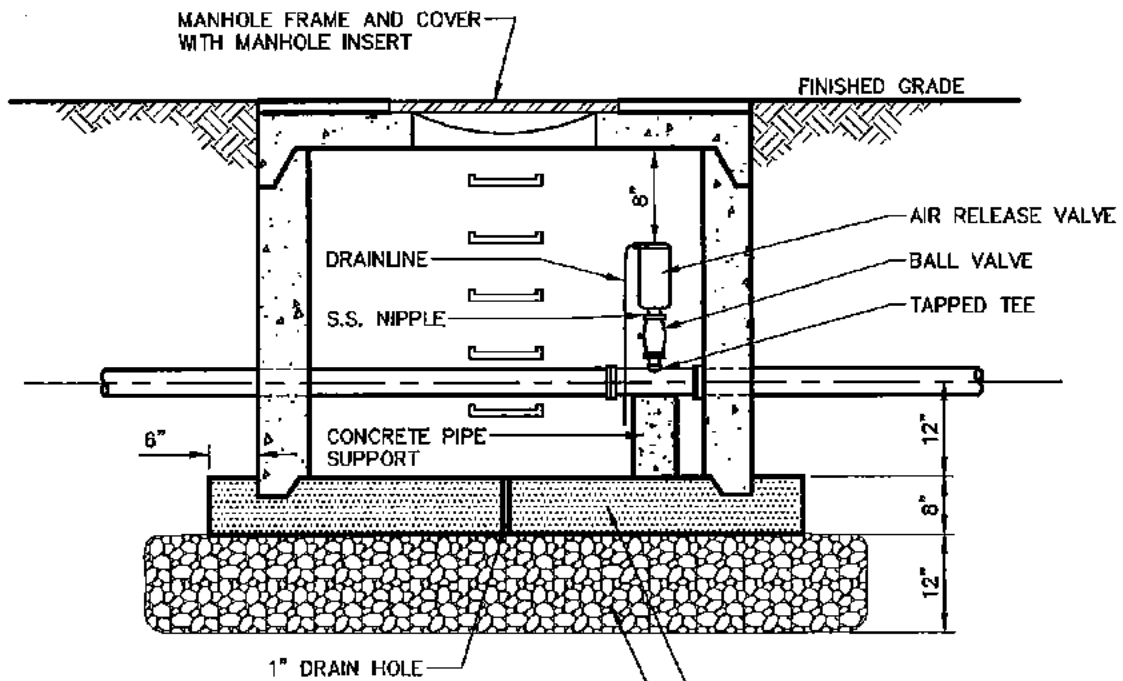
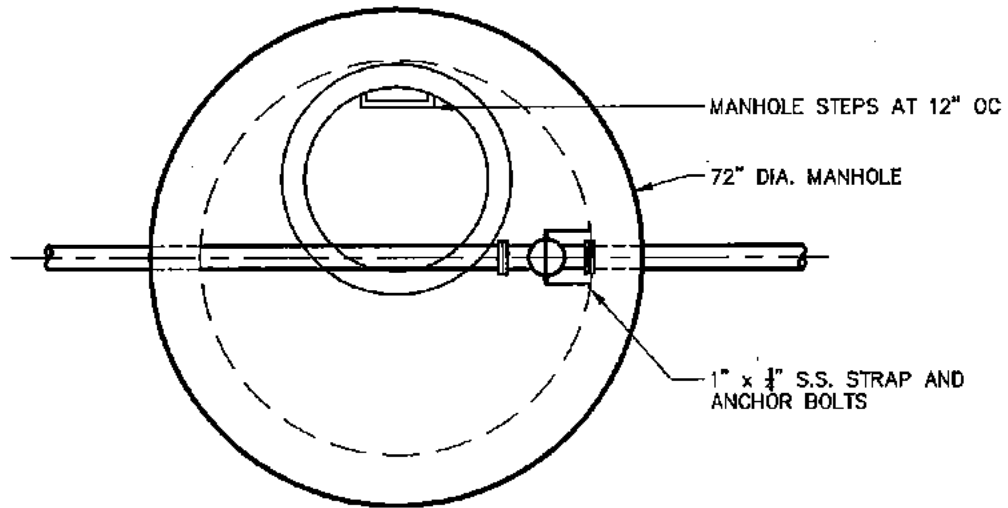
REVISIONS 	LATERAL CONNECTION - LOW PRESSURE	PROJECT NO. ADAM00-08
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	SHEET NO. 14
	HANDOVER ENGINEERING ASSOCIATES, INC.	200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444



REVISIONS	LOW PRESSURE SEWER TRENCH	PROJECT NO.
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	ADAM00-08
	HANDOVER ENGINEERING ASSOCIATES, INC.	SHEET NO.
	200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444	15



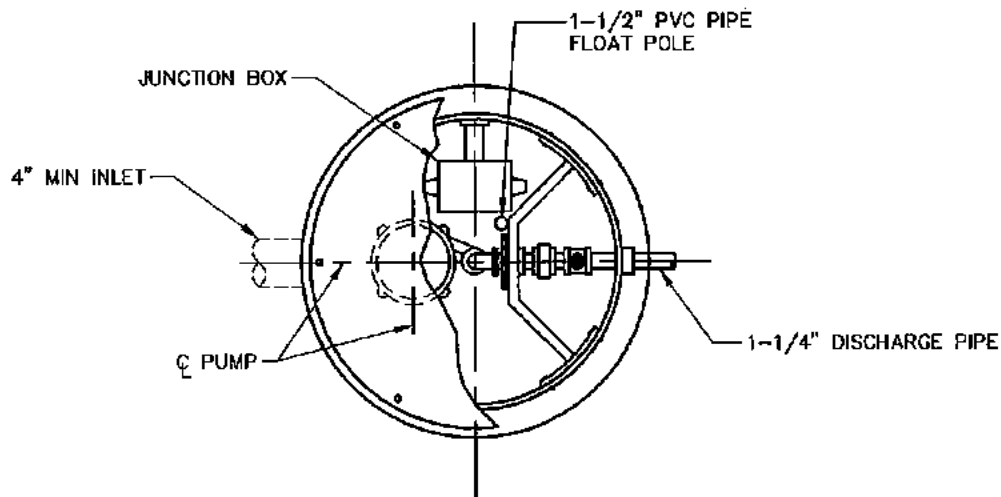
REVISIONS	DROP MANHOLE CONNECTION - LOW PRESSURE FORCE MAIN	PROJECT NO.
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	ADAM00-08
		SHEET NO. 16
HANDOVER ENGINEERING ASSOCIATES, INC.		200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444



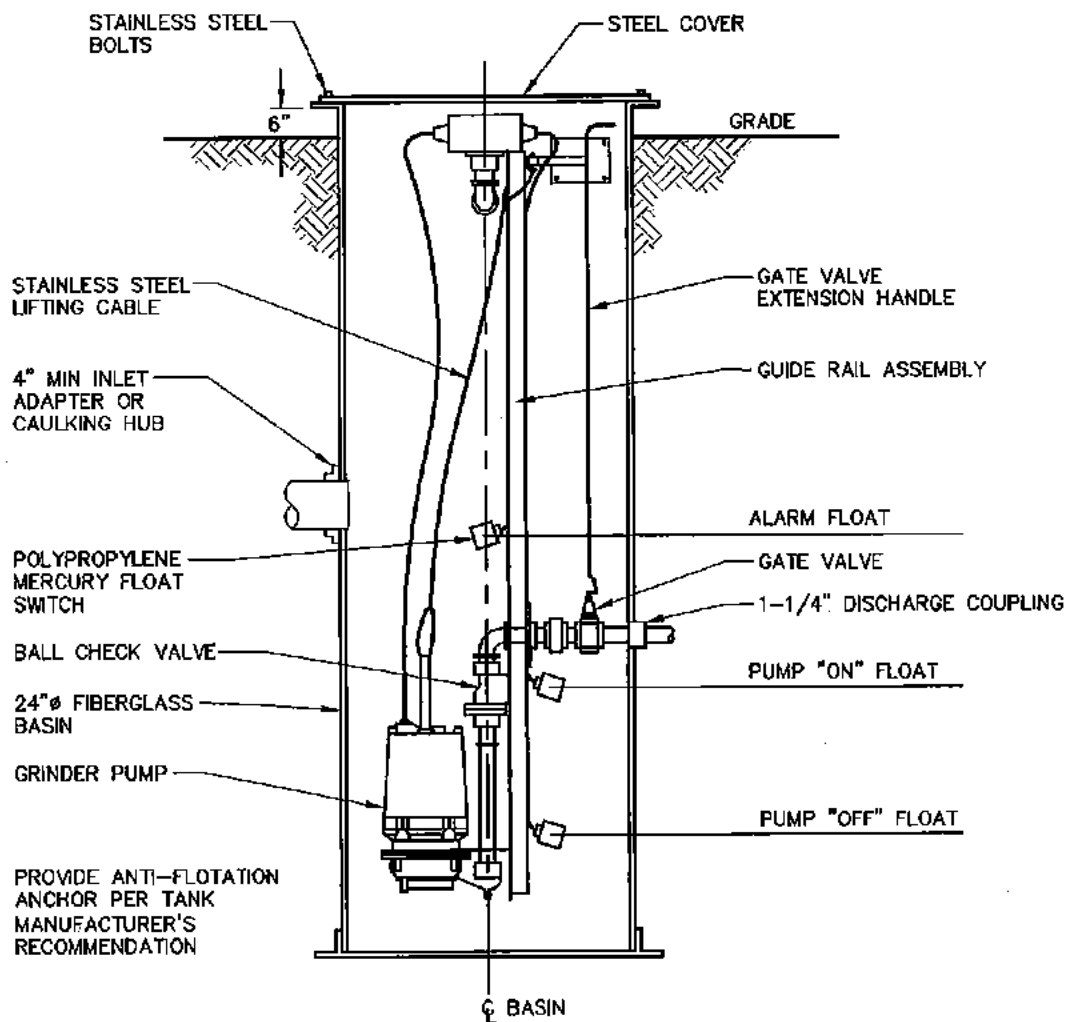
NOTES:

1. MANHOLE SECTIONS SHALL BE TONGUE AND GROOVE WITH DOUBLE RAM-NECK.
2. AFTER MANHOLE IS SET, THE ENTIRE OUTER SURFACE SHALL BE COATED WITH BITUMASTIC.
3. ALL SEWER LINE CONNECTIONS TO MANHOLES SHALL BE MADE USING RUBBER GASKET SEALS.
4. AIR RELEASE VALVE AND TAP SIZE TO BE APPROVED BY ENGINEER.
5. AIR AND VACUUM VALVE TO BE APCO MODEL 481 WITH S.S. FLOATS AND GUIDE.

REVISIONS	WASTEWATER AIR RELEASE VALVE	PROJECT NO.
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	ADAM00-08
	HANDOVER ENGINEERING <small>ASSOCIATES, INC.</small>	SHEET NO. 17
	<small>200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444</small>	



PLAN



SECTION

REVISIONS

SIMPLEX GRINDER PUMP

PROJECT NO.

**STANDARD SPECIFICATIONS
FOR
ADAMSTOWN BOROUGH**

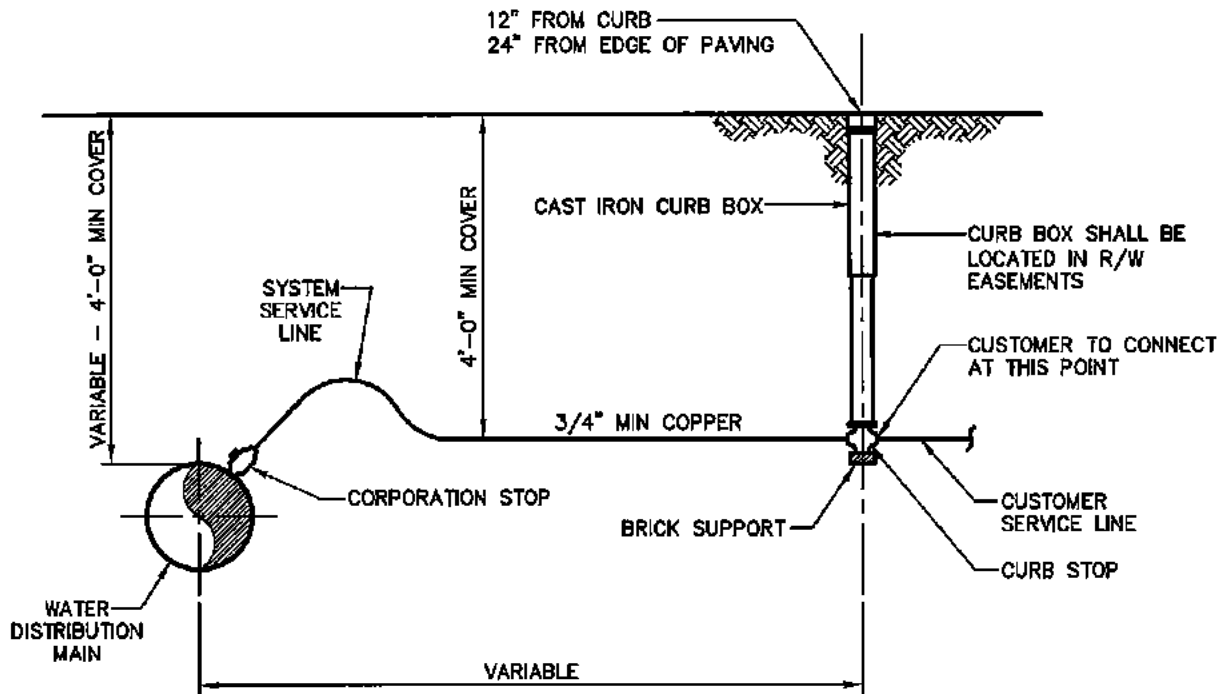
ADAM00-08

SHEET NO.

18

HANDOVER ENGINEERING
ASSOCIATES, INC.

202 SNYDER LANE
EPHRATA, PA 17522-9101
(717) 721-7444

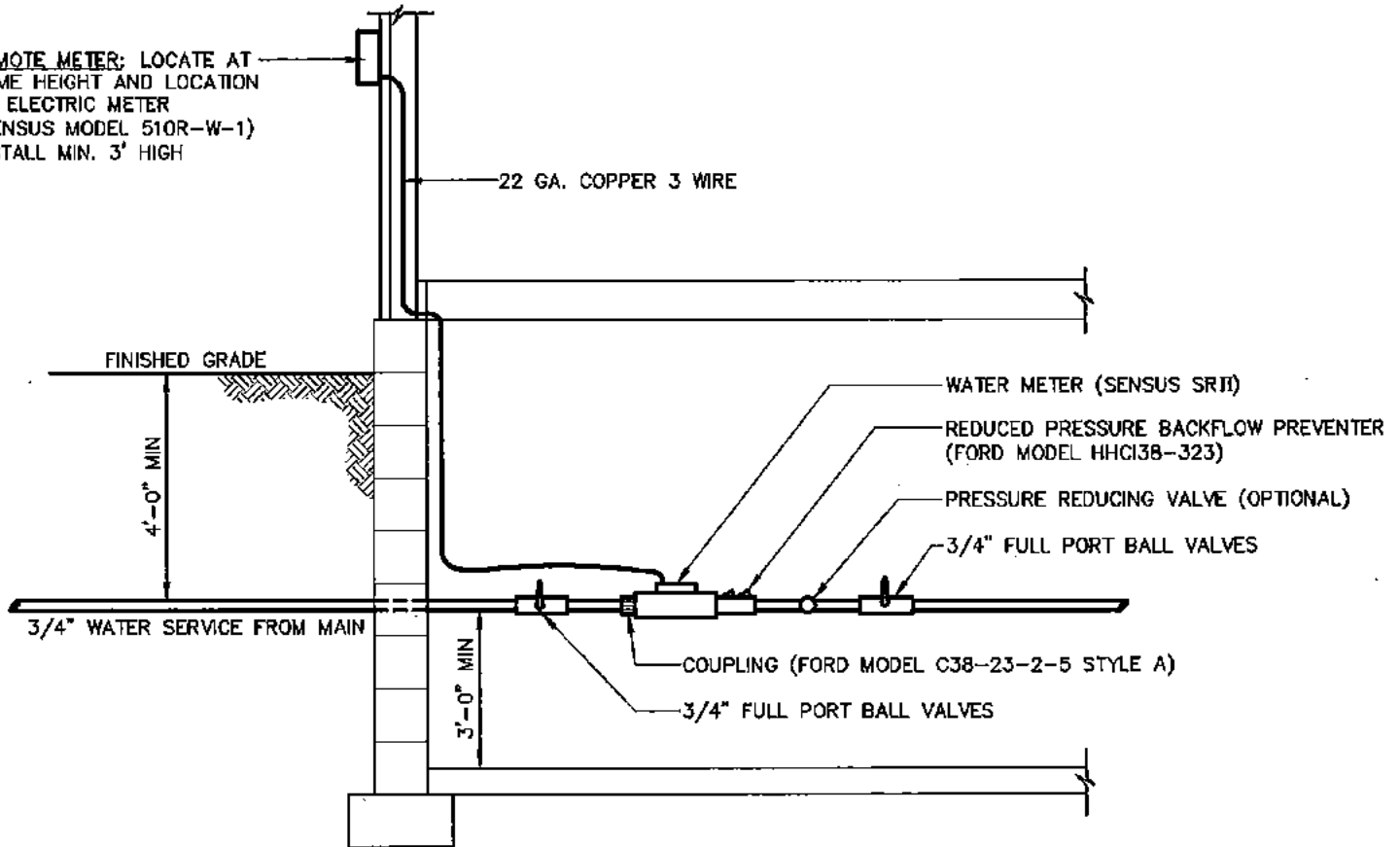


NOTES:

1. CORPORATION STOP SHALL BE TAPERED THREAD AT CONNECTION TO MAIN. ALL OTHER COPPER TUBING CONNECTIONS SHALL BE COMPRESSION FITTINGS.
2. SERVICE TO BE BEDDED IN CLEAN SOIL OR QUARTZITE SAND.
3. DO NOT LOCATE CURB BOX IN SIDEWALK OR DRIVEWAY.
4. SEE SECTION 15200 OF THE STANDARD SPECIFICATIONS AND ITS AMENDMENTS.

REVISIONS	WATERLINE SERVICE CONNECTION	PROJECT NO.
02.01.05	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	ADAM00-08
		SHEET NO.
		20
	HANDVER ENGINEERING ASSOCIATES, INC. 200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444	

REMOTE METER: LOCATE AT
SAME HEIGHT AND LOCATION
AS ELECTRIC METER
(SENSUS MODEL 510R-W-1)
INSTALL MIN. 3' HIGH



NOTES:

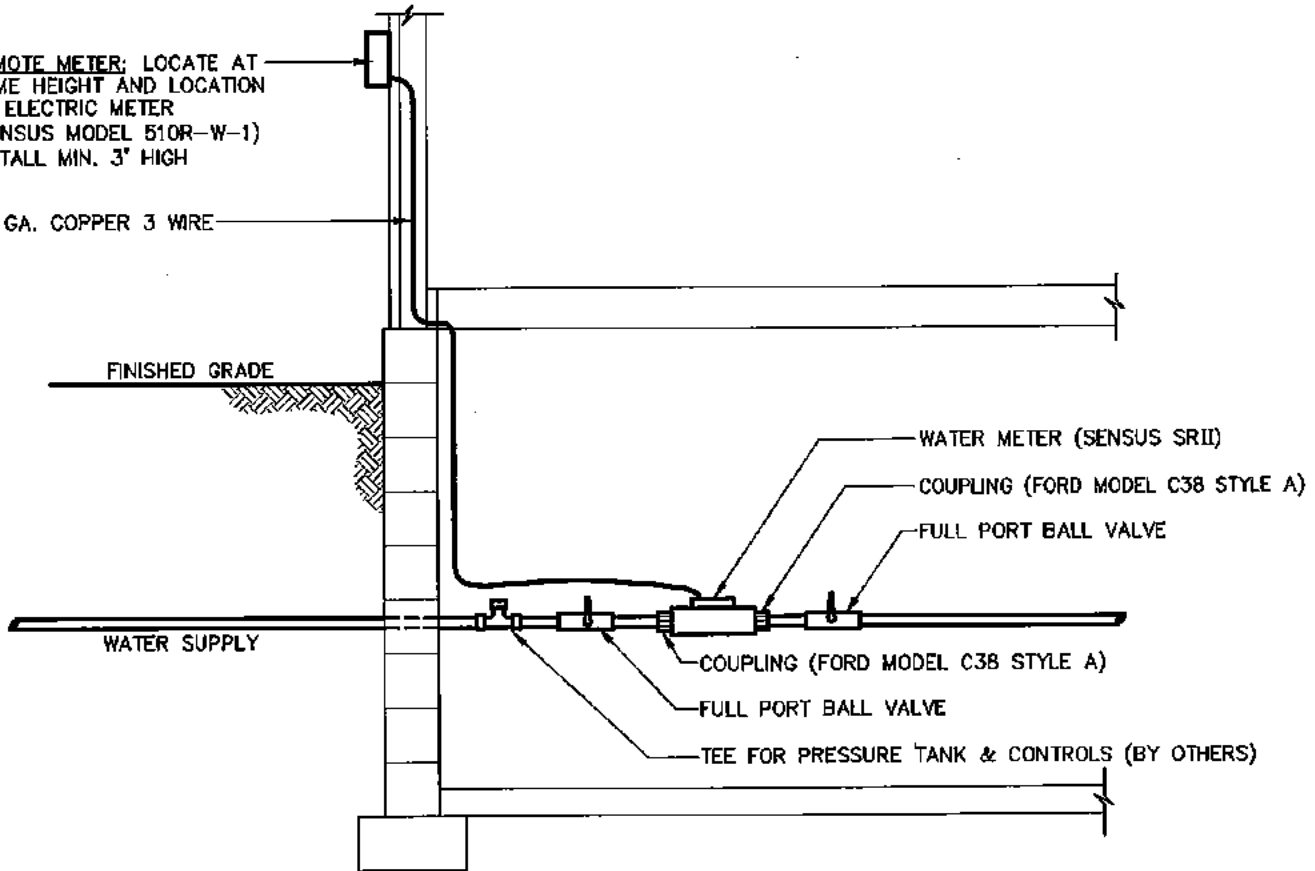
1. NO TAPS OR CONNECTIONS PRIOR TO THE WATER METER.
2. MAXIMUM LENGTH OF SERVICE PRIOR TO METER IS 100 FEET.
3. SUPPORT METER TO PREVENT STRESS ON SERVICE LINE.
4. DO NOT USE WATER LINE FOR ELECTRICAL SYSTEM GROUNDING.
5. POSITION METER HORIZONTALLY.
6. WATER METER, FORD COUPLING, BACKFLOW PREVENTER AND RADIO READ UNIT ARE SUPPLIED BY ADAMSTOWN BOROUGH. THE PROPERTY OWNER IS RESPONSIBLE FOR FURNISHING AND INSTALLING THE WIRE AND ALL ITEMS FURNISHED BY THE BOROUGH.
7. EXTERIOR METER BOXES SHALL ONLY BE PERMITTED BY THE BOROUGH WHEN THERE ARE NO ALTERNATIVES TO A PROTECTED INTERIOR METER. EXTERIOR METER PITS TO BE APPROVED BY THE BOROUGH FOR DESIGN AND LOCATION.
8. INTERIOR METER LOCATION TO REMAIN ACCESSIBLE FOR SERVICING WITHOUT REMOVAL OF EQUIPMENT, STORAGE MATERIALS, PANELS, OR USE OF TOOLS.
9. TWO INSPECTIONS REQUIRED. SERVICE LINE INSPECTED PRIOR TO BACKFILL. METER TO BE INSPECTED AND SEALED PRIOR TO USE.
10. ALL PRESSURE REDUCING VALVES SHALL BE INSTALLED DOWNSTREAM FROM THE WATER METER. THE PROPERTY OWNER IS RESPONSIBLE FOR DETERMINING IF A PRESSURE REDUCING VALVE IS NECESSARY AND IS RESPONSIBLE FOR ALL ASPECTS OF SELECTION AND INSTALLATION OF A PRESSURE REDUCING VALVE.

REVISIONS 02.01.05 04.13.05 07.28.09	WATER METER INSTALLATION	PROJECT NO. ADAM00-08
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	SHEET NO. 21
	HANOVER ENGINEERING ASSOCIATES, INC.	

200 SNYDER LANE
EPHRATA, PA 17522-9101
(717) 721-7444

REMOTE METER: LOCATE AT
SAME HEIGHT AND LOCATION
AS ELECTRIC METER
(SENSUS MODEL 510R-W-1)
INSTALL MIN. 3' HIGH

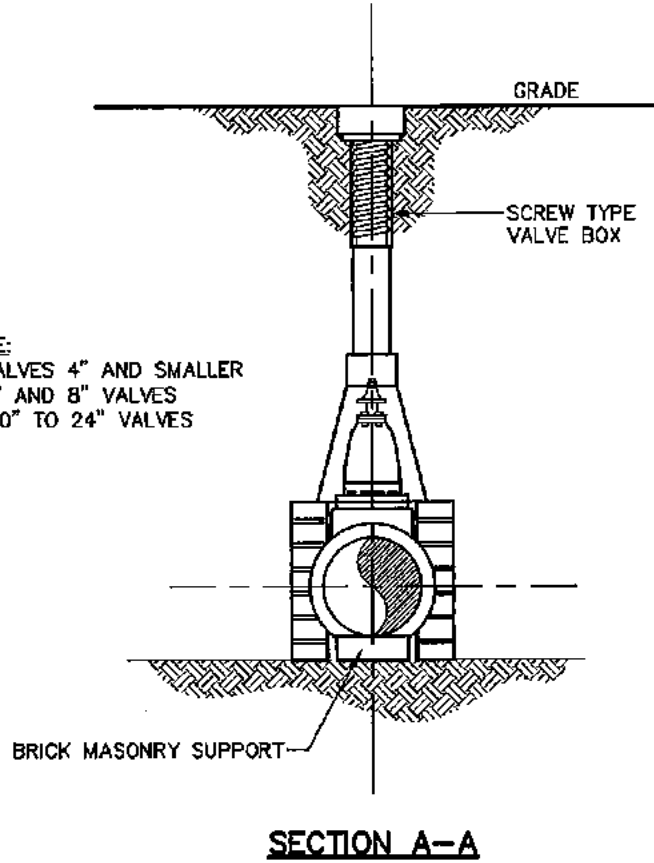
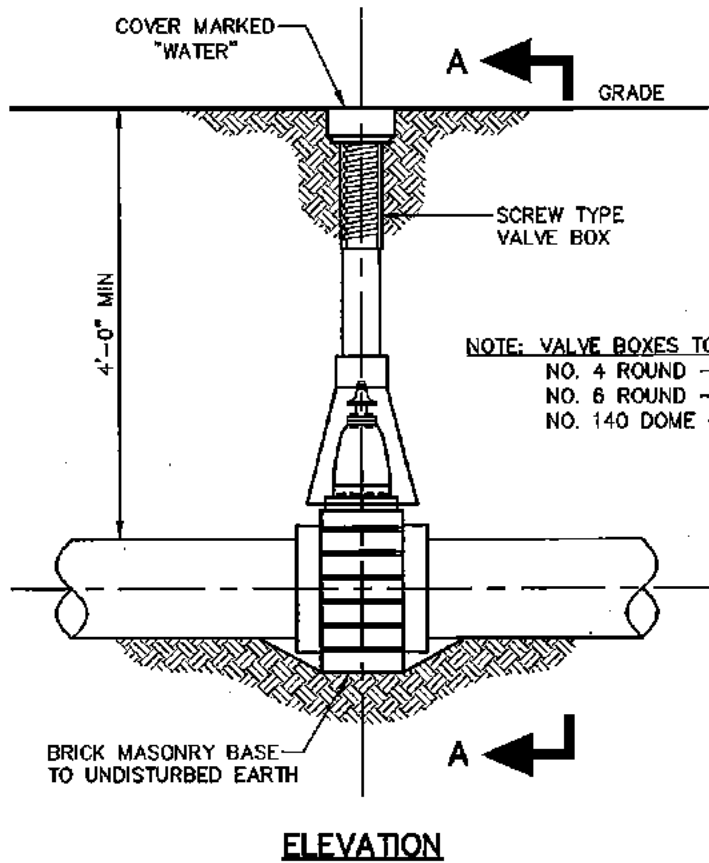
22 GA. COPPER 3 WIRE



NOTES:

1. NO TAPS OR CONNECTIONS PRIOR TO THE WATER METER.
2. WATER METERING EQUIPMENT TO BE INSPECTED AND APPROVED BY ADAMSTOWN BOROUGH PERSONNEL PRIOR TO RELEASE OF SANITARY FLOW TO BOROUGH SYSTEM.
3. SUPPORT METER TO PREVENT STRESS ON SERVICE LINE.
4. DO NOT USE WATER LINE FOR ELECTRICAL SYSTEM GROUNDING.
5. POSITION METER HORIZONTALLY.
6. EXTERIOR METER BOXES SHALL ONLY BE PERMITTED BY THE BOROUGH WHEN THERE ARE NO ALTERNATIVES TO A PROTECTED INTERIOR METER. EXTERIOR METER PITS TO BE APPROVED BY THE BOROUGH FOR DESIGN AND LOCATION.
7. INTERIOR METER LOCATION TO REMAIN ACCESSIBLE FOR SERVICING WITHOUT REMOVAL OF EQUIPMENT, STORAGE MATERIALS, PANELS, OR USE OF TOOLS.
8. PLEASE CONTACT ADAMSTOWN BOROUGH PUBLIC WORKS AT (717) 484-4234 48 HOURS PRIOR TO REQUIRED INSPECTION. METER REMOTE READER TO BE INSPECTED AND SEALED PRIOR TO USE.

REVISIONS	WATER METER INSTALLATION FOR SPRING TOWNSHIP RESIDENTS	PROJECT NO.
02.01.05	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	ADAM00-08
04.13.05		
01.28.09		
	HANOVER ENGINEERING <small>ASSOCIATES, INC.</small>	SHEET NO.
		21A
	<small>20C SNYDER LANE EPHRA1A, PA 17522-9101 (717) 721-7444</small>	



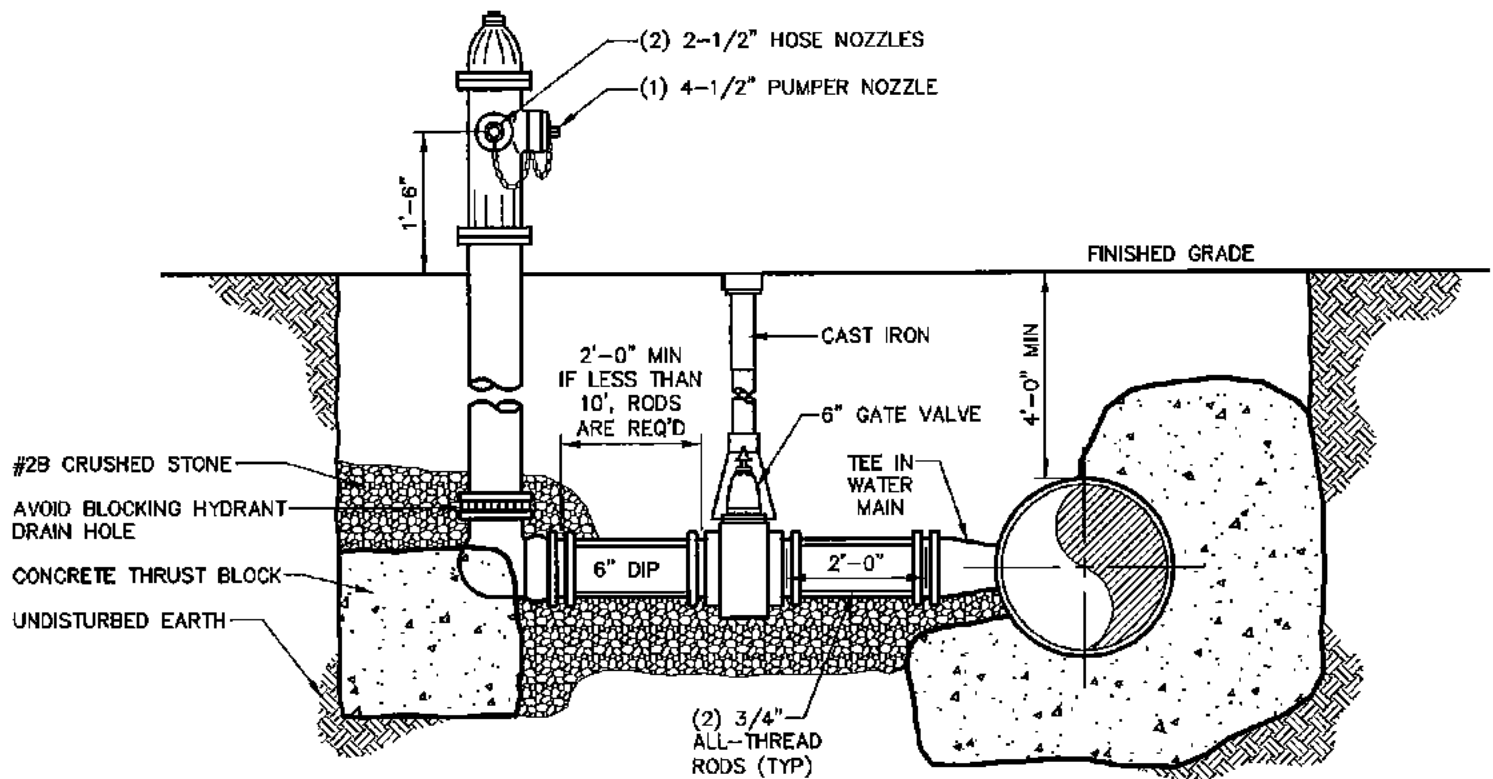
NOTE: VALVE BOXES TO BE:
 NO. 4 ROUND - VALVES 4" AND SMALLER
 NO. 6 ROUND - 6" AND 8" VALVES
 NO. 140 DOME - 10" TO 24" VALVES

NOTE:

1. SEE SECTION 15130 OF THE STANDARD SPECIFICATIONS AND ITS AMENDMENTS.

REVISIONS	GATE VALVE INSTALLATION	PROJECT NO. ADAM00-08
02.01.05 	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	SHEET NO.
	HANOVER ENGINEERING ASSOCIATES, INC.	22

20C SNYDER LANE
 EPHRATA, PA 17522-9101
 (717) 721-7444

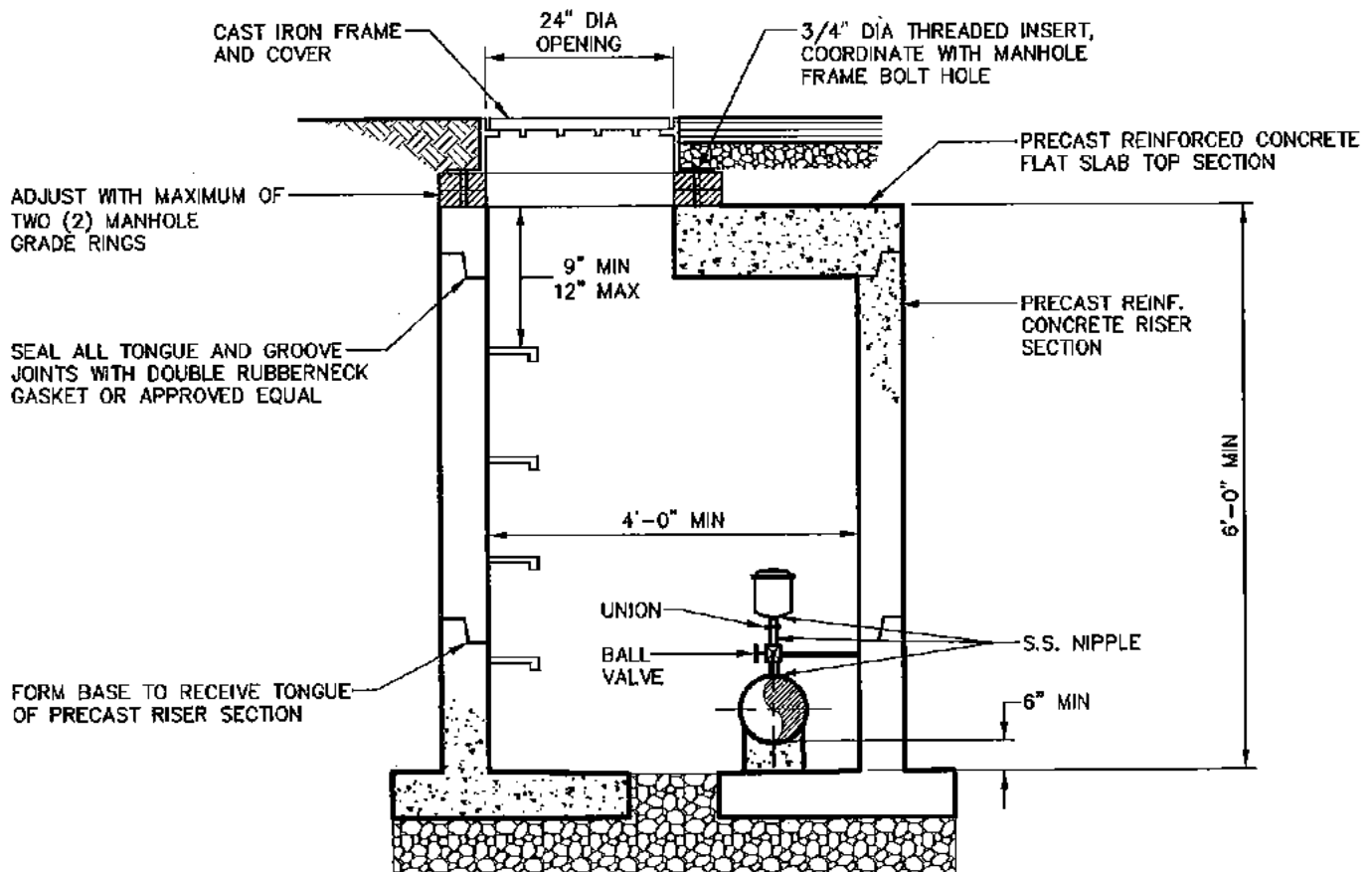
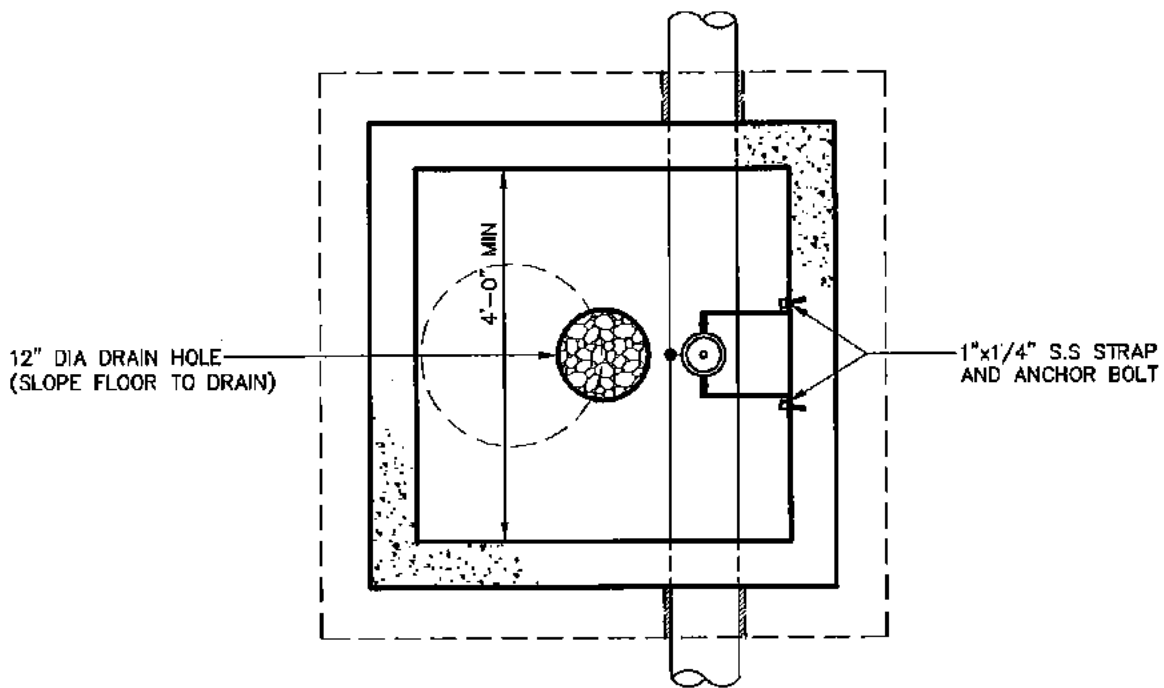


NOTES:

1. HYDRANT USE MAY BE RESTRICTED WITH TIE RODS, CLAMPS, OR RETAINER GLANDS INSTEAD OF CONCRETE REACTION BACKINGS IN A MANNER APPROVED BY THE AUTHORITY.
2. FIRE HYDRANT SHALL BE LOCATED 2.5' BEHIND THE FACE OF CURB WHERE ESTABLISHED. OTHERWISE, FIRE HYDRANT SHALL BE LOCATED 2.5' FROM THE EDGE OF ROAD R/W.
3. NO PART OF HYDRANT SHALL PROJECT BEYOND THE FACE OF CURB.
4. SEE SECTION 15180 OF THE STANDARD SPECIFICATIONS AND ITS AMENDMENTS.

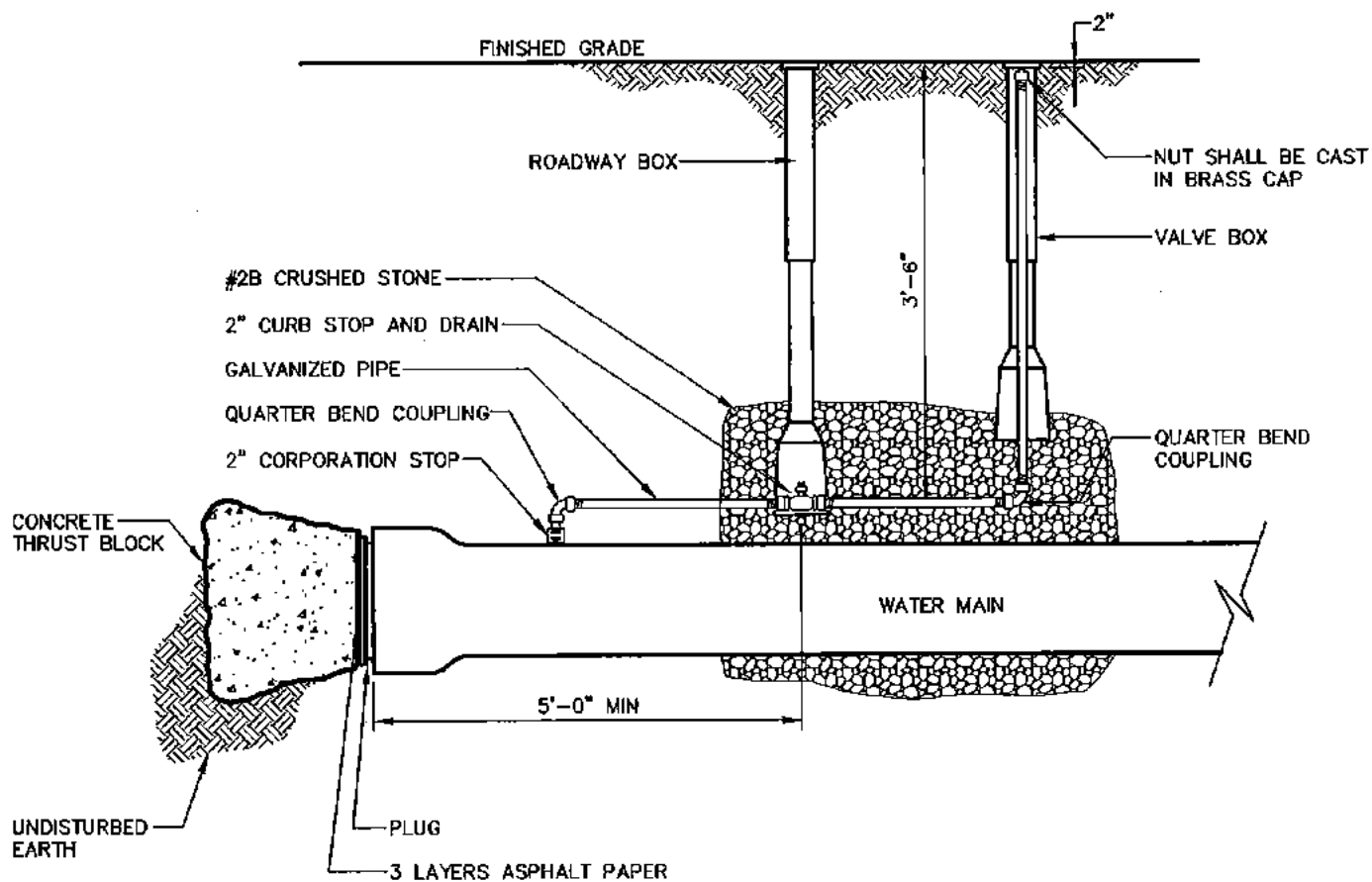
DESIGN PRESSURE	PIPE DIAMETER	REACTION BACKING DIMENSIONS						
		A	B	C	D	E	F	
150 PSI	16	5'-6"	7'-9"	4'-2"	2'-2"	—	3'-4"	
	12	4'-2"	5'-11"	3'-3"	1'-8"	—	2'-6"	
	8	3'-0"	4'-3"	2'-4"	1'-2"	—	1'-8"	
	6	2'-2"	3'-4"	1'-10"	0'-11"	—	1'-3"	
200 PSI	16	7'-3"	10'-3"	5'-7"	2'-10"	1'-6"	3'-4"	
	12	5'-7"	7'-11"	4'-3"	2'-2"	1'-2"	2'-6"	
	8	4'-0"	5'-7"	3'-1"	1'-7"	0'-10"	1'-8"	
250 PSI	6	3'-1"	4'-5"	2'-5"	1'-3"	0'-8"	1'-3"	
	16	7'-5"	10'-6"	5'-8"	3'-7"	1'-10"	3'-4"	
	12	5'-1"	7'-2"	5'-4"	2'-9"	1'-5"	2'-8"	
	8	2'-11"	4'-2"	3'-10"	2'-0"	1'-0"	1'-8"	
		6	1'-8"	2'-4"	3'-0"	1'-8"	0'-10"	1'-3"

REVISIONS	FIRE HYDRANT	PROJECT NO.
02.01.05	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	ADAM00-08
		SHEET NO.
		23
HANOVER ENGINEERING <small>ASSOCIATES, INC.</small>		
<small>20C SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444</small>		



NOTE:
1. USE GASKETED PENETRATIONS
THROUGH MANHOLE WALL.

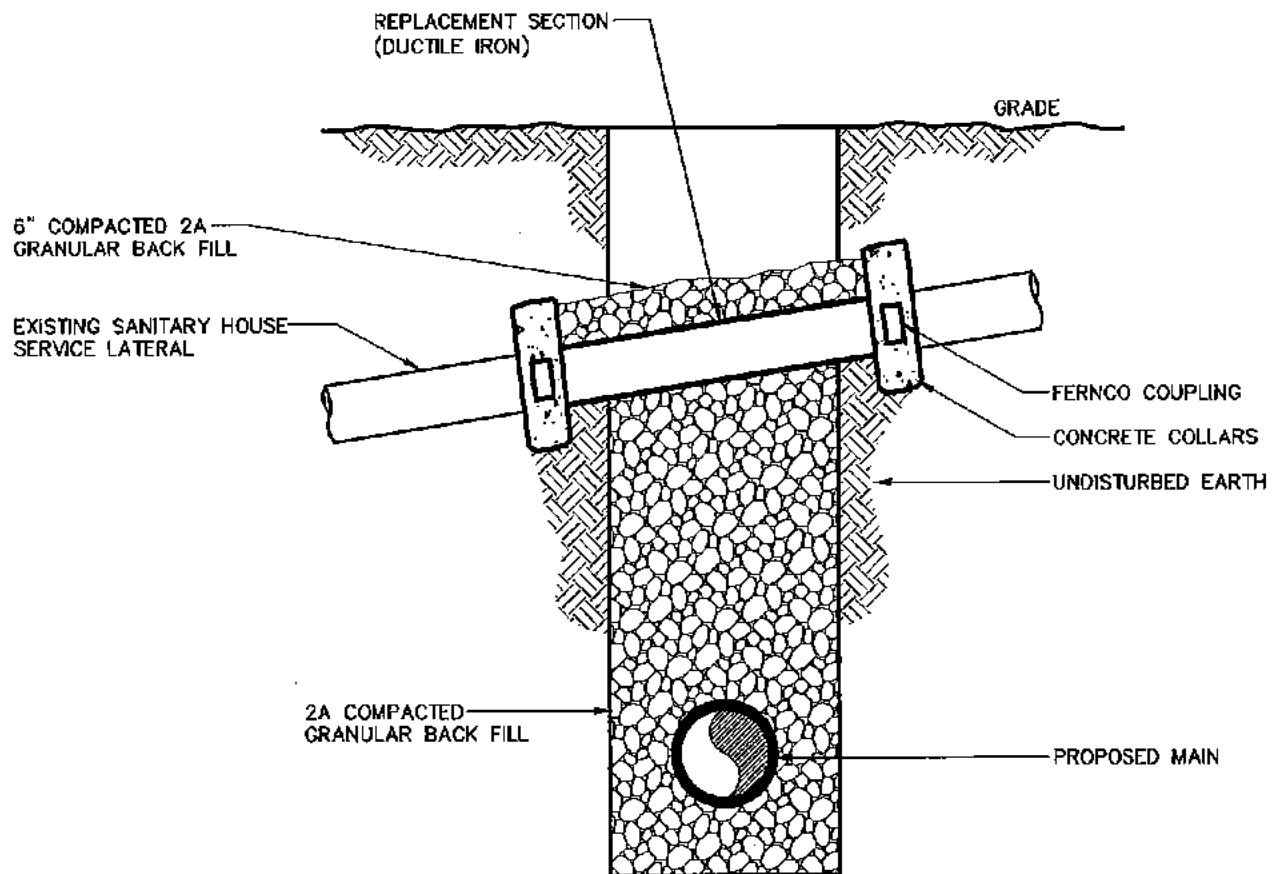
REVISIONS	WATERLINE AIR RELEASE VALVE MANHOLE	PROJECT NO.
	STANDARD SPECIFICATIONS FOR	ADAM00-08
	ADAMSTOWN BOROUGH	SHEET NO.
	HANOVER ENGINEERING ASSOCIATES, INC.	24
	20C SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444	



DESIGN PRESSURE	PIPE DIAMETER	REACTION BACKING DIMENSIONS						
		A	B	C	D	E	F	
150 PSI	18	5'-6"	7'-9"	4'-2"	2'-2"	—	3'-4"	
	12	4'-2"	5'-11"	3'-3"	1'-8"	—	2'-6"	
	8	3'-0"	4'-3"	2'-4"	1'-2"	—	1'-8"	
	6	2'-2"	3'-4"	1'-10"	0'-11"	—	1'-3"	
200 PSI	16	7'-3"	10'-3"	5'-7"	2'-10"	1'-6"	3'-4"	
	12	5'-7"	7'-11"	4'-3"	2'-2"	1'-2"	2'-6"	
	8	4'-0"	5'-7"	3'-1"	1'-7"	0'-10"	1'-8"	
250 PSI	6	3'-1"	4'-5"	2'-5"	1'-3"	0'-8"	1'-3"	
	16	7'-5"	10'-6"	5'-8"	3'-7"	1'-10"	3'-4"	
	12	5'-1"	7'-2"	5'-4"	2'-9"	1'-5"	2'-8"	
	8	2'-11"	4'-2"	3'-10"	2'-0"	1'-0"	1'-8"	
		6	1'-8"	2'-4"	3'-0"	1'-8"	0'-10"	1'-3"

NOTE:
1. BLOW OFF TO BE LOCATED IN STREET TO ALLOW FOR DRAINAGE.

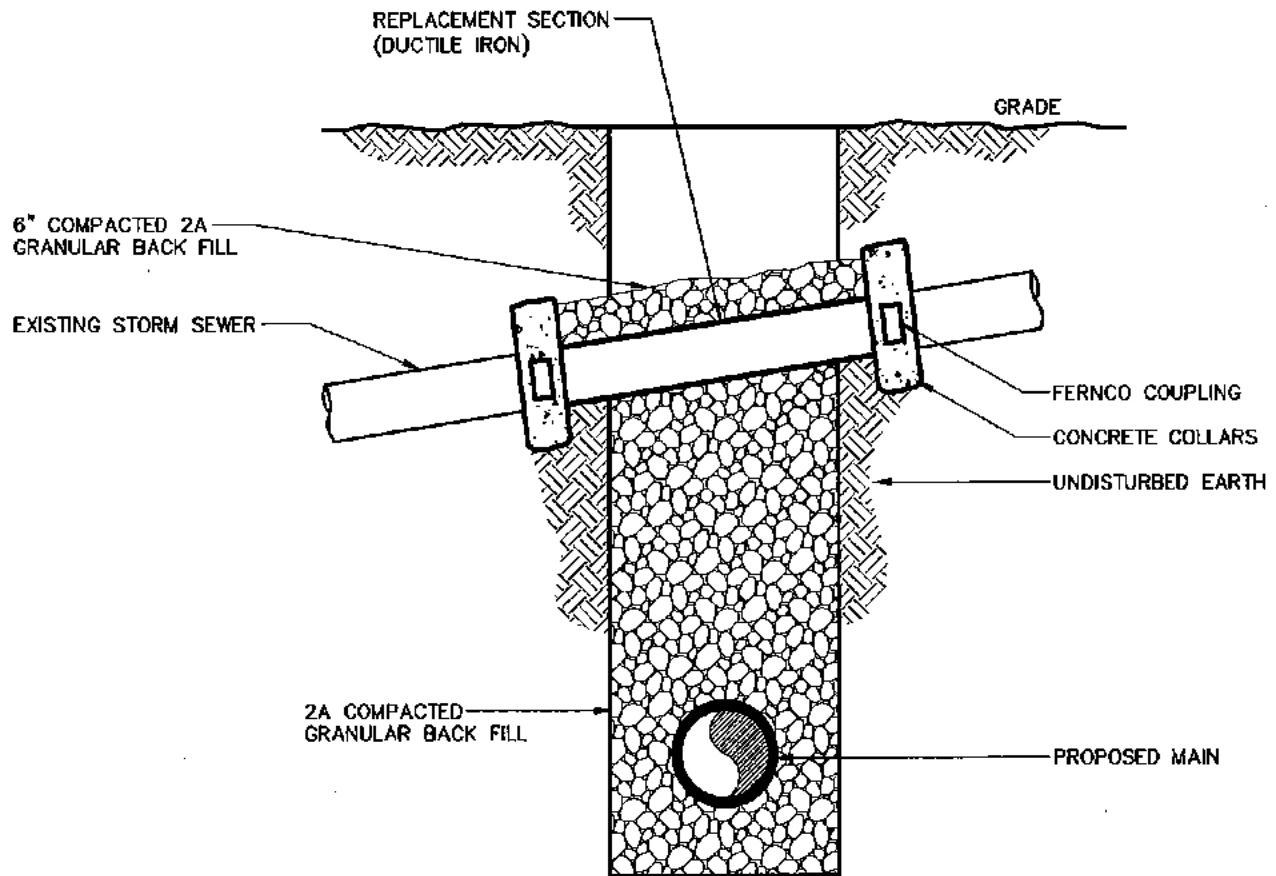
REVISIONS 02.01.05 	WATERLINE BLOWOFF VALVE.	PROJECT NO. ADAM00-08	
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH		
			SHEET NO. 25
	HANDOVER ENGINEERING ASSOCIATES, INC.		200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444



NOTES:

1. IF THE EXISTING SANITARY HOUSE SERVICE IS DAMAGED REMOVED DURING CONSTRUCTION IT SHALL BE REPLACED ACROSS THE TRENCH SUCH THAT THE CONCRETE COLLARS ARE SUPPORTED ON UNDISTURBED EARTH.
2. THE CONCRETE COLLAR SHALL BE FORMED AT A JOINT WITH THE EXISTING HOUSE LATERAL USING FERNCO COUPLINGS.
3. THE REPLACEMENT SECTION SHALL BE CLASS 50 DUCTILE IRON PIPE WITH AN INSIDE DIAMETER EQUAL TO THE EXISTING PIPE. ANSI C151/A21.51 PIPE SHALL BE USED AS A MINIMUM STANDARD.

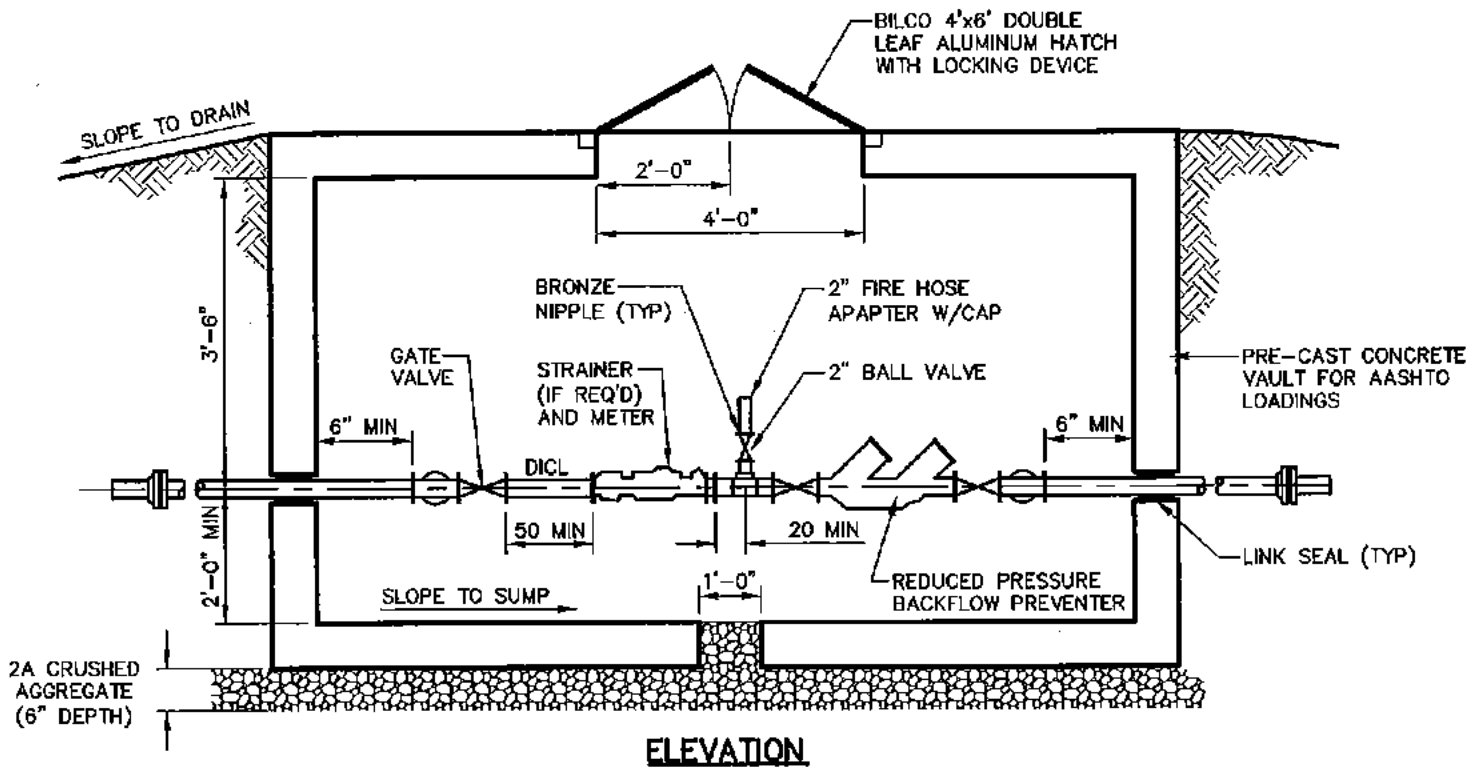
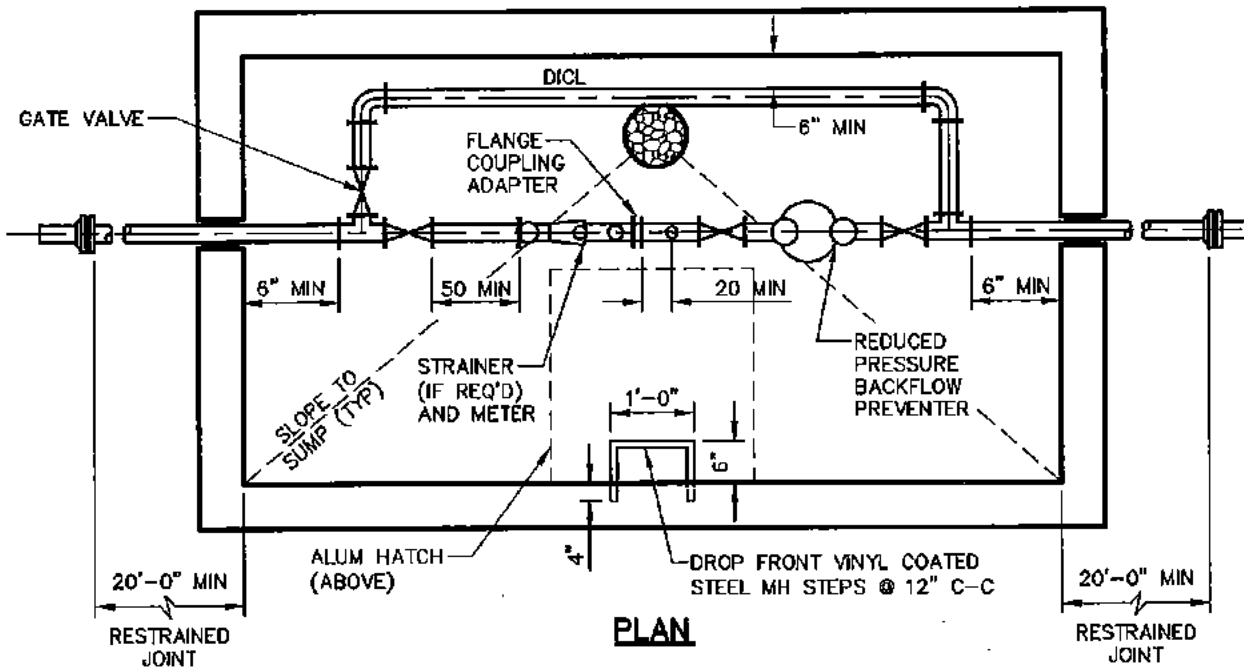
REVISIONS	SANITARY SERVICE REPLACEMENT	PROJECT NO. ADAM00-08
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	SHEET NO. 26
	HANDOVER ENGINEERING ASSOCIATES, INC.	200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444



NOTES:

1. IF THE EXISTING STORM SEWER IS DAMAGED OR REMOVED DURING CONSTRUCTION IT SHALL BE REPLACED ACROSS THE TRENCH SUCH THAT THE CONCRETE COLLARS ARE SUPPORTED ON UNDISTURBED EARTH.
2. THE CONCRETE COLLAR SHALL BE FORMED AT A JOINT WITH THE EXISTING STORM SEWER USING FERNCO COUPLINGS.
3. THE REPLACEMENT SECTION SHALL BE CLASS 50 DUCTILE IRON PIPE WITH AN INSIDE DIAMETER EQUAL TO THE EXISTING PIPE. ANSI C151/A21.51 PIPE SHALL BE USED AS A MINIMUM STANDARD.

REVISIONS	STORM SEWER REPLACEMENT	PROJECT NO.
	STANDARD SPECIFICATIONS	ADAM00-08
	FOR	SHEET NO.
	ADAMSTOWN BOROUGH	27



NOTES:

1. MINIMUM DIMENSIONS SHOWN. DIMENSIONS WILL VARY WITH METER AND PIPE SIZE.
2. VAULT AND HATCH SHALL BE DESIGNED FOR H-20 WHEEL LOADING IN TRAVELED AREAS.

REVISIONS

METER PIT FOR LARGE METERS

PROJECT NO.

**STANDARD SPECIFICATIONS
FOR
ADAMSTOWN BOROUGH**

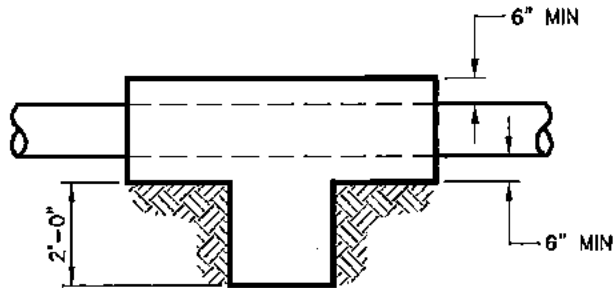
ADAM00-08

SHEET NO.

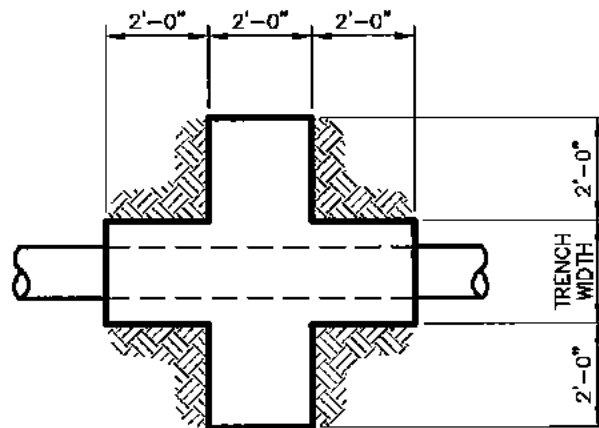
28

HANDOVER ENGINEERING
ASSOCIATES, INC.

200 SNYDER LANE
EPHRATA, PA 17522-9101
(717) 721-7444

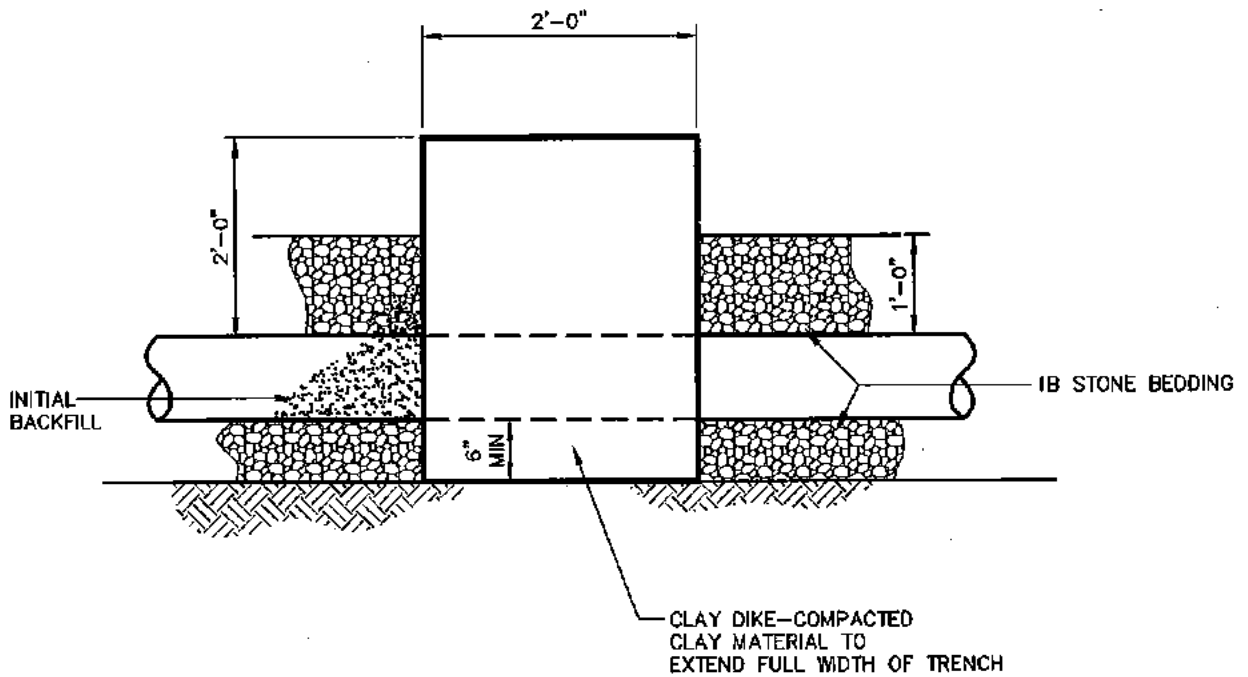


ELEVATION



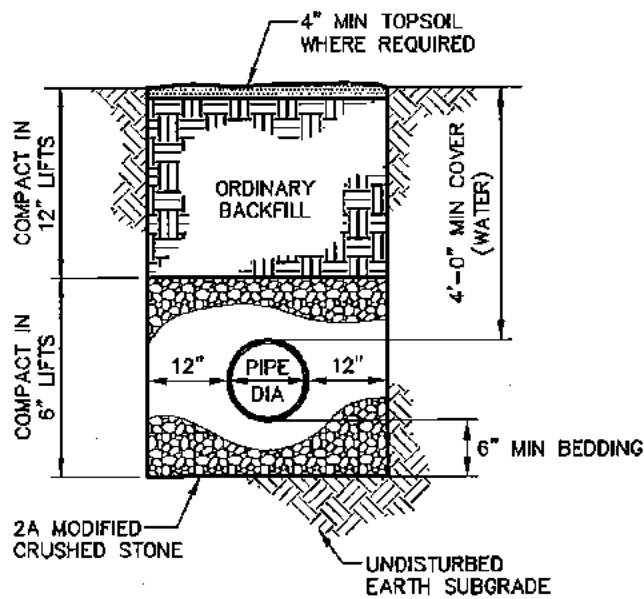
PLAN

REVISIONS 	REINFORCED CONCRETE SLOPE ANCHOR	PROJECT NO. ADAM00-08
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	SHEET NO. 31
	HANDOVER ENGINEERING <small>ASSOCIATES, INC.</small>	<small>20C SNYDER LANE</small> <small>EPHRATA, PA 17522-9101</small> <small>(717) 721-7444</small>

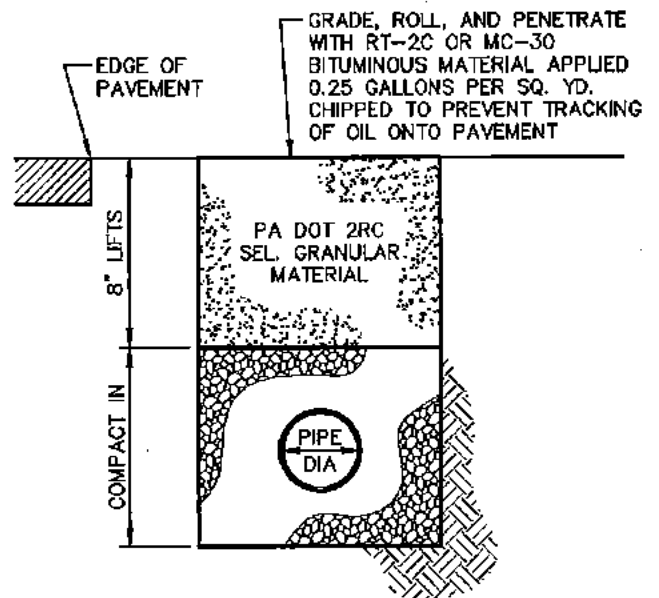


NOTE:
 CLAY DIKE SHALL CONSIST OF CLAY CONTAINING NO MORE THAN 15% (BY VOLUME) STONE NO LARGER THAN TWO (2) INCHES IN DIAMETER. CLAY SHALL BE PLACED IN SIX (6) INCH LIFTS AND COMPACTED BY A MECHANICAL TAMPER TO NOT LESS THAN 95% OF MAXIMUM DENSITY AT OPTIMUM MOISTURE CONTENT.

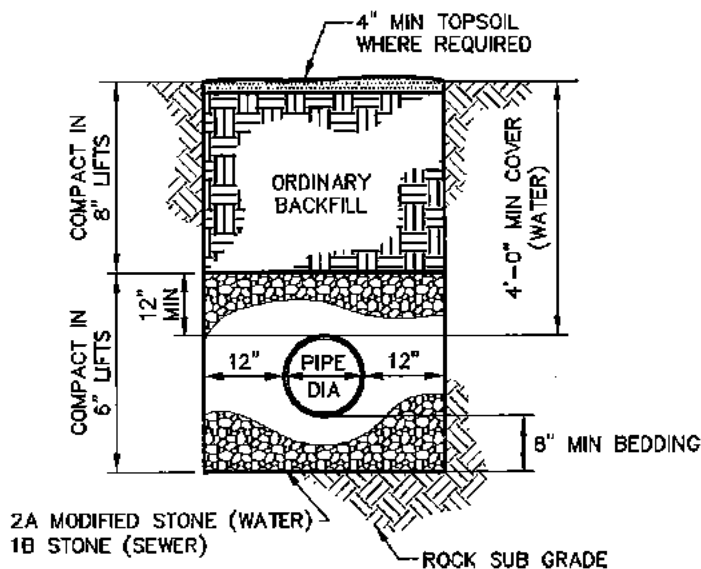
REVISIONS	CLAY DIKE	PROJECT NO.
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	ADAM00-08
		SHEET NO. 32
HANOVER ENGINEERING ASSOCIATES, INC.		200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444



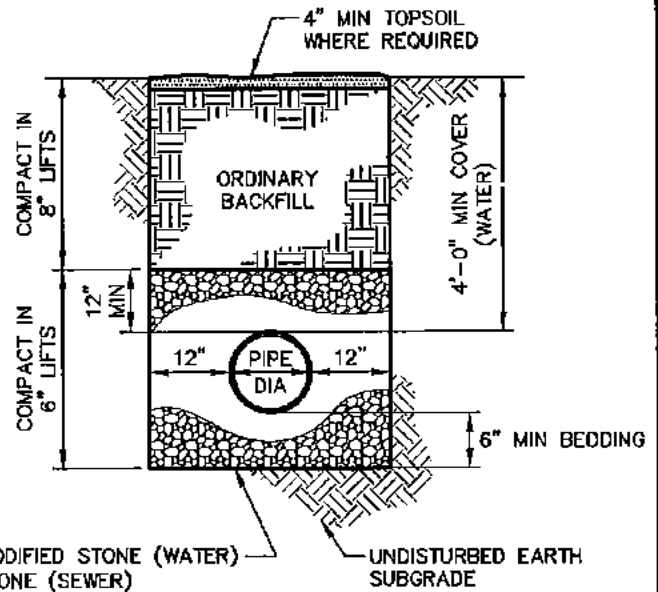
**IN UNSUITABLE SUBSOIL
TYPICAL TRENCH**



**RESTORATION OF
UNPAVED SHOULDERS**



**TYPICAL TRENCH
IN ROCK**



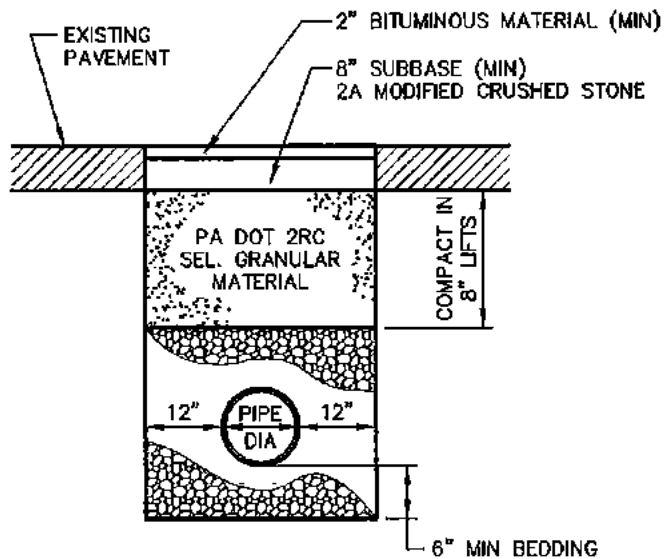
**TYPICAL TRENCH
IN EARTH**

NOTES:

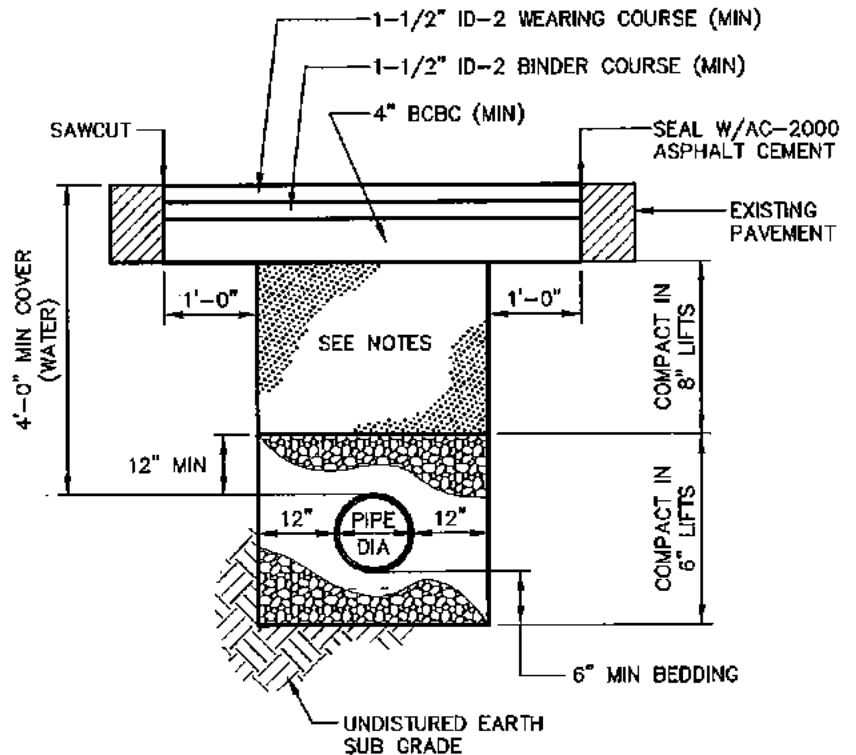
1. ALL BACK FILL MATERIAL IS SUBJECT TO ENGINEER APPROVAL
2. ORDINARY BACK FILL CLEAN DRY EARTH WITH A MAXIMUM STONE SIZE OF 6-INCHES.
3. PA DOT 2RC STONE AGGREGATE BACK FILL SHALL NORMALLY BE REQUIRED IN THE FOLLOWING CONDITIONS:

- (A) IN EXISTING ROADWAY OR PAVED SHOULDERS
- (B) IN UNPAVED SHOULDERS WHEN THE EDGE OF THE TRENCH IS LESS THAN THREE FEET FROM THE EDGE OF PAVEMENT.
- (C) IN DRIVEWAYS, ENTRANCES, AND PARKING AREAS, WHETHER PAVED OR UNPAVED.
- (D) IN SIDEWALKS.
- (E) ALL PROPOSED STREETS UNLESS STREET PAVING TO BE COMPLETED MORE THAN ONE (1) YEAR FROM DATE OF COMPLETION OF WATERLINE.

REVISIONS	TRENCH BACK FILL AND RESTORATION (UNPAVED AREAS)	PROJECT NO.
02.01.05	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	ADAM00-08
		SHEET NO.
	HANDVER ENGINEERING ASSOCIATES, INC.	34
		20C SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444



TEMPORARY FLEXIBLE PAVEMENT REPLACEMENT

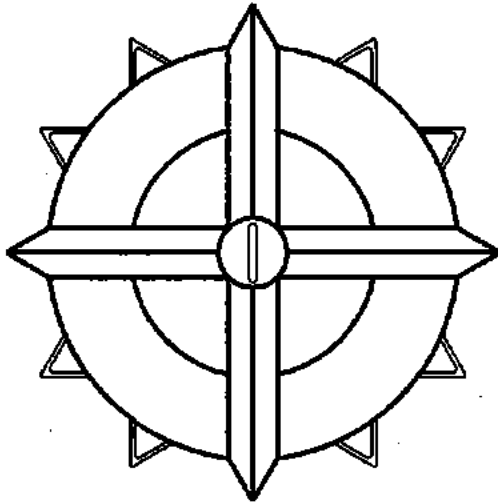
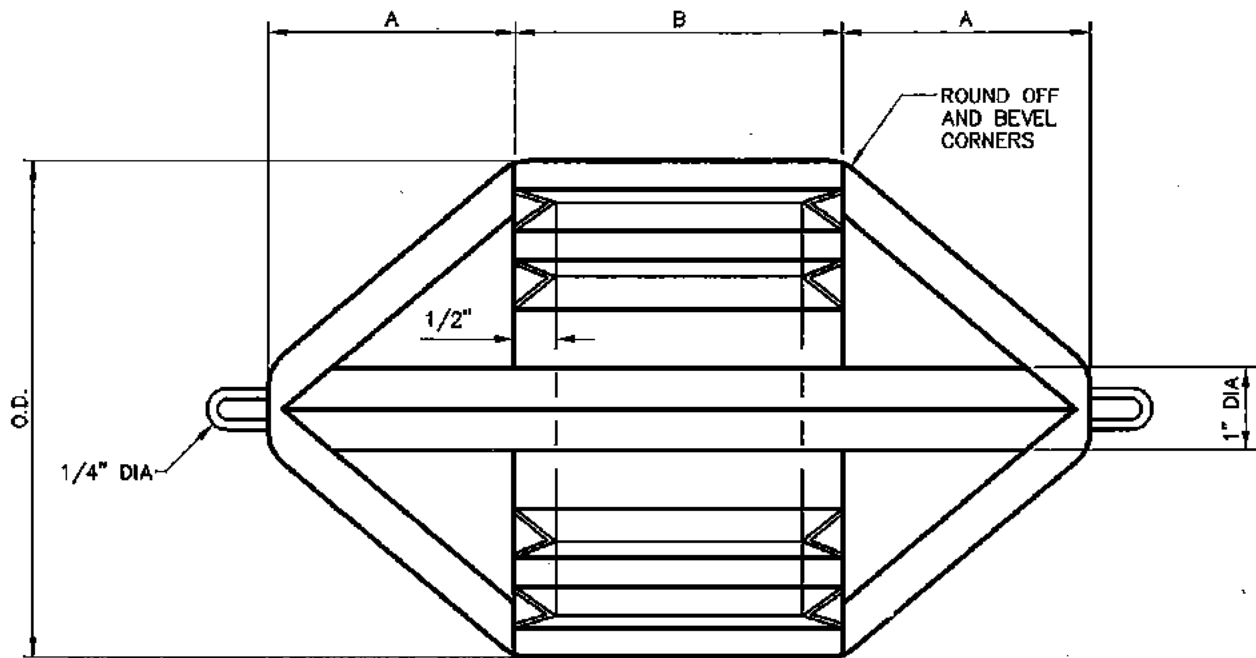


PERMANENT FLEXIBLE PAVEMENT REPLACEMENT

NOTES:

1. ALL BACK FILL MATERIAL IS SUBJECT TO ENGINEER APPROVAL
2. ORDINARY BACK FILL CLEAN DRY EARTH WITH A MAXIMUM STONE SIZE OF 6-INCHES.
3. PA DOT 2RC STONE AGGREGATE BACK FILL SHALL NORMALLY BE REQUIRED IN THE FOLLOWING CONDITIONS:
 - (A) IN EXISTING ROADWAY OR PAVED SHOULDERS
 - (B) IN UNPAVED SHOULDERS WHEN THE EDGE OF THE TRENCH IS LESS THAN THREE FEET FROM THE EDGE OF PAVEMENT.
 - (C) IN DRIVEWAYS, ENTRANCES, AND PARKING AREAS, WHETHER PAVED OR UNPAVED.
 - (D) IN SIDEWALKS.
 - (E) ALL PROPOSED STREETS UNLESS STREET PAVING TO BE COMPLETED MORE THAN ONE (1) YEAR FROM DATE OF COMPLETION OF WATERLINE.

REVISIONS	TRENCH BACK FILL AND RESTORATION (PAVED AREAS)	PROJECT NO.
02.01.05	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	ADAM00-08
		SHEET NO.
		35
HANOVER ENGINEERING ASSOCIATES, INC.		20C SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444

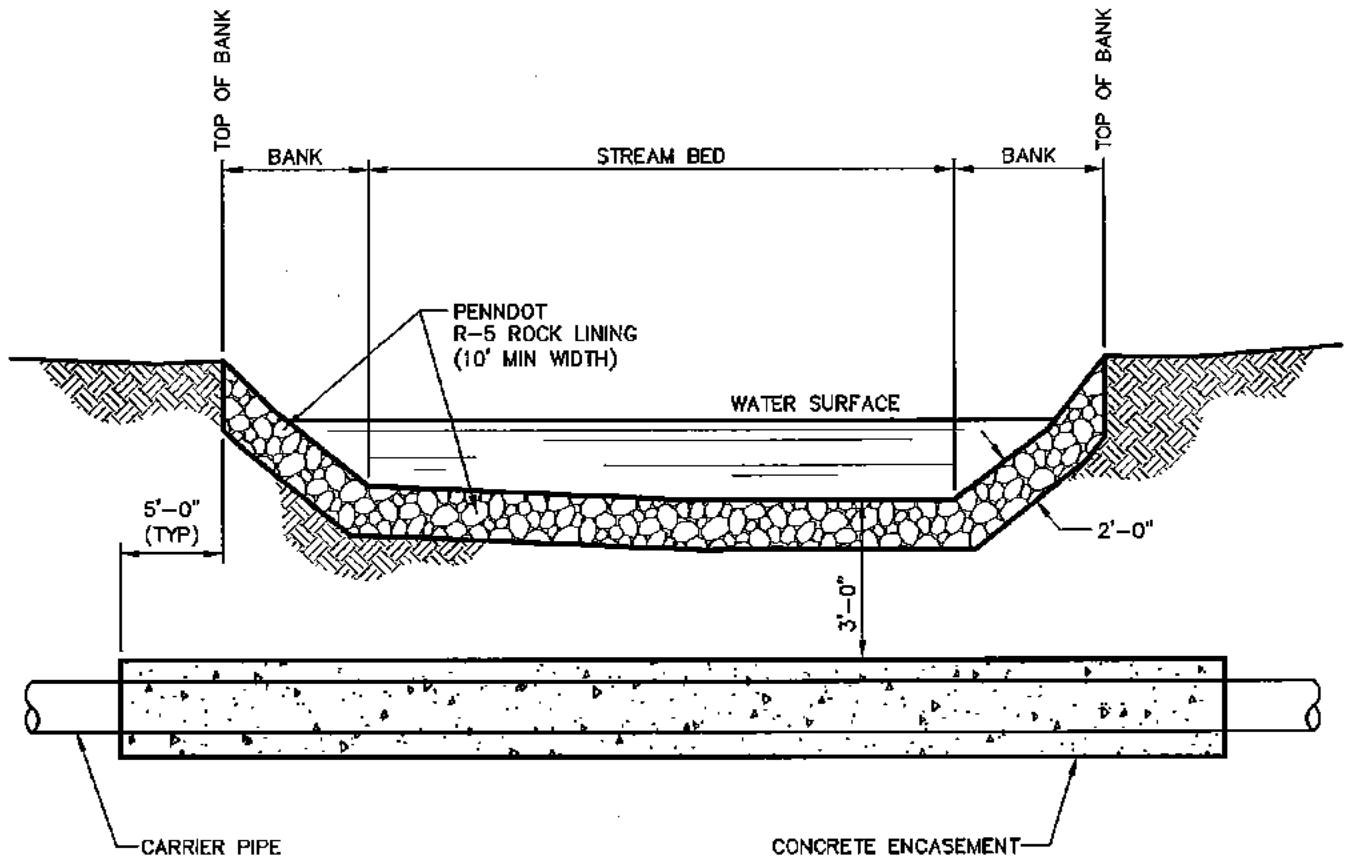


NOTES:

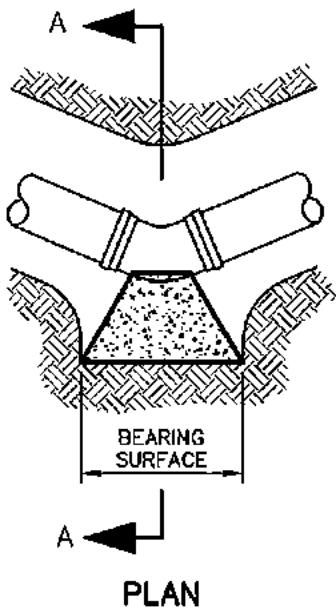
1. AFTER WELDING IS COMPLETED, TRUE THE OUTSIDE DIAMETER DIMENSION FOR THE FULL LENGTH OF "B" TO +0.010" BY TOOL AND LATHE OR GRINDING.
2. MANDREL CONSTRUCTED OF 1" ANGLE IRON AND 1/2" PLATES.

SIZE	A (INCH)	B (INCH)	DEFLECTION O.D.	SIZE	A (INCH)	B (INCH)	DEFLECTION O.D.
4"	3	4	3.71	15"	5	15	13.43
6"	3	6	5.50	18"	6	18	16.13
8"	4	8	7.37	21"	7	21	19.00
10"	4	10	9.23	24"	8	24	21.36
12"	4	12	10.98	27"	9	27	24.06

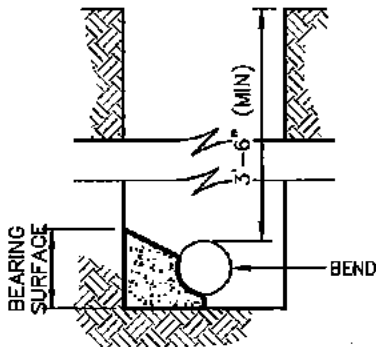
REVISIONS 	MANDREL DIMENSIONS	PROJECT NO. ADAM00-08
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	
	HANDOVER ENGINEERING ASSOCIATES, INC.	
200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444		



REVISIONS 	STREAM CROSSING DETAIL	PROJECT NO. ADAM00-08
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	SHEET NO. 37
	HANDOVER ENGINEERING ASSOCIATES, INC.	200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444

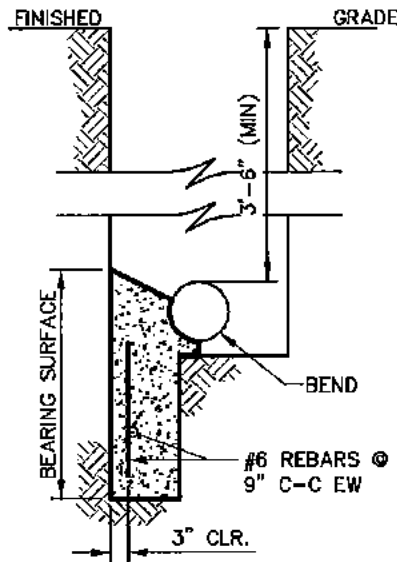


PLAN

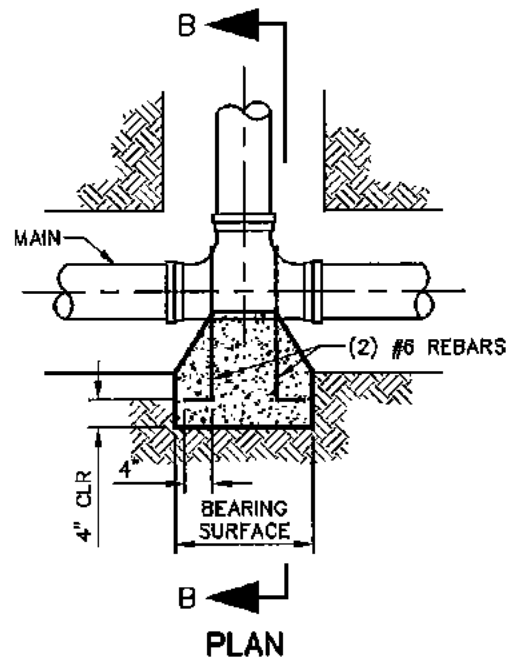


SECTION A-A

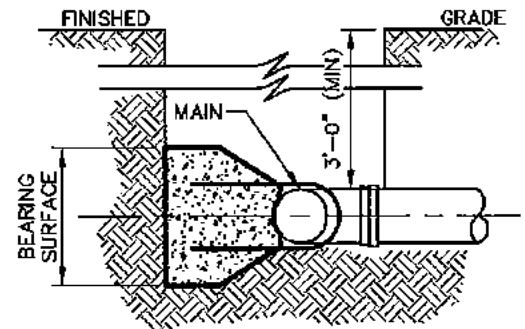
- NOTES:
1. NO COUPLING OR JOINTS SHALL BE COVERED WITH CONCRETE.
 2. REINFORCING BAR STRAPS TO BE SHAPED TO PIPE CURVATURE.
 3. ALL EXPOSED STEEL TO BE PAINTED WITH TWO COATS ASHALTIC PAINT.



SECTION A-A
(ADDITIONAL BEARING AS REQ'D.)



PLAN



SECTION B-B

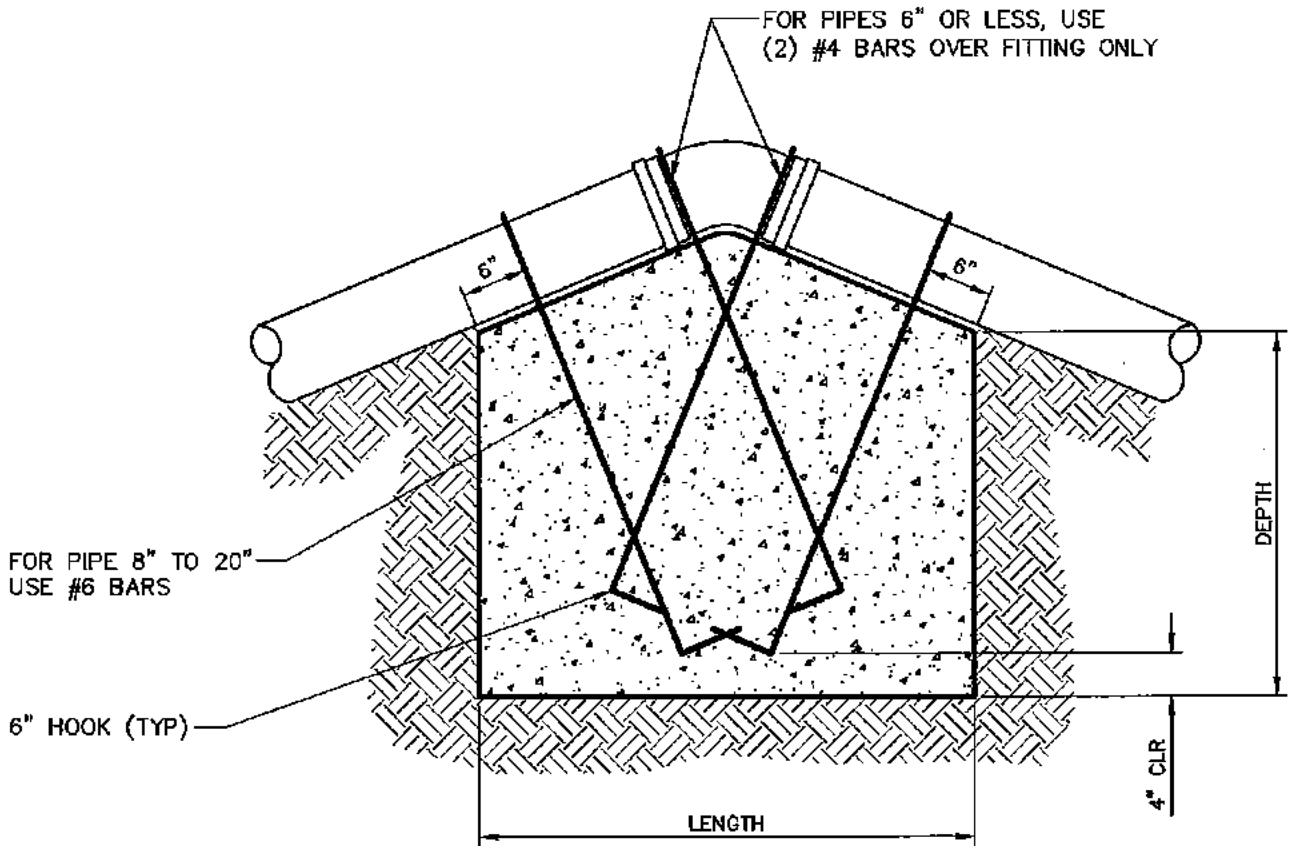
BEARING AREA REQUIRED, SQUARE FEET

TYPE OF BEARING MATERIAL AND ALLOWABLE LOADS, PSF	4" AND LESS DEGREE BEND				6" AND 8" DEGREE BEND				10" AND 12" DEGREE BEND			
	11 1/4'	22 1/2'	45°	90°	11 1/4'	22 1/2'	45°	90°	11 1/4'	22 1/2'	45°	90°
LOOSE SAND OR MEDIUM CLAY - 2,000	1.0	2.0	2.7	4.0	1.5	3.0	6.0	10.0	3.0	6.2	12.0	22.0
PACKED GRAVEL AND SAND - 4,000	1.0	1.0	1.5	2.0	1.0	1.5	3.0	5.0	1.5	3.1	6.0	11.0
ROCK - 10,000	1.0	1.0	1.0	1.0	1.0	1.0	1.2	2.0	1.0	1.3	2.4	4.4

14" AND 16" DEGREE BEND OR DEFLECTION				18" AND 20" DEGREE BEND OR DEFLECTION			
11 1/4'	22 1/2'	45°	90°	11 1/4'	22 1/2'	45°	90°
6.0	12.0	22.5	40.0	9.5	19.0	37.0	67.0
3.0	6.0	11.3	20.0	4.8	9.5	18.5	33.5
1.2	2.4	4.5	8.0	2.0	3.8	7.4	13.5

THRUST BLOCKING FOR TEES SHALL HAVE THE SAME BEARING AREA AS 90° BENDS OF THE PIPE SIZE OF THE OUTLET. DEAD ENDS SHALL HAVE THE SAME BEARING AS 90° BENDS.

REVISIONS	HORIZONTAL THRUST BLOCKING		PROJECT NO.
	STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH		ADAM00-08
			SHEET NO.
HANDOVER ENGINEERING ASSOCIATES, INC.		200 SNYDER LANE EPHRATA, PA 17522-9101 (717) 721-7444	
		38	



TYPICAL SECTION

NOTES:

1. NO COUPLING OR JOINTS SHALL BE COVERED WITH CONCRETE.
2. REINFORCING BAR STRAPS TO BE SHAPED TO PIPE CURVATURE.
3. ALL EXPOSED STEEL TO BE PAINTED WITH TWO COATS ASHALTIC PAINT.

PIPE SIZES	DIMENSIONS OF CONCRETE BLOCKING								
	LENGTH			WIDTH			DEPTH		
	11 1/4'	22 1/2'	45'	11 1/4'	22 1/2'	45'	11 1/4'	22 1/2'	45'
4" AND SMALLER	2'	4'	4'	1.5'	3'	3'	1'	2'	3'
6" AND 8"	3'	4'	6'	3'	3'	3'	2'	3'	4'
10" AND 12"	4.5'	6'	8'	3'	3'	4'	3'	4.5'	5'
14" AND 16"	6'	8'	11'	3.5'	3.5'	5'	2.5'	5'	5'
18" AND 20"	7'	9'	13'	4'	5'	5.5'	4'	5'	6'

REVISIONS 	VERTICAL THRUST BLOCKING STANDARD SPECIFICATIONS FOR ADAMSTOWN BOROUGH	PROJECT NO. ADAM00-08 SHEET NO. 39
HANDOVER ENGINEERING <small>ASSOCIATES, INC.</small>		<small>200 SNYDER LANE</small> <small>EPHRATA, PA 17522-9101</small> <small>(717) 721-7444</small>