

**Upper Allen Township
100 Gettysburg Pike, Mechanicsburg, PA 17055-5698**

**STANDARD CONSTRUCTION
AND
MATERIAL SPECIFICATIONS

FOR THE

SANITARY SEWER SYSTEM**

**UPPER ALLEN TOWNSHIP
CUMBERLAND COUNTY
PENNSYLVANIA**

**April 2018
Edition**

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AND MATERIAL SPECIFICATIONS**

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2018

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PART 1 - OVERVIEW OF PROCEDURES FOR SANITARY SEWER EXTENSIONS

1.01 SUMMARY

- A. Upper Allen Township has prepared *Standard Construction and Material Specifications for the Sanitary Sewer System* containing detailed procedures, instructions, and specifications governing the construction of, and extensions to, the sanitary sewer system. This overview summarizes activities detailed in this document. Any reference to Engineer stated in this document shall mean Township Sanitary Engineer. When the Engineer is not acting as a consultant, the word Township is substituted for Engineer, as defined in these Specifications.

1.02 PLANNING PHASE

- A. During this phase Developers formally express their intent to construct extensions to the sewer system. The activities outlined below should occur concurrent with those outlined in the Subdivision and Land Development Ordinance and the Zoning Ordinance.
 - 1. Submit a written request to the Engineer inquiring as to capacity available to serve the project. Indicate the location of the project, the type of development proposed, the number of proposed equivalent dwelling units (EDUs), and the proposed daily sewage flow. The Engineer will respond in writing as to the available sanitary sewer system capacity after review.
- B. Submit a Pennsylvania Department of Environmental Protection (DEP) Sewage Planning Module Application Mailer, complete with two (2) copies of all required attachments, to the Engineer for review and submission to DEP. If it is determined by DEP that a complete Planning Module is required, then the appropriate documents must be submitted by the Owner or Developer.
- C. A formal project engineering submission should not be developed without a comprehensive understanding of the information contained in the *Standard Construction and Material Specifications for the Sanitary Sewer System*.
- D. The Developer and his engineer are encouraged to meet with Township Sewer Department and Community Development staff along with the Engineer prior to making formal plan submissions. Township staff and the Engineer will provide guidance on the procedures and design requirements contained in this document as well as in the Subdivision and Land Development Ordinance and the Zoning Ordinance.
- E. The Developer shall submit a “Proposed Sewer System Extension Feasibility Study” (hereinafter “Study”) prepared by a registered professional engineer.

The Study shall contain any analysis and information needed to support included certification by the preparer of the Study that:

1. The proposed extension will adequately serve the wastewater needs of the new development;
2. Any existing wastewater collection and/or conveyance system to which the extension is planned to discharge to are capable, or have capacity, to receive the additional flows generated by the development without adverse impacts according to standards applied by the Township Engineer; and
3. The extension can be successfully designed in conformance with the “Standard Construction and Material Specifications for the Sanitary Sewer System”. The Study shall include a general layout of the extension on a plan, if not a finished design, showing the proposed system connection point(s), pipe sizes and locations, manhole locations, locations of any proposed pumping stations, and other features or proposed improvements deemed important to determine the feasibility of the extension.

1.03 DESIGN PHASE

- A. During this phase the Developer shall submit plans and related documents to the Township Community Development Department for distribution to the Township Sewer Department, the Township Engineer, and any other applicable departments, agencies or individuals for review. Some or all of the items listed below may apply depending on the size and scope of the project, as may be determined by the Engineer. These activities should occur consistent with those outlined in the Subdivision and Land Development Ordinance.
- B. All items described below must be received in an acceptable format not less than forty-five (45) days prior to the expiration of the Township Board of Commissioners’ approval of the Preliminary or Preliminary/Final Land Development Plan, Preliminary or Preliminary/Final Subdivision Plan, or Preliminary or Preliminary/Final Subdivision and Land Development Plan, as specified in the Subdivision and Land Development Ordinance.
 1. Escrow Account: Establish a sanitary sewer Escrow Account with the Township by providing a \$1,000.00 (or such other amount as required by the Township) payment to the Township and identifying the project. These funds are required to pay for engineering review, administrative, and legal fees. For large projects, the initial deposit may not be adequate. The Township will notify the Developer when the Escrow Account is nearly depleted. Should the Escrow Account be depleted, engineering, administrative, and legal review work on the project will cease until the Account is replenished.
 2. Design Drawings: Submit design drawings for review. If any revisions are required, comments will be provided with each submission. Upon

- approval, the appropriate number of copies shall be forwarded to the Township for distribution. Three (3) copies of the final construction drawings shall be furnished to the Sewer Department.
3. Rights-of-Way Plats and Legal Descriptions: Submit sewer rights-of-way plats and legal descriptions for review if any of the proposed sewer mains will be located outside existing or proposed Township street rights-of-way. If any revisions are required, comments will be provided. Upon approval, two (2) copies of the final plats and legal descriptions shall be delivered to the Township Sewer Department Office. Said plats and legal descriptions shall be incorporated into applicable sanitary sewer easement agreement and deed of dedication after construction is complete.
 4. Rights of Access on Non-Dedicated Public Streets: For any completed sanitary sewer improvements which are located within future Township street rights-of-ways and are intended to be dedicated to the Township together with street dedication (streets which have not yet been completed and accepted), a note must be added to the drawing granting the Township temporary easements to permit Township to make emergency or other repairs to the sanitary sewer system, if necessary, until such time as Township has accepted the streets and sanitary sewer system, and Deed(s) of Dedication for the same have been executed and recorded. See Section 2.27, A, 5 of the General Instructions.
 5. PennDOT Highway Occupancy Permit (HOP): If the project involves construction activities within PennDOT rights-of-way, an application for an HOP must be prepared by the Developer and submitted to the Township for execution. All HOP applications must be prepared with Upper Allen Township as the permittee. Upon execution by the Township, the HOP application will be submitted by the Engineer to PennDOT using their electronic E-Filing system.

1.04 AGREEMENT PHASE

- A. Following approval of Developer's plan by the Board of Commissioners and receipt and approval of a construction cost estimate, and prior to plan recording, a Sewer Extension Agreement (Agreement) shall be prepared by the Township Sewer Department for execution by the Developer and the Township.
- B. Although the Engineer may not require all items for all projects, generally, the items listed below must be received by the Township in an acceptable format.
 1. Construction Cost Estimate: The Developer shall cause to be prepared a sanitary sewer construction cost estimate signed and sealed by a registered professional engineer or registered landscape architect. This estimate shall reflect prevailing wage rates, which shall be the basis for determining the Escrow Fund and Financial Security amounts as specified in the Sewer Extension Agreement. The estimate shall also be subject to review and approval by the Township Sanitary Engineer.

2. Developer's Escrow for Engineering and Legal Review: The Developer shall deposit funds in the amount of \$1,000.00 for engineering and legal review of all documents pertaining to the sewer extension.
3. Developer's Escrow for Construction Observation and Testing: The developer shall deposit the required funds into an Escrow Account with the Township for construction activities as specified in the Sewer Extension Agreement. The amount of Developer's escrow necessary for mainline, lateral and manhole construction observation and testing, and cleaning and televisual inspection of these facilities shall be initially estimated based on ten (10) percent of the Township approved construction cost estimate for the sanitary sewer extension. On occasion, situations may develop during construction that will prolong inspection or other construction related activities beyond the Engineer's estimate. In such cases, the escrow funds requested for the construction phase may not be adequate. The Township will notify the Developer when the Escrow Account is nearing depletion. Should the Escrow Account be exhausted, construction observation on the project will cease until the account is replenished and any sanitary sewer installation work completed during that time will not be accepted.
4. Sanitary Sewer Installation Financial Security: Developer shall submit financial security documents for the dollar amount specified in the Sewer Extension Agreement, most commonly in the form of an original Irrevocable Letter of Credit, Performance and Payment Bonds, or a corporate check.
 - a. Should sanitary sewer construction begin prior to recording of the final plan as approved by the Township Board of Commissioners, financial security shall be in an amount equal to 110% of the remaining construction costs as determined by the Engineer.
 - b. Evergreen Clause: The installation financial security must contain an "Evergreen" clause which will cause the financial security to automatically renew for an additional one (1) year period, each year, if the issuing financial institution does not request its release at least sixty (60) days prior to its expiration date. The Developer should be aware of this requirement and assume the responsibility of informing the issuing financial institution of the financial security release status within the prescribed time frame.
 - c. Release of Financial Security: Sanitary sewer installation financial security may be released after Developer satisfies the requirements of the Sewer Extension Agreement, including submission and approval of record drawings, deed(s) of dedication transferring ownership of the sanitary sewer extension to the Township and easement agreement(s) (where applicable). Deed(s) of dedication and easement agreement(s) must be recorded by Developer at the Developer's expense at the Office of the Cumberland County Recorder of Deeds.

5. Developer Name/Contact Information: Developer shall provide its corporate name, name of responsible official and title, address, phone number, and email address.
- B. Upon receipt of the above, the Engineer will estimate the amount of funds required for deposit into the Escrow Account to accommodate the Construction and Guarantee Phases of the project. The Engineer will also prepare the Sewer Extension Agreement and forward two (2) copies to the Developer for execution. Alternatively, the Township may provide the Sewer Extension Agreement in electronic form (email), and the Developer may deliver two (2) executed copies to the Township. The Agreements must be executed and returned to the Township. The Agreements will be presented to the Board of Commissioners for approval and execution.

1.05 CONSTRUCTION PHASE

- A. During this phase, the Developer's Contractor meets the conditions listed below and installs the sanitary sewer facilities in accordance with the approved Drawings and Specifications. The Township or Engineer inspects the installation to assure that the materials used and methods employed are in conformance with the Specifications. Upon completion, the new sanitary sewers are subject to testing and final inspection. The following is the sequence of events during the construction phase.
- B. The Contractor must submit the following items to the Township or Engineer prior to the Notice to Proceed being issued and scheduling of a Preconstruction Meeting:
 1. Two (2) copies of the Contractor's Insurance Certificate. Limits of liability are outlined in the Specifications. The Township, Township Sanitary Engineer, and Township Engineer must be included on the Policy as insured.
 2. Four (4) hard copies of Shop Drawings for sewer construction materials, or alternatively, submit Shop Drawings in electronic form (email) to the Township and the Engineer.
 3. Four (4) copies of approved, signed and sealed construction drawings shall be furnished to the Township Sewer Department.
- C. The Developer shall provide the Township with two (2) executed copies of the Sewer Extension Agreement together with all items listed under Agreement Phase above. The Township will then execute these documents and return one (1) copy to the Developer.
- D. The Developer is issued a Notice to Proceed by the Engineer after all of the above items are addressed, and after the Developer or his Contractor schedules a Preconstruction Meeting. The Preconstruction Meeting shall be scheduled on-

site with representatives of the Township, Township Sanitary Engineer, Township Engineer, Developer, Developer's Engineer and Contractor.

1. Preconstruction Meeting: All pertinent information shall be discussed including standard specification requirements, construction dates, work hours, safety, contact information, and related issues.
 2. Construction Start Date: The Developer's Contractor establishes a construction start date with the Engineer. At least three (3) working days' notice of the initiation of construction must be provided in order to set up a meeting to coordinate inspection activities.
- E. During the Construction Phase the Developer's Contractor and/or Engineer and the Township's Engineer shall have certain responsibilities as outlined below:
1. The Developer's Contractor and/or Engineer shall keep record of the installed depth and length of the sewer mains and service laterals, final elevations of manholes, and final location of all piping including station of service wyes off the mainline. This information is required for the generation of Record Drawings.
 2. Construction activities, construction observation, and compaction density tests are performed where applicable or as directed by the Engineer.
 3. After the Contractor indicates that construction is complete, the Engineer provides a Punch List of any tasks remaining to be performed.
 4. Upon completion of the sewers, the Engineer witnesses the sewer line acceptance testing consisting of a mandrel testing, low pressure air testing, internal televisual inspection, and vacuum testing of manholes.
 5. The Engineer shall provide the Township with a letter certifying that all work completed by the Developer's Contractor has been completed, tested and accepted in accordance with the Township's Standard Construction and Material Specifications for the Sanitary Sewer System.

1.06 GUARANTEE PHASE

- A. Guarantee (Maintenance) Financial Security: During this Phase, the Developer posts Guarantee (Maintenance) Financial Security in order to insure the sanitary sewer improvements function as designed and to protect the Township against any observed deficiencies associated with the installed facilities. The required security for the guarantee phase is fifteen percent (15%) of the actual cost to install the sanitary sewer facility improvements, said cost to be provided by the Developer. Aggregate backfill material for backfilling trenches in paved roadways to be dedicated to the Township is recommended. In-lieu-of aggregate backfill material being used within paved roadways to be dedicated to the Township, approved on-site native backfill material can be used if approved by the Township Engineer. Developer must agree and understand that the Township shall retain installation financial security in the amount of fifteen percent (15%) of the actual cost to install the sanitary sewer facility improvements for an additional period of 3 ½ years from the date of receipt of the above documents and shall not accept dedication of the improvements until that time. After said period of 3 ½

years, the Township may accept dedication of the improvements and release the installation financial security, provided the developer causes to be recorded the executed deed of dedication and easement agreement and delivers to the Township a maintenance guarantee in the amount of 15% of the actual cost to install the improvements for a period of 18 months, from the date of recording of the above documents. The same requirements shall apply to work that is completed within PennDOT rights-of-way. Items required prior to releasing installation financial security and posting guarantee (maintenance) financial security are as follows:

1. Record Drawings: Record (As-Built) Drawings shall be submitted by Developer or Developer's engineer, and shall be reviewed and approved by the Township Sewer Department. If any revisions are required, comments will be provided. Upon approval, two (2) paper copies, one (1) Mylar reproducible, and one (1) copy of electronic data files are required for record drawings. Record drawing electronic data file information must be in both PDF and AutoCAD format using the "NAD 83 PA South Zone Grid" for horizontal datum and the "NAVD 88 Datum" for vertical datum.
 2. Deed(s) of Dedication and Easement Agreement(s): Deed(s) of Dedication and Easement Agreement(s), together with attached plats and legal descriptions signed/sealed by a registered professional engineer or registered professional surveyor, shall be submitted by Developer and reviewed by both Township Sewer Department staff and the Township Solicitor. If any revisions are required, comments will be provided. Upon final review and acceptance Developer shall have documents properly executed and recorded at the Office of the Recorder of Deeds at the Cumberland County Courthouse and provide documents and proof of recording to the Township.
- B. Prior to the expiration of the maintenance financial security the Engineer shall perform an inspection of the completed sanitary sewer improvements to verify that they continue to meet Township specifications and are functioning as designed. Any identified deficiencies must be corrected by the Developer prior to release of the maintenance financial security.
- C. The maintenance financial security must contain an "Evergreen" clause which will cause the financial security to automatically renew for an additional one (1) year period, each year, if the issuing financial institution does not request its release at least sixty (60) days prior to its expiration date. The Developer should be aware of this requirement and assume the responsibility of informing the issuing financial institution of the financial security release status within the prescribed time frame.

1.07 CONNECTION PHASE

- a. Upon receipt of the additional 3 ½ years installation financial security (when applicable) or maintenance financial security, the Township will issue Permits allowing service connections to be made to the new lines. No permits to connect to the sewer system will be issued until the above requirements have been met.

1.08 PROJECT CLOSEOUT

- A. Following an inspection of the completed sanitary sewer improvements, correction of any deficiencies by Developer/Contractor, and expiration of the maintenance financial security, the Engineer will recommend that the Developer's Escrow Account be closed out and that any remaining balance be returned to the Developer.

END OF SECTION

PART 2 - GENERAL INSTRUCTIONS

2.01 DEFINITIONS

- A. Wherever in these Specifications the following words, terms and expressions, or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

Approved, etc. The words "approved", "acceptable", "satisfactory", or like words shall mean approved by, or acceptable, or satisfactory, to the Township and/or the Engineer, unless another meaning is plainly intended or otherwise specifically stated.

Building Sewer: The extension from the sewage drainage system of any structure to the lateral of a sanitary sewer. Generally the building sewer is that portion of sewer line located outside the sewer easement or street rights-of-way and within private property.

Completion Certificate: The certificate of the Engineer approved by the Township indicating the completion and acceptance of all work specified and performed in accordance with the approved Plans and/or Standard Specifications for a Developer project, under Township Contract, or individually by a Person.

Contract: The written agreement executed by and between the Developer and the Contractor, or by the Township and the Contractor, covering the performance of the work and the furnishing of labor, materials and service in the construction of sewer extensions, repairs or replacements to the Upper Allen Township wastewater collection system.

Contractor: Party of the Second Part or Second Party to the Contract, acting directly or through his authorized lawful agents, legal representatives, superintendents, or employees, appointed to act for said party in the performance of the work. Contractor shall also mean a Person acting on behalf of themselves in the performance of the work.

Developer: Any landowner, or sometimes hereafter and otherwise referred to as "owner", agent of such landowner, or tenant with the permission of such landowner, who makes or causes to be made a subdivision of land or a land development, or other prospective users of the Township's sanitary sewer system developing in that portion of the Township served through the sewage treatment plants of the Lower Allen Township Authority and the Township.

Drawings or Plans: Collectively, all of the drawings or plans (or reproductions of them) pertaining to the construction of the project and attached to the Contract or otherwise made a part thereof; and also the Standard Detail Drawings contained in these Specifications and other such supplementary drawings as may be issued from time to time in order to elucidate or clarify said Contract Drawings, or for showing details which are not shown thereon.

Engineer: The person or organization duly employed by the Township as consultant and authorized to inspect the results of the performance of the work under Contract by the Contractor, acting directly or through properly authorized agents, engineers, assistants, inspectors, or other representatives acting severally within the scope of the particular duties entrusted to them. The word "Engineer" shall mean sanitary engineer, and shall include the officers, agents and employees of the Engineer. In cases where the Township does not employ a consultant, the word "Township" is substituted for "Engineer" throughout these Specifications.

House Drain: The main horizontal drain and its branches inside the walls of the building or structure and for three (3) feet outside thereof, and extending to and connecting with the building sewer.

Improved Property: Shall mean any property located within this Township 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.

Industrial Establishment: Any room, group of rooms, building or other enclosure used or intended for use, in whole or in part, in the operation of one business enterprise for manufacturing, processing, cleaning, laundering or assembling any product, commodity or article or from which process waste, as distinct from sanitary sewage, shall be discharged. An industrial establishment represents a non-residential use.

Industrial Waste: Any solid, liquid or gaseous substance, water-borne waste or form of energy which is produced as a result, whether directly or indirectly, of any industrial, manufacturing, commercial, trade or business or research process or activity or in the course of developing, recovering or processing of natural resources and which is discharged into the sewer system; but not non-contact cooling water or sanitary sewage. Any wastewater which contains industrial waste and which is discharged from an industrial, manufacturing, trade or business premises is considered industrial waste for the purposes of these Rates, Rules, and Regulations.

Inspection: The examination of the work performed by the Contractor to ascertain its conformity with the Specifications.

Lateral: That part of the sewer system extending from a sewer main to the limits of the sewer easement or street rights-of-way for the purpose of providing for connection of any building sewer; this term may also be referred to as "service lateral".

Owner: The word "Owner" appearing throughout the Specifications and elsewhere in this document shall have the same definition as the word Township. The word "owner" may represent any person vested with ownership, legal or equitable, sole or partial, of any improved property.

Person: Any individual, partnership, co-partnership, firm, company, association, joint-stock company, society, trust, corporation, estate, governmental entity, limited liability

company or other group or legal entity, or their legal representatives, agents or assigns. The masculine gender shall include the feminine; the singular shall include the plural where indicated by context.

Project: All the necessary performance, services and materials required for the satisfactory completion of the work in connection with an extension, a repair or replacement, or connection to the sanitary sewer system as may be described in the Specifications and indicated on the Drawings.

Sanitary Sewer: A sewer carrying only domestic or industrial wastes and to which stormwater, surface water or groundwater are not intentionally admitted.

Sewer Extension Agreement: The written agreement executed by and between the Township and the Developer or Person covering the performance of the work and the furnishing of labor, materials and service in the construction of the project, also any and all supplemental agreements which could reasonably be required to complete the construction contemplated.

Sewer System: All facilities, as of any particular time, for the collecting, transporting, pumping, treatment and disposal of sanitary sewage and industrial waste, including all related and necessary facilities, and including all additions, extensions, alterations and improvements owned or to be owned by the Township or to which the Township has the right to utilize such facilities for the purpose of providing public sanitary sewer service.

Specifications: Collectively, all of the definitions, descriptions, directions, provisions, requirements, detail drawings, terms and stipulations contained in these Standard Specifications; and all written supplements thereto, made or to be made, pertaining to the sanitary sewer system, and the materials and workmanship to be furnished in the construction thereof.

Standard Detail Drawings: Drawings contained in these Specifications indicating all materials, installation and specification requirements for all physical components of the Sewer System. The latest edition of the Standard Detail Drawings contained herein shall supersede any detail drawings shown on or made a part of any Contract or other Drawings pertaining to a Project.

Subcontractor: A person, firm or corporation having a direct contract with the Contractor to perform part of the latter's contract; such as one who installs or furnishes and installs materials forming a permanent part of the Contract work, or who furnishes labor for work required by the Contract in accordance with the Plans and Specifications. This term does not include individual workmen furnishing labor only, nor one who merely furnished material not worked to a special design.

Township: The Township of Upper Allen, a First-Class Township, Cumberland County, Pennsylvania, a Pennsylvania municipality, acting by and through its Board of Commissioners or, in appropriate cases, acting by and through its authorized

representatives, and shall include the Township Sewer Department Manager and Assistant Sewer Department Manager.

2.02 DRAWINGS AND SPECIFICATIONS

- A. The Drawings and Specifications are complementary, and the requirements of any one shall be considered as the requirements of all.
 - 1. The Specifications in this document are written as if they were included in the Contract Documents executed by and between the Developer and the Contractor. Whether they are so used is at the discretion of the Developer; however, the Township will not accept the sanitary sewer extensions provided by the Developer unless and until they conform to the requirements of these Standard Specifications.
 - 2. All drawings or plans pertaining to the Project (the Contract Drawings) shall be submitted by the Developer to the Township for review. After review of the Contract Drawings by the Township, the Developer shall make any corrections required, and submit corrected copies thereof to the Township. The Township's approval of the Contract Drawings shall not relieve the Developer from responsibility for errors or discrepancies in such drawings. All Contract Drawings shall be prepared and submitted in conformance with the requirements stated in Section 01300.
 - 3. Deviations from the Drawings or Specifications required by the exigencies of construction will be determined by the Engineer only, and authorized in writing.
 - 4. At all times the Contractor shall keep on the Project, available to the Engineer and his representatives, one (1) copy of the Drawings, and Specifications.

2.03 PRELIMINARY INSPECTION

- A. Unless the requirement is waived by the Engineer prior to the start of actual construction operations, the Contractor, or his authorized representative, shall go over the Project accompanied by the Engineer, or his designated representative, and shall observe for himself, with the approved Drawings before him, all pertinent conditions relative to the Contract, including the status of rights-of-way and structures, obstructions, or other objects to be removed, altered and changed.

2.04 COMPETENT WORKMEN

- A. The Contractor shall employ only competent and efficient superintendents, foremen, clerks, timekeepers, equipment operators, laborers, and mechanics or artisans, for every kind of work. These requirements shall not operate against the employment of physically handicapped persons otherwise employable, where such persons may be safely assigned to work which they can ably perform. No person under the age of sixteen (16) years, and no person currently serving sentence in a penal or correctional institution, shall be employed to perform any work under the Contract.
- B. The Contractor shall provide a competent and reliable person, who is delegated to be readily available and have full authority to act on the behalf of the Contractor, in case it

is necessary to deal with any emergency situations, which may arise in connection with the project during off working hours, evenings, weekends or holidays.

2.05 WORKING CONDITIONS

- A. No night, Sunday, or legal holiday work, requiring the presence of the Engineer or his representative, will be permitted, except in cases of emergency, and then only with the written consent of the Engineer, and to such an extent as he may judge necessary.
- B. No work shall be done when, in the opinion of the Engineer, the weather is unsuitable for good and careful work to be performed. Should the severity of the weather continue, such that the work cannot be prosecuted successfully, the Contractor, upon order of the Engineer, shall cease all such work until directed to resume the same.
- C. The Contractor shall arrange for, and be responsible for, a sufficient amount of illumination at all times subject to the approval of the Engineer, to carry on all phases of the work.
- D. The Engineer shall be given at least three (3) working days notification prior to construction to schedule an inspection.

2.06 MATERIALS

- A. The Contractor shall furnish the Engineer, promptly after the award or execution of the Contract, with a complete statement of the origin, composition, and manufacture of all materials to be used in the construction of the Project. Only materials conforming to the requirements of these Specifications and approved by the Engineer shall be used in the work.
- B. Representative preliminary samples of the materials, of the character and quality prescribed in the Contract shall be submitted when indicated or directed, for advance examination or test. Written approval of the quality of such samples shall be received by the Contractor prior to obtaining materials from the respective sources of supply.
- C. Samples of all materials requiring laboratory tests shall be taken under the direction or supervision of, or in the manner prescribed by the Engineer. Such materials shall not be used until accepted as the result of such tests. Materials will be used only so long as the quality of the material remains equal to that of the accepted sample. The acceptance at any time of any material shall not be a bar to its future rejection, if it is subsequently found to be defective or inferior in quality to the material specified.
- D. Required laboratory tests of materials shall be made by a testing laboratory or agency selected or approved by the Engineer and in accordance with the methods indicated herein. When standard Specifications and serial numbers of technical societies and associations are stipulated, the reference shall be construed to be the latest of such Specifications and serial numbers.

- E. The Contractor shall furnish all labor, materials, and equipment necessary for collecting, packaging and identifying, representative samples of materials, and the shipping of such samples to the testing laboratory.
- F. For tests or inspections conducted by, and at the options of, the Engineer, at sites other than the testing laboratory and not under the jurisdiction thereof, the Contractor shall furnish or arrange with the producer to furnish all material, labor, tools, and equipment, and every facility for the verification of the accuracy of all scales, measures and testing equipment, necessary for such tests or inspections.
- G. The Contractor shall permit or arrange with the producer to permit the Engineer or any agent of the testing laboratory to inspect or test any and all material being used or to be used, at any time before, during or after its preparation, or while being used during the progress of the work or after the work has been completed.
- H. Materials shall be stored so as to insure preservation of their specified quality and fitness for the work. When considered necessary they shall be placed on wooden platforms or other hard and clean surfaces, and not on the ground, and shall be placed under cover when directed. Stored materials shall be located so as to facilitate prompt inspection. Private property shall not be used for storage purposes without permission of the owner or lessee of the property.
- I. If any material intended for use in the construction of the Project has been inspected and rejected after such material has been delivered to the Site, all such rejected material shall be immediately removed from the property by the Contractor.

2.07 REFERENCED STANDARDS

AASHTO: American Association of State Highway and Transportation Officials

ACI: American Concrete Institute

AISC: American Institute of Steel Construction

ANSI: American National Standards Institute

ASTM: American Society for Testing Materials

Fed. Spec: Federal Specifications, United States Government

2.08 ASSIGNED WARRANTIES

- A. Manufacturer's warranties on materials and equipment, including internal components, exceeding the guarantee time period as stated in the Agreement, shall be assigned directly to the Township. Assigned warranties shall be submitted to the Township with the appropriate information required therein written and executed before final payment.

2.09 ADVERTISING

- A. No advertising will be permitted on any part of buildings, scaffolding, fences, materials, obstructions, barricades or work.

2.10 PERMITS AND LICENSES

- A. 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. The Township requires the Developer to complete all necessary permit applications.
- B. Certain permits/approvals required in connection with a sewer extension shall be obtained in the Township ' s name. The permit applications shall be submitted to the Township for review and submission to permitting agencies. The following permits/approvals, as applicable, shall be acquired in the Township ' s name:
 - 1. DEP Planning Exemption. Obtain and complete DEP Planning Exemption postcard mailer and submit to Township. Township shall submit mailer to DEP for approval.
 - 2. DEP Bureau of Water Quality Management Sewerage Permit. Obtain and complete all applicable DEP permit applications and submit to the Township. Construction plans, soil erosion and sediment pollution control plan and narrative, and DEP filing fee shall also be included.
 - 3. PennDOT Highway Occupancy Permit. If the sewer extension is to be located in a State highway, obtain and complete the Highway Occupancy Permit application form (PennDOT form M945A) and submit to the Township.
 - 4. Railroad Occupancy License. If the sewer extension is to cross or be located in railroad property, the Developer shall determine the requirements of the railroad owner. Developer shall complete all application forms and ensure that the sewer design conforms to the requirements of the railroad owner. The Developer shall submit to the Township the completed forms and design information necessary for submission to the railroad owner.
 - 5. Other Utility Rights-of-Ways. If the sewer extension is to cross or be located in other utility rights-of-ways, the Developer shall determine the requirements of the utility company and shall complete all application forms and ensure that the sewer design conforms to the requirements of the utility owner. The Developer shall submit to the Township the completed forms and design information necessary for submission to the utility owner.
 - 6. Any pavement cut or pavement cut excavation permits required by Upper Allen Township.
 - 7. After review of the applications by the Township, the Developer shall make any corrections, if required, and submit corrected copies to the Township. The Township will forward the applications and fees to the applicable agencies.
 - 8. The Developer shall be responsible for compliance with and payment of costs (fees, inspectors, etc.) in connection with all permits, licenses, and regulations applicable to sanitary sewer extension construction.
 - 9. Information on the permit forms specific to the Township as applicant may be obtained from the Township ' s Engineer.

2.11 CARE OF PUBLIC AND PRIVATE PROPERTY

- A. The Contractor shall take all necessary precaution to prevent damage to all overhead and underground structures and to protect and preserve property within or adjacent to the Project and shall be responsible for damage thereto. Special care shall be used by the Contractor in the prosecution of the work in order to avoid interference or damage to any operating utilities or plants; however, where there is any possibility of such interference or damage, the Contractor shall make satisfactory arrangements with responsible officers or with the owners of the utilities or plants, covering the necessary precautions to be used as safeguards during the performance of the work by the Contractor. Such arrangement shall be made before the work is started and shall be subject to the approval of the Engineer, which approval will not be considered as releasing the Contractor from any responsibility for the acts of himself or his employees or representatives.
- B. The Contractor shall protect all land monuments and property markers which will be affected by the construction until they have been correctly referenced. Monuments and markers which are disturbed by the Contractor during the construction of the Project or otherwise, shall be satisfactorily reset by him when directed.
 - 1. Pennsylvania One Call: If public or privately owned utility pipelines, cables or structures exist below the surface within the construction area, no sub-surface work shall be done in the area without the presence or approval of an authorized representative of the utility company or agency having jurisdiction.
 - 2. Attention is directed to the provisions of the Underground Utility Line Protection Law Act No. 287 (1974), as amended, and full compliance therewith is required of the Contractor.
 - 3. The Contractor shall not proceed with construction operations in any work area where subsurface utility pipelines, cables or structures may exist until he has:
 - a. Notified the facility owners through the One Call System (1-800-242-1776) not less than 3 or more than 10 working days prior to excavation.
 - b. Determined from the owners of such and by use of other prudent techniques the precise locations of such pipelines, cables or structures.
 - c. Made necessary arrangements with said owners for, and has had the locations of the existing pipelines, cables or structures shown on the surfaces by painted markings (or with wood stakes in earth surfaces) and also the kind of utility pipeline, cable or structure shown by painted markings (or markings on wood stakes in earth surfaces).
 - d. Maintained such painted markings and stakes until such time as the work in the area has been completed, and renewed such markings whenever deemed necessary by the Engineer during the maintenance period.
 - e. Otherwise complied with the requirements of Act No. 287 (1974) as amended.

2.12 SAFETY REQUIREMENTS.

- A. The Contractor is solely responsible for implementing any and all safety requirements.

- B. The Contractor shall furnish, erect and maintain at closures, intersections and throughout the Project, all necessary approved barricades, suitable and sufficient red lights, approved reflectors, danger signals, warning, and closure signs, provide a sufficient number of watchmen and take all necessary and legal precautions for the protection of the work and safety of the public. All barricades, danger signals, warning signs and obstructions shall be illuminated at night and all lights shall be kept operational from sunset until sunrise. All materials and safety devices (i.e., barricades, flashing warning lights, torches, reflectors and signs) which the Contractor provides for the purpose of protecting the work and the safety of the public and for maintaining and protecting traffic shall conform to the requirements specified in Section 901 of the current edition of the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, as supplemented and to the requirements specified in the current edition of PA Code Title 67, Transportation Chapter 203 - Work Zone Traffic Control which complements Section 901.
- C. If, and when the use of explosives is necessary for the prosecution of the work, the Contractor shall observe the utmost care, so as not to endanger life or property. All explosives shall be stored in a secure and safe manner in strict conformity to all State and local regulations, and all such storage shall be clearly marked "DANGEROUS EXPLOSIVES", and shall be in care of a competent watchman at all times. A "Blasting Activity Permit" must be obtained through the DEP agency's Bureau of Mining Programs and submitted to the Township.
- D. The safety provisions or applicable laws, and regulations of the Pennsylvania Department of Labor and Industry, and building and construction codes shall be observed. Machinery, equipment, and other hazards shall be guarded in accordance with the safety provisions of the "Manual of Accident Prevention in Construction", published by the Associated General Contractors of America, to the extent that such provisions are not in contradiction of applicable state and local laws.
- Observance of, and compliance with, said regulations shall be solely and without qualification, the responsibility of the Contractor, without any responsibility whatsoever on the part of the Township or Engineer. The duty of enforcing such laws and regulations lies with the said Department, not with the Township or Engineer.
- E. The provisions of the "OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970" of the U.S. Department of Labor shall be complied with in the performance of all work. Observance of, and compliance with, said Act shall be solely and without qualification the responsibility of the Contractor, without reliance on superintendence of, or direction by, the Township or Engineer. The duty of enforcement of the provisions of the Act lies with the U.S. Department of Labor, not with the Township or Engineer.
- F. Confined Spaces: The Contractor is hereby advised that confined space entry may be required in the performance of this work. No confined spaces shall be entered by Contractor personnel until Contractor written confined space entry procedures are developed for the Project in accordance with the provisions contained within 29 CFR 1910.146 Permit Required Confined Spaces - effective April 15, 1993. These

procedures require the identification of potential hazards, safety precautions, protective equipment requirements [29 CFR 1910.132 (d)] and rescue procedures [29 CFR 1910.146 App F]. If respiratory protection is required for entry, the Contractor shall have a written respiratory protection program in effect and which defines attendant responsibilities, communication procedures and safety equipment utilization [29 CFR 1910.134 (c)].

2.13 REGULATIONS OF THE DEPARTMENT OF LABOR AND INDUSTRY

- A. The regulations of the Pennsylvania Department of Labor and Industry relating to wage scales, trenches and excavations, tunnel construction, equipment, materials, labor, safety, sanitation, and other regulations on which the Contractor shall be fully informed and with which he shall fully comply. Observance of and compliance with said regulations shall be solely and without qualification, the responsibility of the Contractor, without reliance or superintendence of, or direction by, the Township or Engineer. The duty of enforcing such laws and regulations lies with the said Department.

2.14 REGULATIONS AND REQUIREMENTS OF THE DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP)

- A. 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.

2.15 OBSERVANCE OF LAWS

- A. 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 authority or jurisdiction over the work, materials, equipment, employees or the Contract; such observance and compliance shall be solely and without reliance on superintendence or direction by the Township or Engineer. The duty of enforcement of all of said laws, ordinances, regulations, orders or decrees lies with the body or agency promulgating them, not with Township or Engineer.

2.16 CLEANING SITE

- A. The Contractor shall at all times keep the Project Site free from accumulations of waste material or rubbish caused by the work. Before the work will be considered as having been completed, the Contractor shall clean and remove from the Project and adjacent property, all surplus and discarded materials, equipment and temporary structures. The Contractor shall also restore all cultivated lawns and shrubbery which he may have damaged in the course of construction.

2.17 ENGINEER'S DUTIES, EXAMINATION AND INSPECTION

- A. The work shall at all times be subject to the examination and inspection of the Engineer and his authorized assistants, who shall have free access to the work, and be furnished by the Contractor with every reasonable facility for examination of the work, to the extent of uncovering, testing or removing finished portions thereof. The Contractor shall provide all labor and equipment necessary for such examinations. The Engineer may require the Contractor to uncover for examination, or to remove any work done or placed in violation or disregard of instructions issued to the Contractor by the Engineer or his representative.
- B. The Engineer will not perform or be responsible for any hiring, firing, supervision, superintendence, direction of personnel, use of equipment, construction site safety, safety programs or the direction of the manner of methods of construction employed by the contractors, their subcontractors, agents, servants or employees.
- C. All inspections and tests shall be performed without unnecessarily delaying the work. All material and workmanship, if not otherwise designated by the Specifications shall be subject to inspection, examination and test by the Engineer or his duly authorized representatives. The Engineer shall have the right to reject defective material or workmanship, or require its correction. Rejected workmanship shall be satisfactorily replaced with proper material and the Contractor shall promptly segregate and remove rejected material from the premises. If the Specifications, the Engineer's instructions, laws, ordinances, or any public authority require the work to be specially tested or approved, the Contractor shall give the Engineer timely notice of its readiness for inspection.
- D. The Engineer shall, within a reasonable time after presentation to him, determine all questions in relation to the construction of the Project, and in all cases decide every question which may arise relative to the performance of the work covered by the Contract.
- E. The Engineer shall have full authority to decide all questions which may arise under the Contract relative to the quality and acceptability of materials furnished and the manner, rate of progress, quality and acceptability of work performed, and the interpretation of any or all Plans and Specifications.
- F. Any verbal opinion or suggestion which the Engineer may give the Contractor shall in no way be construed as binding the Township in any way.
- G. In case of any dispute relative to the quality of materials or work, the Engineer shall have authority to reject materials and to advise the Township to suspend the work. He shall not be authorized to revoke, alter, enlarge, relax or release any requirements of the Specifications, nor to approve or accept any portion of the work, or issue instructions contrary to the Specifications.
- H. Within ten (10) working days after the Developer notifies the Township in writing that the collection system has been completed and is ready for final inspection, the

Township, or the Township ' s agent, shall begin to inspect the collection system in order to verify that the system has been completed in accordance with the approved plans and Specifications. The costs incurred in performing the inspection and testing will be the responsibility of the Developer. The Developer agrees that all defects, problems, damages, or items of poor workmanship that may be found as a result of the inspection, field testing or by any other manner or means, shall be repaired by the Developer in proper manner under the direction and inspection of the Township ' s representative prior to acceptance by the Township. After the acceptance of the sewers, the Township will issue the required connection permits.

2.18 DEFECTIVE WORK

- A. When any material not conforming to the requirements of the Specifications and Drawings, has been delivered upon the Site of the Project, or incorporated in the work, or when any work performed is of inferior quality, such material or work shall be considered as defective and shall be immediately removed and renewed or made satisfactory as directed by the Engineer. Failure or neglect on the part of the Engineer to condemn or reject any bad or inferior work or materials, shall not be construed as to imply an acceptance of such work or materials, if such bad or inferior material or work becomes evident at any time prior to the delivery of the Completion Certificate by the Township to the Developer.
- B. The Contractor shall remove any work or material condemned, and shall rebuild and replace the same.
- C. The Contractor shall promptly move from the premises all materials condemned by the Engineer as failing to conform to the Specifications, whether incorporated in the structure or not, and the Contractor shall promptly replace his own work in accordance with the Contract.

2.19 NOTICE

- A. The service of any notice, by the Township or Engineer to the Developer or Contractor, shall be considered accomplished upon completion of any one of the following procedures.
 - 1. When delivered, in writing, to the person in charge of the office used by the addressee to conduct business;
 - 2. When delivered, in writing, to the addressee or any of his authorized agents in person;
 - 3. When delivered, in writing, to the addressee or any of his agents at the office used by the addressee to conduct the business of the Contractor at or near the Site of the work;
 - 4. When deposited in the United States Mail, postpaid, and addressed to the party intended for such service at his office used for conducting the business of the Contract at the Site of the work, or his last known place of business; or Company and addressed to the party intended for such service at his last known place of business or for conduction the business of the Contract at the Site of the work.

2.20 ENGINEERING STAKES/PROJECT BENCH MARK

- A. The Contractor shall furnish, set and maintain without cost to the Township, suitable stakes, grade boards, temporary structures, templates, and other materials for establishing and maintaining points, marks, and lines. The Contractor shall be held responsible for the preservation of all stakes and marks. Provide a level and rod for use by the Township to verify accuracy of installation. The project bench mark shall be set within the project area for use by the Engineer.

2.21 INSURANCE AND INDEMNITY REQUIREMENTS

- A. The Developer shall not commence work until all protections required under this section are in full effect and verified to the satisfaction of the Township.
1. Duties of The Developer. Four (4) copies of the original certificates shall be prepared as indicated in the following subparagraphs and forwarded to the Engineer. In addition, the Township or its representative shall have the right to reject any form of security which does not meet nationally recognized standards for financial strength as indicated below. Contractors and subcontractors shall satisfy all conditions to the same extent unless otherwise specified herein. Protections as described shall be maintained until work in connection with the Project has been accepted by the Township. In the case of wrap up policies or claims made policies, coverages shall be maintained for a minimum of two years after the project has been completed.
 2. Coverages to be Maintained by the Developer. The insurance types to be provided are General Liability, Automobile Liability, and Workers' Compensation, and Railroad Protective Liability when Contract includes work on, under or adjacent to Railroad rights-of-way or properties. The minimum specific insurance coverages, and minimum limits of liability carried by the Developer and/or his Contractors and Subcontractors, shall be as follows:

<u>TYPE OF INSURANCE</u>		<u>LIMITS OF LIABILITY</u>
(1) COMMERCIAL GENERAL LIABILITY		
Insured: Contractor or Developer		
Additional Insureds: Upper Allen Township, GHD, Inc., and C.S. Davidson, Inc.		
Required Submission: Certificate, four copies		
	<u>Each Occurrence</u>	<u>Aggregate</u>
Premises-Operations	<u>*General Aggregate</u>	\$2,000,000
Explosion and Collapse Hazard	<u>Product-Completed</u>	
Underground Hazard	<u>Operations Aggregate</u>	\$1,000,000
Contractual Insurance	<u>Bodily Injury and Property</u>	
Broad Form Property Damage	<u>Damage - Combined</u>	\$1,000,000
Independent Contractors		

Personal and Advertising Injury Advertising Injury \$1,000,000

*General Liability "General Aggregate" limit with a minimum \$2,000,000
amended by Endorsement (CG2503) to apply on a "Per Project" Basis.

(2) AUTOMOBILE LIABILITY

Insured: Contractor or Developer

Additional Insureds: Upper Allen Township, GHD, Inc., and C.S. Davidson, Inc.

Required Submission: Certificate, four copies

		<u>Each Person</u>	<u>Each Accident</u>
Any Auto	Bodily Injury	\$ 500,000	\$1,000,000
	Property Damage		\$500,000
	OR		
	Bodily Injury and Property Damage		\$1,000,000
			Combined Single Limit

(3) EXCESS LIABILITY

Insured: Contractor or Developer

Additional Insureds: Upper Allen Township, GHD, Inc. and C.S. Davidson, Inc.

Required Submission: Certificate, four copies

Umbrella, Following Form - Excess liability forms may be used to satisfy "Limit Requirements" shown under General Liability, Automobile Liability and Workers' Compensation coverages as long as it meets all requirements of this Article 2.21 paragraphs (a), (b), (d) and (f).

(4) WORKER'S COMPENSATION

Insured: Contractor or Developer

Required Submission: Certificate, four copies

Coverage A (Statutory) - Sufficient limits and endorsements to discharge obligations under all applicable WC Laws, USL&H Act, the Jones Act and Admiralty or Maritime Law.

Coverage B (Employers' Liability) - \$500,000 (Each Accident)
\$500,000 (Disease - Policy Limit)
\$500,000 (Disease - Each Employee)

-
3. Certificate Preparation. The Contractor's Insurance provider shall prepare Insurance Certificates for the coverages listed previously, provide the quantity of copies as stated previously, show the following the Certificates:

OWNER: UPPER ALLEN TOWNSHIP
100 Gettysburg Pike
Mechanicsburg, PA 17055-5698

ENGINEER: GHD, Inc.
1240 North Mountain Road
Harrisburg, PA 17112
and/or
C.S. Davidson, Inc.
50 West Middle Street
Gettysburg, PA 17325

PROJECT NAME: SANITARY SEWER SYSTEM EXTENSIONS

4. Coverage Modifications Which Shall be Obtained: Township and Engineer and each of their Officers, Agents and Employees shall be named as additional insureds with respect to all work performed in connection with this Project. This applies to General Liability, Automobile Liability and Railroad Protective Liability coverages.
 - a. Township shall be notified by Registered United States Mail thirty (30) days in advance of any cancellation or any material change resulting in the elimination or reduction of any protection.
 - b. Waiver of Subrogation in favor of the Township and Engineer and each of their Officers, Agents, and Employees applying to all Workers' Compensation coverages shall be provided by the Developer unless not permitted by laws of the state in which this Agreement applies.
5. Indemnification of Township and Engineer by Developer: Developer is responsible for all liabilities and duties assumed by Developer including but not limited to the indemnity liability in the Agreement between Township and Developer and the provisions of this subparagraph (d) and shall provide such protections for the Township and Engineer whether or not such claims, losses, liabilities or expenses are covered by insurance.
 - a. The Developer shall at all times, indemnify and save harmless the Township and Engineer, of and from all claims of whatsoever nature, including without limitation claims which may be made by any of the employees of the Developer or by any employees of any Contractor or Subcontractor to whom the Developer may have let the performance of any part of the work and the Developer will appear for and defend the Township and Engineer against any and all such claims.
 - b. The status of the Developer in the work to be performed by him is that of an Independent Contractor and as such he shall properly safeguard against any and all personal injury including death, or damage to the public, to public and private property, materials and things; and as such, he alone shall be responsible for any and all damage, loss or injury to persons or property that may arise, or be incurred, in or during the conduct or progress of said work without regard to whether or not the Developer, Contractor, his Subcontractors, Agents, or Employees have been negligent; and the Developer shall keep the

Township and Engineer indemnified from and discharged of, and from any and all responsibility and liability for risks and casualties of every description, as provided in the Agreement between the Township and Developer.

- c. The Developer shall assume and be liable for all blame and loss of whatsoever nature by reason of neglect or violation of any federal, state, county, or local laws, regulations or ordinances.
- 6. Minimum Standards of Financial Strength and Policyholder Service Required of Insurance Carriers Providing Coverage for the Work:
 - a. Insurance Companies used shall be admitted carriers authorized to transact business in the Commonwealth of Pennsylvania unless Township is notified and waives this requirement.
 - b. Insurance Companies used shall be rated (A 10) or better by Best's Rating Service unless Township is notified and waives this requirement.

2.22 FEE REQUIREMENTS

- A. The Developer must enter into a Sewer Extension Agreement with the Township and as such shall be required to deposit with the Township the following fees applicable to the sewer extension.
 - 1. Township/Legal Review Fees: Deposit with the Township the sum of \$1,000.00 or an amount as determined by the Township Engineer, to be held in escrow by the Township, with no interest, which amount shall be used by the Township to defray the following costs chargeable to the Township in the performance of the Agreement:
 - a. The charges of the Engineer for examination and review of all detailed plans, permit applications and planning modules, hereinafter collectively referred to as "permit documents," for the proposed extension to the sanitary sewage collection system of the Township.
 - b. The charges incurred in filing of said permit documents and in securing approvals thereof, exclusive of any permit fees. Such permit fees shall be paid by the Developer as indicated below.
 - c. The initial deposit of \$1,000.00 shall be remitted with the first submission of documents to the Township for review. Additional fees in \$1,000.00 increments shall be remitted to the Township when requested as the review continues. Any balance remaining after the review is complete will be deposited in the escrow account described below.
 - 2. Inspection and Project Administration Fees: When the sewer extension is approved for construction, the Developer will be required to deposit with the Township an amount of money as determined by the Township Engineer, to be held in escrow by the Township, with no interest, which amount shall be used by the Township to defray the costs of inspection and project administration chargeable to the Township in the performance of the Agreement, as follows:
 - a. All on-site inspection, shop drawing review and other project and construction related activities incorporated in the permit documents. The initial amount of the escrow account shall be ten percent (10%) of the estimated cost of the sanitary sewer improvements, said cost based upon Pennsylvania Prevailing

Wage Rates and the Engineer's certified construction cost estimate- as approved by the Township, or \$500.00, whichever is greater.

- b. Legal and administrative expenses incurred in connection with the Agreement.
 - c. Additional charges incurred in connection with Township or legal review of the permit documents.
3. DEP Permit Application Filing Fee: A fee of \$100.00 (or such other fee as required by DEP) shall accompany the permit application to DEP, when required. The check shall be made payable to Pennsylvania Department of Environmental Protection.
- B. Should the total funds deposited in the escrow accounts listed above exceed the actual cost to the Township of said specified charges and fees, the balance remaining upon the completion of the project shall be refunded in full to the Developer; but should said deposit be insufficient in the above respect, the Developer shall pay the deficiency or expected deficiency to the Township upon demand. Upon such demand, the Township shall stop work on the project until said deficiency or expected deficiency has been paid to the Township by the Developer.

2.23 ITEMS REQUIRED PRIOR TO BEGINNING CONSTRUCTION

- A. Executed Sewer Extension Agreement with the Township.
- B. Preliminary plan approval.
- C. Financial security to assure completion of the sewer extension and to cover the warranty period. The sanitary sewer installation financial security amount will be 110% of the approved/certified construction cost estimate.
 - 1. Should sanitary sewer construction begin prior to recording of the final plan as approved by the Township Board of Commissioners, financial security shall be in an amount equal to 110% of the remaining construction costs as determined by the Engineer.
 - 2. Should the financial security be deemed unsatisfactory or become unacceptable to the Township at any time, the Developer shall, upon written notice of the Township, promptly furnish acceptable or substitute security as may be required to protect the interests of the Township or of persons supplying services (including rental of equipment), labor, or materials in the prosecution of the work under the Sewer Extension Agreement.
- D. Receipt of a letter from the Developer stating the name of the Contractor who will be installing the sanitary sewer extension.
- E. Certificates of public liability and property damage, auto liability and worker's compensation insurance. The Township and Engineer shall be certificate holders and shall be named by endorsement as additional insureds.
- F. Receipt from the Township of a copy of the Planning Exemption letter or Water Quality Management Permit issued by DEP, as applicable.

- G. Receipt from the Township of the PennDOT Highway Occupancy Permit, if applicable.
- H. Approved Erosion and Sedimentation Control Plan from Cumberland County Conservation District.
- I. Receipt by the Township of a copy of any agreements with other utilities, railways, etc. when crossing and occupying their easements with new sanitary sewer facilities.
- J. Blasting Permit, if needed.
- K. A list of suppliers for the materials to be used in the sanitary sewer construction.
- L. Shop drawings of manhole bases, manhole risers, manhole frames and covers, pipe and other necessary construction materials approved by the Township.
- M. Certification from the pipe manufacturer that the pipe meets or exceeds the requirements of the Township's Standard Specifications.
- N. Written approval by the Township to proceed with construction.
- O. A pre-construction meeting must be set up and held by Contractor with the Engineer and their representatives present.

2.24 ITEMS REQUIRED FOLLOWING COMPLETION OF CONSTRUCTION

- A. Upon completion, inspection, and testing of the sanitary sewer extension to the satisfaction of the Township, Developer shall cause to be prepared, and shall deliver for review and approval, record drawings, final plats and legal descriptions, a deed of dedication transferring ownership of the sanitary sewer extension to the Township and an easement agreement conveying limited rights of access to sanitary sewers located on non-Township owned property or outside of Township rights-of-way.
- B. Upon acceptance of above documents by the Township, including receipt of an executed deed of dedication and easement agreement from Developer, and recording of the deed of dedication and easement agreement by Developer at the Cumberland County Office of the Recorder of Deeds, the Township will release the developer from all obligations to the Township with respect to the extension, except that Developer shall furnish financial security guaranteeing the sanitary sewer installation/improvements, including materials and workmanship, for a period of 18 months from the date of recording of the executed deed of dedication and easement agreement. For work completed within PennDOT right-of-ways, or where on-site suitable native backfill material was approved for installation, Developer must provide additional financial security for a period of three-and-one-half years, prior to and in addition to the standard 18 month guarantee or maintenance financial security.

2.25 STEEL PRODUCTS PROCUREMENT ACT

- A. Special attention is drawn to the provisions of the Commonwealth of Pennsylvania "Steel Products Procurement Act" - Act No. 3 of 1978, as amended by Act No. 1982-161 and Act No. 1984-144 and subsequent amendments (73 P.S. 1881 et seq). The Township affirms its compliance with the Act. The Developer is advised that only steel products as defined in said Act (which includes cast iron in the definition of steel products) shall be used or supplied in the performance of the contract for public works or any subcontracts thereunder.

2.26 PROCEDURES FOR SUBMISSIONS

- A. Preliminary Subdivision Plans Submissions: At the time of submission of preliminary plans for the subdivision to the Township, complete the necessary documents and submit them as well to the Township for review. Any documents requiring corrections will be returned to the Developer for correction and re-submission. Each time a submission is made to the Township, two copies shall be provided. The required documents are as follows:
 - 1. Contract Drawings and Township review fee. If the sanitary sewer extension is part of a larger project, those sections of the project specifications dealing with the sanitary sewer extensions shall be submitted.
 - 2. Copies of the Pennsylvania Department of Environmental Protection (DEP) Planning Modules, Components II and IV, and a copy of DEP 's approval of Components II and IV.
 - 3. DEP Sewerage Permit Application form (Bureau of Water Quality Management), if necessary, Erosion and Sediment Pollution Control Plan and Narrative, and filing fee.
 - 4. Any other permit or license applications required to be in the Township 's name, including associated documents and fees.
 - 5. If the above documents meet the approval of the Township, the Developer will be so notified. The Developer will then be required to furnish the filing fee and additional copies of documents as may be required for submission to the permitting agency.
- B. The Developer may elect to submit the Contract Drawings (with Township review fee) for preliminary review and approval prior to completion of the required permit applications.

2.27 CONTRACT DRAWINGS - DEVELOPER SUBMISSION

- A. General Requirements: Submit two (2) copies of drawings for review. After review of the drawings, make any corrections required and re-submit two (2) corrected copies. Once the review process is complete and Township approval has been granted, four (4) copies of the approved drawings must be submitted to Township. All drawings shall be at a scale such that all features and notations are clearly legible. A minimum scale of 1" = 50' is acceptable; however, a scale of 1" = 40' is preferred.
 - 1. Sheet Size: 24-inches or 30-inches by 36-inches.

2. Elevations and coordinates shown on the drawings shall be based on the PA South State Plane coordinate system with a horizontal datum of NAD83 and a vertical datum of NAVD88.
3. Benchmark(s) and monument(s) should be labeled and located on drawings.
4. Survey information should generally include the following:
 - a. Two (2) foot contours, labeled. Engineer may require one (1) foot contours.
 - b. Street names and State road numbers. (Segment and Offsets)
 - c. Public street and easement rights-of-way widths.
 - d. Existing underground and above ground utilities and appurtenances including waterlines, sanitary sewer lines, storm sewer lines, gas lines, and overhead, guy wires and underground electric, telephone and TV cable lines. (all existing underground utilities)
 - e. Storm sewers and appurtenances including sizes, types, top and invert elevations.
 - f. New and existing sanitary sewer sizes, types; and, manhole diameters and rim and invert in (all) and out elevations (including drops).
 - g. Water valve box top, operation nut elevation and bottom elevations. (if possible).
 - h. Utility pole locations and identifications numbers.
 - i. Adjacent building locations, address and description (house, shed, garage, gazebo, barn etc.).
 - j. Existing sanitary sewer lateral cleanout and/or vent locations. Water services (curb stops and valves).
 - k. Pertinent features including curbs, sidewalks, driveways, retaining walls, signs, affected trees, etc.
 - l. Creek, streams, swales etc.
5. Include the following notes on the Drawings, where applicable:
 - a. All sanitary sewer construction methods and materials shall conform to the latest standards of the Upper Allen Township Standard Construction and Materials Specifications for the Sanitary Sewer System and shall be subject of approval by the Township Engineer. Any construction methods or specifications not shown on the Drawings and not specified by Upper Allen Township shall be in accordance with PennDOT specifications – Publication 408, and Construction Standards – Publication 72, current edition.
 - b. Proposed sanitary sewer mains located in public streets will be offered for dedication to Upper Allen Township.
 - c. A note regarding PA DEP planning exemption or permit status should be provided for sanitary sewer extensions.
 - d. All sanitary sewers constructed in public streets shall be subject to backfill compaction testing at the Developer's expense.
 - e. A minimum 10-foot horizontal separation and 18-inch vertical separation shall be maintained between waterlines and sanitary sewer lines whenever possible.
 - f. Developer grants to Upper Allen Township (Township) temporary easements in connection with any sanitary sewer mains, manholes and appurtenances constructed within public streets, until such time that construction of said streets is completed and streets are dedicated to the Township. The purpose of the temporary easements is to permit Township to make emergency or other

- repairs to the sanitary sewer system, if necessary, until such time as Township has accepted the streets and Deed(s) of Dedication for the same.
- g. Pipe lengths shown on the profile drawings represents distance from center to center of manhole; pipe slope shown on the profiles is calculated based on distance from inside face of manhole to inside face of manhole.
 - h. Lots may be served with gravity basement service provided the installation is in accordance with “Chapter 200 – Sewers” of the Township Code.
6. Standard Sanitary Sewer Detail Drawings are included in these Specifications. Applicable Standard Sanitary Sewer Detail drawings are also to be included as a part of the Developer’s approved Drawings.
 7. Bind drawings in sets and number them consecutively, when applicable.
 8. Include on the drawings a list of Act 287 (as amended) users. The list of Act 287 users may be obtained from the Cumberland County Recorder of Deeds, and shall include the name, address, phone number, email address, and person to contact of each utility maintaining facilities in the area of the proposed extension.
 9. All main sewers shall have a minimum of five (5) feet of cover unless otherwise approved in writing by the Engineer.
- B. Indicate on the drawings the following general items:
1. Name of the Design Engineer/Surveyor.
 2. Seal of the Design Engineer/Surveyor.
 3. Signature of the Design Engineer/Surveyor.
 4. Name of the development and the owners.
 5. Original date of Drawings along with any revision dates.
 6. Indicate by note on the Index Map(s) or Plan and Profile sheet(s) the Water Quality Management Permit Number of the existing facility that the proposed sewers are connecting into.
- C. Include the following in the Developer submission contract drawings:
1. Location Plan: Showing approximate area of the municipality in which the project is located. No particular scale is required.
 2. Index Map(s): Drawn to a scale of no less than 1-inch equals 500-feet and having the following items included thereon:
 - a. Sewer sizes other than 8-inch sewers.
 - b. Name of each street.
 - c. Number designation of each manhole. Contact Township Sewer Department ~~Engineer~~ to coordinate manhole numbering system.
 - d. Development phase delineation.
 3. Manhole Location Coordinates: Table showing northing and easting coordinates for manhole locations.
 4. Plan and Profile Sheets: Plan View drawn to a scale of 1-inch equals 50-feet (minimum) and Profile View drawn to a horizontal scale of 1-inch equals 50-feet (minimum) and a vertical scale of 1-inch equals 10-feet, or 1-inch equals 5-feet; a horizontal scale of 1-inch equals 40 feet shall be provided in the Plan View and Profile View whenever possible.- The following items are to be included on the Plan and Profile sheets, as applicable:

- a. Location of each existing or proposed building with elevation of the existing or proposed basement (Plan View). If proposed basement elevations are not known, the drawings shall include a note stating which lots are not intended to be provided with gravity basement drainage.
- b. Top elevations of manholes (Profile View).
- c. Sewer mainline invert in (all pipes) and invert out elevations of for each manholes (Profile View), based on chart below:

<u>SLOPE*</u>	<u>DROP (in feet)</u>
0 to 4%	0.10
4.01 to 8%	0.33
8.01 to 12%	0.50
12.01 to 20%	0.75
> 20%	1.00

* Should the mainline pipe into and out of the manhole not fall within the same slope criteria then the run with the greater slope will be used to determine the drop across the manhole.

- d. Manhole invert elevations having 24 inches or greater difference between influent and effluent shall require construction of an inside drop connection system. Manholes which require an inside drop connection system shall be a minimum of five (5) feet in diameter. Five (5) foot or greater diameter manholes must be noted on the Profile View.
- e. Manholes with the flow angle being less than 90 degrees shall be a five (5) foot diameter manhole.
- f. All manholes shall be a minimum of four (4) foot diameter and have a minimum 6-inch anti-flotation ring or toe.
- g. Manhole numbers corresponding to those on Index Map (Plan View and Profile View). Numbering system to be provided by Township Sewer Department.
- h. Distance between manholes representing distance from center of manhole to center of manhole (Profile View).
- i. Grade of proposed sewer, must represent the pipe slope calculated based on using the distance from inside face of manhole to inside face of manhole (Profile View).
- j. Flow direction arrows (Plan View).
- k. Size of proposed sewer (Profile View).
- l. Material of proposed sewer (Profile View).
- m. Location, size and elevation of all existing and proposed underground utilities (Plan View and Profile View).
- n. Labeled horizontal and vertical grid lines (Profile View)
- o. The permit number and permittee of the existing receiving sewer (Plan View).
- p. Rights-of-way limits (Plan View).
- q. Sewers installed at a depth greater than 20 feet shall be made of C-900 DR-25/165 PSI PVC pipe, or Class 52 epoxy lined ductile iron pipe with Field Lok gaskets, as shown on the approved Drawings or as directed and approved by the Engineer.

- r. For sewers installed in fill areas, a note should be placed on the drawings indicating that the “fill shall be compacted to a minimum of 95% of ASTM D698 Standard Proctor.” The Township may request, at Developers expense, testing data to verify that at the invert elevation of the sewer main the compaction requirements have been met. Any sewers located in fill are to be constructed of ductile iron pipe and have Field Lok gaskets.
 - s. Service Connection/Lateral Locations:
 - i. The measurement to locate the sanitary wye branch is the horizontal distance measured along the centerline of the main sewer from the center of the downstream manhole to the center of sanitary wye branch.
 - ii. The measurements necessary to locate the upper free end of the service laterals are:
 - a) The horizontal distance from the center line of the main sewer to the end of the service connection.
 - b) The depth from the ground surface to the invert of the service connection.
 - iii. Laterals shall be installed at right angles to the main where possible.
 - iv. Connections to manholes are not permissible without Engineer’s approval. If approval is granted, invert in elevation will be three tenths (0.3) of a foot above the invert out elevation.
 - v. A note should be included indicating that no laterals shall be placed in driveways, sidewalks, less than 10 feet from a water service, and less than 15 feet from any street tree planting.
- D. Record Drawings: Before Sewer Connection Permits will be issued and the work will be accepted by the Township, submit record (as-built) drawings consisting of two (2) sets of paper prints and one (1) set of Mylar reproducible of all working drawing modifications as necessary to show the facilities as constructed, consisting of pipe sizes and slopes, horizontal and vertical location, manhole rim and pipe invert elevations, location (station), length, size and depth of laterals, and coordinate location of cleanouts, vaults, reconnection fittings and other appurtenances. Additionally, submit a certified copy of the associated electronic drawing data file which shall be in both PDF and AutoCAD format (release date no older than five years from date of submittal), in a format such that the horizontal datum is “NAD 83 PA South Zone” and vertical datum is “NAVD 88”.
- 1. Submit a certificate from the Developer’s engineer with the record drawing submittals attesting to the correctness of all information shown on the Drawings. It is the Township’s intent to utilize Record Drawings to provide information to designers and contractors as required by the Commonwealth of Pennsylvania Act 287 (as amended).

END OF SECTION

SECTION 01010 – SUMMARY OF WORK

PART 1 GENERAL

1.01 SITE LOCATION

- A. Project locations will be in Upper Allen Township, Cumberland County, Pennsylvania.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. Without intending to limit or restrict the extent of the Developer/Contractor work required under these Specifications, the work generally comprises construction of extensions to the existing wastewater collection systems in accordance with these Standard Construction and Material Specifications and the Sewer Detail Drawings bound herein.
- B. The Standard Construction and Material Specifications for Sanitary Sewer System Extensions manual may be purchased from Upper Allen Township for a fee which is set annually by the Board of Commissioners in the Township's Schedule of Fees.
- C. Sewer Detail Drawings: The Sewer Detail Drawings, listed under Part 4 in the Table of Contents, represent the standards of construction for the Upper Allen Township sanitary sewer system, and are found at the end of this manual.

1.03 PRELIMINARY REQUIREMENTS

- A. Consultant: Before any work is started, the Developer shall ascertain from the Township whether or not the latter intends to employ a consultant as Engineer for the Project. If the Township indicates that no Engineer will be employed, the word "Township" is substituted for the word "Engineer" throughout these Specifications, and the Developer and Contractor shall be guided accordingly.
- B. Street Regulatory Requirements: Where sewers are to be installed within the limits of existing streets, all removal and protection of street paving, backfilling of trenches, temporary and permanent replacement of street paving, restoration of shoulders and the maintenance and protection of traffic will be performed in strict conformance with the requirements of Upper Allen Township, other governing municipalities in the immediate vicinity, or the Commonwealth of Pennsylvania Department of Transportation, all as applicable.
 - 1. The cost of inspection by personnel of the Commonwealth of Pennsylvania Department of Transportation shall be paid for by the Developer.
 - 2. Perform work within the rights-of-way of State Highways in accordance with the requirements of the latest edition of the Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 459, Occupancy of Highways by Utilities. These referenced Regulations are made a part of these Specifications.

- C. DEP Regulations and Requirements: The Contractor and Developer will be required to conduct their work in complete compliance with all of the rules, regulations and requirements of the Pennsylvania Department of Environmental Protection (DEP). The DEP Domestic Wastewater Facilities Manual is available at:

Chief, Permits Section
Pennsylvania Department of Environmental Protection
Bureau of Water Quality Protection
RCSOB 11th Floor
P.O. Box 8774
Harrisburg, PA 17105-8774

Or on the web at:

<http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-106697/362-0300-001.pdf>

- D. House or Building Sewer Requirements: House or building sewers extend from the 6-inch two-way cleanout (test/observation tee) at the end of the Township owned sewer lateral to the required 4-inch or 6-inch two-way cleanout located within three (3) feet of the house or building.
1. Construction of house or building sewers shall be in accordance with these Upper Allen Township Construction and Material Specifications and Standard Detail Drawings included herein.
 2. Inspection and testing of house or building sewers shall be scheduled with the Township with a minimum of 24-hours notice, and inspections shall occur prior to backfilling and testing.
 3. Testing of building sewers shall be in accordance with these specifications.
- E. Sewer Locations: New sewers shall be located in streets and paved areas to the maximum extent possible, where feasible, to facilitate access for maintenance purposes. In addition, sanitary sewer manholes shall be located outside of the travelled tire path on streets to the maximum extent possible. If sewers must be located on private property, rights-of-way of at least 30 feet wide centered on the sewer shall be dedicated from the Developer to the Township.
1. Surface stabilization shall be provided for unpaved sewer rights-of-way, at locations determined by the Engineer, in accordance with the SURFACE STABILIZATION FOR SANITARY SEWERS LOCATED IN UNPAVED AREAS Sewer Detail Drawing.
 2. The Township will not grant final approval of the sanitary sewers for the project and will not grant approval to proceed with sanitary sewer construction until the Township is in receipt of plats, legal descriptions, and executed deeds of easement for the rights-of-way by the property owners.
- F. Unauthorized Connections to Sanitary Sewers: Stormwater and groundwater drainage, and all non-residential condensate lines and elevator pit sump connections.
1. 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.

2. The sanitary sewer system and all extensions are intended for and may only be used for conveying sanitary sewage.

- G. Two-Way Cleanout (Test/Observation Tee) Requirement: When a house or building sewer is repaired or replaced and reconnected to a lateral that does not contain a two-way cleanout, make the new connection to the lateral in accordance with the BUILDING SEWER DETAIL in these specifications.

1. Construct the two-way cleanout in accordance with the BUILDING SEWER DETAIL Sewer Detail Drawing.

1.04 PROJECT CONDITIONS

- A. Design Criteria: In addition to the design guidelines of the Pennsylvania Department of Environmental Protection (DEP), comply with the following:

1. Grade of Proposed Sewers: Minimum 0.50 percent on 8-inch mains and 1.0 percent on terminal manhole sewer runs.
2. Minimum Cover: Provide a minimum cover of five feet over the sanitary sewers measured from finished grade elevation.
3. Underground Utility Clearances:
 - a. Provide a minimum of 18-inches vertical clearance between sanitary sewers and domestic water supply lines. Provide a minimum clearance of 12-inches between sanitary sewers and other underground utilities.
 - b. Provide a minimum horizontal clearance of ten feet between sanitary sewers and other underground utilities. Provide a minimum horizontal clearance of five feet between the sanitary sewers and existing and proposed utility structures such as manholes, inlets, curbs, etc.

- B. DIP and Concrete Encasement Requirement: Wherever the sewer depth exceeds 20 feet, sewers are being constructed in fill areas, the required clearances between the sanitary sewer and domestic water supply lines or the minimum cover over the sanitary sewer cannot be provided, or the sewer must extend across a sinkhole that has been remediated, the sanitary sewer shall be run in cement-lined ductile iron pipe (DIP) and/or encased in concrete, as directed by the engineer.

1. Concrete encasements where required shall extend a minimum distance of ten feet on either side of the area of sub-standard clearance, minimum cover deficiency, or remediated sinkhole area.
2. Whenever concrete encasement of the sanitary sewer is required, the entire length of sewer between manholes shall be run in DIP, unless otherwise directed by the Engineer.
3. Whenever ductile iron pipe is required within 1,500 feet of a pumping station discharge, the pipe shall be cement-lined and fitted with an epoxy liner a minimum of 40 mils thick, as specified herein.

- C. Concrete Anchors: Whenever the sanitary sewer is constructed at a slope of greater than fifteen percent, concrete anchors shall be used at intervals identified by DEP. In

addition, these steep slope sewers will be constructed in accordance with the STEEP SLOPE (GREATER THAN 15%) SANITARY SEWER DETAIL drawing.

1. Where concrete anchors are required on the sanitary sewer the entire length of sewer between manholes shall be run in DIP.

END OF SECTION

SECTION 01300 - SUBMITTALS

PART 1 GENERAL

1.01 SUBMISSIONS REQUIRED

- A. General Requirements: Developer shall comply with the rules and regulations included in the Code of the Township of Upper Allen, Chapter 200, Sewers and Sewage Disposal. Those regulations are in addition to the requirements stated herein, and if in conflict, the Code shall prevail. The description under the SUBMITTALS Article in each Specifications Section indicates the type of submission required.
 - 1. Make each submission to the Township office unless otherwise directed by the Township.
- B. Definition: The term shop drawing used throughout this Section includes manufacturer's product data in the forms of descriptive literature, specifications and published detail drawings, and also Contractor prepared drawings, certified test records or reports and such other certificates required by the Specifications.

1.02 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. The Contractor will provide a schedule indicating the sequence of work and the estimated dates of completion; estimated dates for delivery of materials shall be included. Schedule shall be in the form of a bar chart.

1.03 SHOP DRAWINGS - CONTRACTOR SUBMISSION

- A. Submit shop drawings in electronic form with such promptness as to avoid delay in the work. If necessary, hard copies of shop drawings may be submitted in lieu of submission in electronic form.
- B. Each submission of shop drawings shall be accompanied by a letter of transmittal listing the items in the submission. Each shop drawing shall be marked with the name of the Project and the name of the Contractor and be numbered consecutively.
- C. When making a submission for approval, the Contractor shall do so with the understanding that he is considered to have checked the items in the shop drawing before submitting them and that he is satisfied that, in their present state, they not only meet the requirements of the Specifications, but will present no difficulties in erection and completing his Contract. The Contractor shall clearly note his approval on all shop drawings prior to their submission to the Engineer. Failure of the Contractor to note his approval will be reason for the Engineer to return such submission to the Contractor unchecked.
 - 1. If it appears that shop drawings submitted by the Contractor to the Engineer have not been properly checked, even though the Contractor's approval has been noted thereon, it will also be considered reason for the Engineer to return such submission to the Contractor unchecked.
 - 2. Markings, written or otherwise, made by the Contractor or by his suppliers or

manufacturers shall be made on the Submittal in a color other than red. RED is reserved for the exclusive use of the Engineer in marking Submittals.

- D. If shop drawings show variations from the Specifications requirements because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in his letter of submission in order that (if accepted) suitable action may be taken for proper adjustment in the Contract; otherwise the Contractor will not be relieved of the responsibility for executing the Work in accordance with the Specifications even though the shop drawings have been approved.
- E. The approval of shop drawings will be general and shall not relieve the Contractor from the responsibility for proper fitting and construction of the Work nor from furnishing materials and work required by the Specifications which may not be indicated on the shop drawings when approved.
- F. After review by the Engineer, shop drawings will be returned marked as follows:
Approved, Approved As Noted, Revise and Resubmit, Not Approved, or Action Not Required.
 - 1. Approved: When shop drawings are returned "Approved," that means the shop drawings have been found to be in conformance with the Specifications. The Engineer's approval of the shop drawings does not relieve the Contractor from responsibility for errors or discrepancies in such shop drawings.
 - 2. Approved As Noted: When shop drawings are returned "Approved As Noted" that means the shop drawings have been found to be in conformance with the Specifications, provided the changes noted by the Engineer are incorporated in the shop drawings. Shop drawings returned "Approved As Noted" will not require re-submission.
 - 3. Revise and Resubmit: When shop drawings are returned noted "Revise and Resubmit" that means the Contractor shall make the required corrections and resubmit corrected shop drawings to the Engineer.
 - 4. Not Approved: When shop drawings are returned "Not Approved" that means the Contractor shall make completely new shop drawings and submit to the Engineer for review.
 - 5. Action Not Required: When shop drawings are returned noted "Action Not Required" that means there is no action necessary for the Engineer on the submitted documents.

1.04 CERTIFICATIONS

- A. When required in individual Specifications sections, submit manufacturer's certificate, in triplicate, certifying that products meet or exceed specified requirements, and are installed in accordance with the Contract Documents and the manufacturer's instructions. Certifications will be executed by a responsible officer of the manufacturer and will be notarized. Certificates issued by agents, sales representatives, etc. will not be accepted.

END OF SECTION

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

- A. General Requirements: Provide for the following temporary facilities, controls and services at the worksite throughout the entire period of construction and until the work is completed and the new facilities are placed in control of the Township.

1.02 TEMPORARY CONTROLS AND PROTECTION

- A. Temporary Stormwater Control: The Contractor is responsible for maintaining temporary stormwater control as shown on the approved Cumberland County Conservation District stormwater management plan and as specified hereinafter. The means and methods the Contractor employs to meet the following requirements are at his discretion.
 - 1. At all times during the construction, maintain the flow of stormwater and naturally occurring water in existing facilities and channels affected by the Work.
 - 2. The Contractor assumes risk from flooding and any damages done to the work in progress or work to be completed. Contractor to make repairs and replacements to the satisfaction of the Engineer.
 - 3. Contractor assumes responsibility for damages to property caused by flooding of property due to blocking or restriction of stormwater passages, natural waterways and stormwater facilities.
 - 4. Do not pump or otherwise permit groundwater to flow into existing wastewater pipelines during the construction.
- B. Temporary Wastewater Flow Control: During the connection to existing wastewater collection system, the Contractor is responsible for maintaining continued wastewater service and flow. The means and methods the Contractor employs to meet the following requirements are at his discretion.
 - 1. Bypassing: Maintain continued wastewater flow by bypass pumping or other suitable means of wastewater bypassing. When bypass pumping, a standby pump of equal or greater capacity shall be provided on-site.
 - 2. Unlawful Sewage Discharges: It is unlawful to permit wastewater (sewage) flow from existing sewers to discharge into nearby waterways or to flow on surface areas. Should an accidental discharge occur, notify the Department of Environmental Protection and Upper Allen Township immediately.
 - 3. Penalties: Fines and related costs resulting from failure to provide adequate protection against wastewater overflow are the obligation of the Contractor.

1.03 TEMPORARY SERVICES

- A. Temporary Sanitary Facilities: Provide and maintain as required by local laws, temporary toilet facilities for the workmen on the Project. Sanitary facilities shall conform to OSHA requirements.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 REMOVAL

- A. Contractor shall dismantle (if required) and remove such temporary facilities as required during construction of the project.

END OF SECTION

SECTION 01570 – TRAFFIC REGULATION

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: This Section includes general guidelines for the control of traffic while work is being performed within existing street rights-of-ways. The goal is to help ensure safe and efficient traffic movement through work areas and provide safety for the Contractor's work force.

1.02 QUALITY ASSURANCE

- A. Traffic Control on Township Roadways: Traffic control on roadways other than State Highways, shall conform to the requirements of Upper Allen Township and its designated representative according to field conditions.
 - 1. Township roadways shall not be unnecessarily obstructed, and the Contractor shall take measures to keep the roadways open and safe for at least one lane of traffic at all times.
 - 2. After working hours, cover trenches with steel plate or wood planking, both of adequate strength to permit safe and unrestricted traffic movement.
 - 3. Provide and maintain at closures, intersections, and throughout the Project, necessary approved barricades, required quantity of approved lights, approved reflectors, danger signals, warning, detour and closure signs.
 - 4. Barricades, danger signals, signs and obstructions shall be illuminated from sunset until sunrise. Materials and safety devices (i.e., barricades, flashing warning lights, reflectors and signs) shall conform to Pennsylvania Department of Transportation (PennDOT) Specifications.
 - 5. Fines and related costs resulting from the Contractor's failure to provide adequate traffic control shall be borne solely by the Contractor.
- B. Traffic Control on State Highways: Provide traffic control in complete compliance with the rules and regulations of the Pennsylvania Department of Transportation (PennDOT), including but not necessarily limited to the following:
 - 1. PA Code Title 67, Transportation: Chapter 213 – Temporary Traffic Control Guidelines
 - 2. PA Code Title 67, Transportation: Chapter 441 - Access to and Occupancy of Highways by Driveways and Local Roads.
 - 3. PA Code Title 67, Transportation: Chapter 459 - Occupancy of Highways by Utilities.
 - 4. Section 900 Maintenance and Protection of Traffic During Construction of the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, as supplemented, and such other sections therein which complement this Section.
- C. Traffic Control Figures: Traffic control requirements of the construction site within state highway right-of-way shall be illustrated on the Drawings by way of figures taken

from Chapter 213 of the PennDOT regulations.

1. The traffic control figures are to be used in conjunction with the Specifications to establish the minimum requirements for the Project and in no way preclude the installation of additional control measures.

- D. Police Traffic Control: When required by local traffic regulations provide traffic control in the form of uniformed police physically directing traffic. The costs for such police traffic control activity shall be the direct charges, without Contractor's mark-up, passed on to the Township for payment directly to the local police force.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials and safety devices such as barricades, flashing warning lights, reflectors and signs, provided for the purpose of protecting the work and the safety of the public, and for maintaining and protecting traffic, shall conform to the requirements specified in Section 900, Traffic Accommodation and Control, of the current edition of the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, as supplemented.
 1. Safety devices shall also conform to the requirements specified in the current edition of PA Code Title 67, Transportation, Chapter 212, Official Traffic-Control Devices, and Publication 213 - Work Zone Traffic Control, which complement Section 901, Maintenance and Protection of Traffic During Construction, as specified in PennDOT Publication 408.
 2. Provide danger signals and warning signs in the approved color.

END OF SECTION

SECTION 02010 – SUBSURFACE EXPLORATION

PART 1 GENERAL

1.01 DESCRIPTION

- A. Pennsylvania One Call System Notification: Prior to digging, the Contractor must notify the Pennsylvania One Call System, in accordance with Pennsylvania's Underground Utility Line Protection Law, Act 287 of 1974 as amended by Act 121 of 2008. Call 1-800-242-1776 or dial 811.
- B. Digging Test Pits: Whenever new sanitary sewers are proposed in areas where there are known existing underground utilities, cables or structures, the Contractor will not be permitted to proceed with the new construction until he has dug test pits and determined the exact locations and elevations of the existing underground utilities, cables or structures.
 - 1. No excavation, pipe laying or other work is permitted in the underground utility location without the presence or approval of an authorized representative of the owner of the subsurface utility.
 - 2. Dig test pits only at the locations agreed to by the owner of the subsurface utility and the Engineer.

END OF SECTION

SECTION 02151 - SHORING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The work specified in this Section consists of providing shoring which conforms to Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees.
- B. Related Sections: Division 2 Sections involving excavations.

1.02 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Shoring materials and installation work shall conform to Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees.
 - 1. The responsibility for inspection, determination, compliance and enforcement of Federal, State, local laws, rules, regulations, requirements, precautions, orders and decrees rests with the regulatory agency and not with the Township or Engineer.
- B. Shoring Design: The design and the adequacy of the shoring installed is the responsibility of the Contractor.

1.03 SITE CONDITIONS

- A. Responsibility for Condition of Excavation: The Contractor is solely responsible for the condition of his excavations.
 - 1. The failure or refusal of the Engineer to suggest the use of Shoring, or a better quality, grade, or section, or larger sizes of Shoring materials, or to suggest 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 of any of his obligations under the Contract, nor impose any liability on the Engineer or the Township.
 - 2. No delay, whether caused by any action or want of action on the part of the Contractor, or by any act of the Engineer, Township, or their agents, or employees, resulting in the keeping of any excavation open longer than would otherwise have been necessary, shall relieve the Contractor from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of his obligations under the Contract relating to injury to persons or property.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Shoring materials shall conform to Federal, State and local laws, rules, regulations,

requirements, precautions, orders and decrees.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Shoring installation shall conform to Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees.

END OF SECTION

SECTION 02221 – TRENCHING, BACKFILLING AND COMPACTING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: This work specified in this Section consists of trench and in-line structure excavation, backfilling, compacting, and trench line surface restoration work.
- B. Related Sections:
 - 1. Subsurface Exploration: Section 02010.
 - 2. Shoring: Section 02151.
 - 3. Erosion and Sediment Pollution Control: Section 02270.
 - 4. Paving and Surfacing: Section 02500
 - 5. Cast-In-Place Concrete: Section 03300.

1.02 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM D 698; Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49-kg) Rammer and 12-in. (304.8 mm) Drop.
 - 2. ASTM D 1556; Test Method for Density of Soil in Place by the Sand-Cone Method.
 - 3. ASTM D 2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 4. ASTM D 2774, Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Pipe.
 - 5. ASTM D 2922; Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- B. Commonwealth of Pennsylvania Department of Transportation (PDT), Specifications Publication 408, as supplemented.
 - 1. PDT Section 703.1 Fine Aggregate.
 - 2. PDT Section 703.2 Coarse Aggregate.
 - 3. PDT Section 703.3 Select Granular Material (2RC) (Only allowed within PennDOT Rights-of-Way.
 - 4. PDT Section 704 Cement Concrete

1.03 DEFINITIONS

- A. Subgrade: Trench bottom prepared as specified to receive bedding material, concrete cradle or encasement, or the bottom of excavations prepared to receive piping materials.
- B. Pipe Zone: The area within the trench which extends from subgrade elevation to an elevation at least twelve inches above the top of the outside barrel of the pipe. Also, the trench dimensions within this pipe zone area shall be carefully controlled in order to comply with pipe manufacturer's warranty requirements.

1.04 SUBMITTALS

- A. Aggregate Certificates: Submit testing laboratory aggregate test report certificates based on the specified requirements.
- B. Compaction Density Field Test Reports: Submit compaction density test reports based on method of density determination as specified in Reference Standards or such other method as approved by the Engineer.

1.05 QUALITY ASSURANCE

- A. Aggregate Material Quality: Aggregate quality shall be determined by tests in accordance with the requirements of the appropriate PennDOT Referenced Standard for such materials.
 - 1. Acceptance of aggregate material shall be based on certification from supplier that the aggregate originates from a source approved by PennDOT and that the aggregate complies with specified PennDOT requirements.
- B. On-Site Backfill Field Tests: Obtain samples of on-site backfill for testing in the presence of a representative of the Township. Obtain samples from test pits dug at intervals of not less than 500 feet along the proposed alignment, or 250 feet if varying soils are encountered, as determined by the Township representative.
 - 1. The Contractor shall reimburse the Township for inspection services as provided by the Township.
- C. Aggregate Material Tests: Conduct aggregate quality tests in accordance with the requirements of appropriate Referenced Standard as included under Materials.
 - 1. The Engineer reserves the right to accept aggregate materials based on certification from supplier that the aggregate originates from a source approved by Penn DOT and that the aggregate complies with specified Penn DOT requirements.

1.06 SITE CONDITIONS

- A. Classification of Excavated Materials: No consideration will be given to the nature of materials encountered in trenching operations.
- B. Borrow Material: When the required quantity of On-Site Backfill material or On-Site Select Earth Backfill material is insufficient to complete the backfilling of excavations, provide Borrow Material.
 - 1. If Borrow Material is needed, notify the Engineer sufficiently in advance to permit the Engineer to verify such need and to view the proposed borrow pit to determine the material suitability.
 - 2. Borrow Material will be subject to the Engineer's approval whose written consent shall be obtained prior to its use.
 - 3. Borrow Material shall meet the requirements for On-Site Backfill material or On-

Site Select Earth Backfill material.

- C. Excess Materials: No right of property in materials is granted to the Contractor of excavated materials prior to backfilling. This provision does not relieve the Contractor of his responsibility to remove and dispose of surplus excavated materials or excavated materials not suitable for use in backfilling.
- D. Removal of Obstructions: Remove, realign or change the direction of above or below ground utilities and their appurtenant supports, if such is required in the opinion of the Engineer. Perform such work unless such work is done by the owner of the obstruction. However, uncover and sustain the obstruction prior to the final disposition of obstruction. Additional precautions concerning obstructions as follows:
 - 1. Do not obstruct fire hydrants.
 - 2. Do not interfere with persons, firms, corporations or utilities employing protective measures, removing, changing or replacing their property or structures, but allow these persons, firms, corporations or utilities to take such measures as they may consider necessary or advisable under the circumstances; which shall not relieve the responsibilities of the Contractor.
 - 3. If necessary, break through and reconstruct the invert or arch of an existing sewer, storm drain, or conduit that may be encountered, when such existing obstruction is in such a position (in the judgment of the Engineer) as not to require its removal, realignment or complete reconstruction.
 - 4. Expenses incurred by the owner of the trackage for shoring his railroad tracks due to trenching of this Contract crossing or paralleling the railroad rights-of-way shall be borne by the Developer or the Contractor whether billed to him directly or to the Township.
- E. State Highway Pipe Foundation Underdrain: Replace underdrain which is damaged or removed during construction.
 - 1. Use same type and quality of pipe, and coarse and fine aggregate backfill material as existing.
 - 2. Salvage and reuse of the piping will be permitted to reconstruct the pipe foundation underdrain; however, the Engineer will inspect this pipe after its removal and pipe determined unsuitable for reuse shall be replaced by the Contractor with new pipe.
 - 3. Use new coarse and fine aggregate backfill material.
 - 4. Work shall be performed to the requirements and satisfaction of the Pennsylvania Department of Transportation.
- F. Environmental Requirements: Plan work so as to provide adequate protection during storms with provisions available for preventing flood damage. Protect installed piping and other work against damage from uplift due to high ground water levels.
 - 1. Do not perform trenching, backfilling or compacting when weather conditions or the condition of materials are such, in the opinion of the Engineer, that work cannot be performed satisfactorily.
 - 2. Do not use frozen materials as backfill nor wet materials containing moisture in excess of the amount necessary for satisfactory compaction.

3. Prior to use, moisten dry backfill material not having sufficient moisture to obtain satisfactory placement or compaction.
 4. Provide effective dust control by sprinkling water, spreading calcium chloride or other method approved by the Engineer. Employ dust control when, where and in a manner required by the Engineer.
 5. When it is necessary to haul wet soil material over roadways, use suitably tight vehicles to prevent spillage. Clear away spilled materials, as caused by hauling, from roadways.
- G. Accommodation of Drainage: Keep both piped and open drainage facilities unobstructed for proper surface drainage. No damming or ponding of water in gutters or other waterways will be permitted, except where stream crossings are necessary and then only to an extent which the Engineer shall consider necessary.
1. Do not direct water flows across or over pavements except through approved pipes or properly constructed troughs of proper sizes and lengths.
 2. Perform grading in the vicinity of trenches so that the ground surface is properly pitched to prevent water running into the trenches.
- H. Dewatering: Keep excavations free from water during the performance of the work. Provide and operate dewatering equipment of sufficient capacity for dewatering the excavations.
1. Provide for the disposal of the water removed from excavations in such manner as not to cause injury to the public health, to public or private property, to the work of others, to the portion of the work completed or in progress, nor to cause an impediment to the use of streets, roads and highways.
 2. Do not dispose of water in trenches by draining through completed portions of sewer piping.
- I. Protection: Assume the risks attending the presence or proximity of overhead or underground public utility (if any) and private lines, pipes, conduits and their attending support work, existing structures and property of whatever nature. Responsibility for damages and expenses arising out of the Work, for direct or indirect injury to such structures or to any person or property by reason of them, or by reason of injury to them, whether such structures are or are not shown on the Drawings, rests solely with the Contractor.
1. Excavation Condition: The Contractor is solely responsible for the conditions and results of his excavation work. Remove slides and cave-ins at whatever time and under whatever circumstance they occur.
 2. Protection Outside Rights-of-Way: Take necessary precautions to protect trees, shrubs, lawns and such other landscaping from damage. Restitution work for damages rests solely with the Contractor.
 3. Support of Existing Utility Lines: Adequately support underground utilities not requiring removal and exposed as a result of excavations. Provide adequate support along their entire exposed length by timber or planking. Install these supports in such manner that backfilling may be performed without dislodging such utilities.
 - a. Place and carefully compact On-Site Select Earth Backfill or Aggregate

Backfill around the supports, and leave such supports in place as a guard against breakage due to backfill settlement.

4. Temporary Protective Construction: Erect and maintain substantial temporary barricades and fences surrounding excavation to prevent unauthorized access.
 - a. Temporary Barrier: Where necessary, to keep one side of streets or roadway free from obstruction or to keep material piled along side of the trench from falling on private property outside the rights-of-way, erect and maintain a safe and substantial barrier fence.
 - b. Excavation Covers: Cover open excavation when work therein is suspended or left unattended, such as at the end of a work day. For such covers, use materials of sufficient strength and weight to prevent their removal by unauthorized persons. The use of covers instead of backfilling is subject to the Engineer's approval.
 - c. Remove temporary protective construction at the completion of work on the Project.
 5. Structure Supports: Where excavations are in the vicinity of buildings or structures, which by their construction or position might exert detrimental pressure on the excavation, provide suitable structure supports for such buildings or structures. Structure supports may be in the form of underpinning or special driven sheeting, or other suitable support systems of the Contractor's choosing. The option is allowed for more than one short lengths of trench to be opened at one time.
- J. Explosives and Blasting: Use and store explosives in accordance with requirements of Federal, State and local laws, rules, regulations, precautions, orders and decrees. Additionally comply with the following:
1. Utilities Notifications: Notify utility owners having structures or other installations above or below ground in proximity to the trenching work prior to use of explosives.
 - a. Such notice shall be given sufficiently in advance to enable the utility owners to take such steps as they may deem necessary to protect their property from injury.
 - b. Such notice shall not relieve the Contractor of responsibility of damage resulting from his use of explosives.
 2. General Requirements: The Contractor is solely responsible for injury to persons or property as a result of his use of explosives, and shall provide competent licensed blasting person to supervise blasting operations.
 - a. Do not use methods of blasting which will result in breakage beyond trenching areas or which is dangerous to the public or destructive to property.
 - b. Schedule blasting in the proximity of proposed new concrete work prior to placement of concrete.
 - c. Stop blasting operations when street paving adjacent to trench is being damaged by blasting. Repair damaged street paving.
 3. Pennsylvania Code Requirements: In addition to the above requirements, perform blasting in accordance with the applicable requirements of the Pennsylvania Code, Title 25 Subpart D, Article IV, Chapter 211.

4. Rock Removal by Means Other Than Blasting: Where explosives and blasting are not permitted in performance of trenching work, remove rock by such mechanical means and methods as developed specifically for rock removal without blasting. Additionally, perform rock removal in accordance with the requirements of State and local laws, rules and regulations, and utility owner requirements.
 - a. The Engineer reserves the right to direct that rock within five feet of pipe, conduit or other structures encountered in the trench be removed by methods other than blasting.
- K. Trench Work for Electrical: The requirements specified herein for excavating, backfilling and compacting pipeline trench work shall also apply to such work required for electrical conduit installations.
 1. Exceptions to pipe line trench work requirements are as specified throughout the remainder of this Section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. On-Site Backfill: On site excavated soil or soil-rock mixed materials free of topsoil, vegetation, lumber, metal and refuse; and free of rock or similar hard objects larger than six inches in greatest dimension. Rock to soil ratio shall not exceed one part rock to three parts soil.
- B. On-Site Select Earth Backfill: On-site excavated material free of vegetation, lumber, metal and refuse; and free of rocks or similar hard objects larger than one inch in greatest dimension. Rock to soil ratio shall not exceed one part rock to three parts soil.
- C. Aggregate Backfill: Slag aggregates are not allowed.
 1. Select Granular Material (2RC) conforming to PDT Section 703.3. (Only within PennDOT rights-of-way).
 2. Coarse Aggregate Material (2A) conforming to PDT Section 703.2.
- D. Pipe Zone Materials: Slag aggregates are not allowed.
 1. Pipe Zone Bedding: Coarse Aggregate conforming to PDT Section 703.2.
 - a. For piping having a diameter of 21 inches and less use AASHTO No. 8 Coarse Aggregate to within 5 feet of manholes.
 - b. For piping having a diameter of 24 inches and larger, or within 5 feet of any manhole, use AASHTO No. 57 Coarse Aggregate.
 2. Initial Backfill: Coarse Aggregate conforming to PDT Section 703.2.
 - a. For piping having a diameter of 21 inches and less use either AASHTO No. 8 or AASHTO No. 57 Coarse Aggregate.
 - b. For piping having a diameter of 24 inches and larger use AASHTO No. 57 Coarse Aggregate.
- E. Fine Aggregate (Sand): Natural or manufactured sand conforming to PDT Section 703.1, for Type A sand. Sand made from slag aggregates is not allowed.

- F. Concrete Cradle and Encasement: Conforming to requirements of Section 03300 and of Class B, 3,000 psi quality.
- G. Foundation Backfill: AASHTO No. 3 Coarse Aggregate conforming to PDT Section 703.2. Slag aggregates are not allowed.
- H. Underground Warning Tape: Printed polyethylene metallic detection tape, four inches minimum width, color coded, one inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types.
 - 1. Provide detection tape for the following pipe lines and utilities as installed or encountered in the work:
 - a. Sanitary Sewers and Service Connections - Green
 - b. Sewage Force Main - Green
 - c. Pressure Wastewater Sewer - Green
 - d. Electrical Conduit - Red
 - e. Water Line - Blue
 - f. Gas Line - Yellow
 - g. Telephone Conduit - Orange
 - h. CATV Conduit - Orange
 - i. Petroleum Line - Yellow
 - 2. Typically bury detection tape approximately one foot below finished grade.
- I. On-Site Topsoil: On-Site as-excavated topsoil free of subsoil, clay, stones (or similar hard objects) larger than two inches in greatest dimension, partially disintegrated debris, and materials toxic or harmful to growth.
 - 1. Borrow Topsoil: Provide productive topsoil from Contractor's source and of a quality conforming to the requirements stated previously.

2.02 GRASS RESTORATION MATERIALS

- A. Agricultural Liming Materials: Products containing calcium and magnesium compounds capable of neutralizing soil acidity and containing not less than 80 percent of total carbonates.
 - 1. Use liming materials meeting requirements of ASTM Designation C 602 and conforming to applicable state liming material regulations.
- B. Fertilizer: Commercial fertilizer specifically formulated for lawn growth of uniform composition, free-flowing and in conformity with applicable state fertilizer laws.
- C. Grass Seed conforming to PA DOT Publication 408, Formula B: New crop seed, furnished in sealed packages with proof of correct mixture evidenced, age of seed indicated and compliance with applicable state regulations evidenced if required. Provide seed that will produce a lawn matching existing disturbed areas. Minimum requirements are as follows:

Mix Percent	Min. Percent	Max. Percent
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<u>Species in Mix</u>	<u>by Weight</u>	<u>Purity</u>	<u>Germination</u>	<u>Weed Seed</u>
Kentucky Bluegrass (Poa pratensis)	50	98	80	0.20
Creeping Red or Chewings Fescue	30	98	85	0.15
Perennial Rye Grass (Lolium perenne)	20	98	90	0.015

- D. Lawn Mulch: Straw Stalks of threshed grain or tall heavy grass stalks free from seed bearing stalks or roots harmful to lawn growth. Mulch material containing noxious weeds, decomposed material or brittle weed material is not acceptable.
1. Nonasphaltic Emulsion Mulch Binder: Provide either a water soluble blend of vegetable gum blended with gelling and hardening agents, or a water soluble blend of hydrophilic polymers, viscosifiers, sticking aids and gums.
 2. Asphalt Emulsion Binders: Not permitted.

PART 3 EXECUTION

3.01 PREPARATION

- A. Trench Line and Grade: Maintain trench line and grade for sewers and pipelines as follows:
1. DEP Requirements: Sewer grades shall generally conform to the guidelines of the Pennsylvania Department of Environmental Protection (DEP) Domestic Wastewater Facilities Manual (Publication 362-0300-001); however, Township requirements shall supersede these guidelines whenever possible. The minimum grade of terminal sewer runs shall be 1.0 percent.

Sewer Size (inches)	DEP Minimum Slope in Feet Per 100 Feet	Recommended in Feet Per 100 Feet
4	-----	2.00
6	0.60	1.00
8	0.40	0.60
10	0.28	0.50
12	0.22	0.30
14	0.17	0.25
15	0.15	0.20
16	0.14	0.16
18	0.12	0.15
21	0.10	0.15
24	0.08	0.10
27	0.07	0.10
30	0.06	0.10
36	0.05	0.08

2. Control Points: Prior to excavation for a run of piping, set control points for line and grade as given on the Drawings. Compute the depth of cut to sewer invert from top of grade stakes or other control points. Use the computed depths of cut as guides for rough excavation allowing for excavating to accommodate the required bedding and concrete encasement or cradles.
 - a. Set control points sufficiently offset from the trench centerline to prevent loss of the points during the work. Set control points 25-feet apart maximum.
 - b. In unpaved areas, mark control points on the top portion of stakes and in paved areas, drive spikes or cut crosses into the paving, both encircled with paint.
 3. Methods for Maintaining Line and Grade: Use methods to maintain line and grade as are customarily used in the utility construction industry.
 - a. Laser: When using a laser beam instrument, perform field checks of the beam position for each fifty feet of installed pipeline. Use survey equipment or other approved method to perform the beam position check.
 4. Optional Method for Maintaining Line and Grade: As excavation and pipe installation progresses, obtain proper grade and alignment utilizing appropriate survey instruments for each section of pipe installed.
- B. Soil Erosion Control: Perform soil erosion control work in accordance with requirements of Section 02270.
- C. Preparation of Surfaces: In sewer rights-of-way do not remove trees and other permanent plantings except by authorization of the Engineer.
1. When tree and other permanent plantings removal is authorized, remove both the above ground and below ground portions by methods meeting Engineer's approval.
 2. Trim merchantable timber of limbs and tops, and unless otherwise ordered by the Engineer, saw timber into eight foot lengths. Stock-pile timber at locations designated on the site by the Engineer. Merchantable timber is timber larger than six inches in smallest diameter from which saw logs, pulpwood, posts, poles, ties or cordwood can be produced. Merchantable timber will remain the property of the property owner.
 3. Dispose of tree limbs, stumps and permanent plantings debris in a lawful manner off site.

3.02 EXCAVATING

- A. Trench Shoring: Perform shoring in accordance with requirements of Section 02151. Follow OSHA requirements for trench shoring as applicable to prevent trench wall collapse.
- B. Reclaimed Topsoil: Prior to any trench excavation in open areas of rights-of- way (not in streets) strip turf and topsoil to the depth of suitable topsoil material and stockpile for subsequent topsoil placement operations. Stockpiled topsoil material shall be protected

in accordance with the applicable erosion control plan for the project.

- C. General Requirements: Perform excavation using machinery, except that hand excavation and backfilling may be required where necessary to protect existing structures, utilities or private or public properties; and except that backfilling by hand shall be done to the extent specified herein:
 - 1. Begin excavation in trenches at the control point having the lower invert and proceed upgrade.
 - 2. Remove surface materials of whatever nature over the line of trenches and other excavations, and properly separate and store removed materials as suitable for use in backfilling or other purposes.
 - 3. Remove subsurface materials of whatever nature down to subgrade elevation. Properly separate and store removed subsurface materials as suitable for use in backfilling.
 - 4. Cut paving with a mechanical saw and to neat lines equidistant from the centerline of the trench.
- D. Rock Removal: Where rock removal is required below subgrade, and in the opinion of the Engineer the resultant subgrade is unfit for foundations, backfill to subgrade with Class B Concrete, or backfill with other material as allowed by the Engineer.
 - 1. Remove rock to subgrade at least 25 feet in advance of pipe laying.
 - 2. Excavate rock in miscellaneous excavations to the extent required by the Engineer.
 - 3. Where rock is encountered in excavations for manholes in which blank connections are to be left for future extensions of sewers, remove rock for a distance of not less than ten feet from the center of the manhole in the direction of future extension. Excavate trench to specified width, depth and length.
 - 5. Remove and lawfully dispose of excavated materials not suitable for use as backfill, or not required for backfill.
- E. Excavated Material Storage:
 - 1. In State Highway rights-of-way remove the excavated materials as soon as such is excavated. Store and return this same excavated materials for backfilling when required. In no case will the Contractor be allowed to place excavated material beyond the curb or rights-of-way lines or on sidewalks or lawns.
 - 2. In existing and proposed streets other than State Highways where more material is excavated from trenches than can be backfilled or stored on the street or within rights-of-way limits, leaving space for traffic and drainage, remove and store such excess material off-site. Return this same excavated material for backfilling when required.
- F. Trench Width and Depth:
 - 1. Pipe Zone Area: In the pipe zone area, which extends from subgrade elevation to an elevation at least twelve inches above the top of the outside barrel of the pipe, excavate trench banks to vertical lines and not less than the minimum nor more than the maximum widths specified in Table A.

TABLE A

<u>Diameter of Pipe</u>	<u>Minimum Trench Width (Outside Diameter of Pipe at the Barrel Plus)</u>	<u>Maximum Trench Width (Outside Diameter of Pipe at the Barrel Plus)</u>
4 through 24 inches	12 inches	16 inches
27 through 36 inches	20 inches	24 inches
42 through 72 inches	26 inches	30 inches
Larger than 72 inches	30 inches	36 inches

2. Remainder of Trench: Beginning at a point at least twelve inches above the top of the outside barrel of the pipe, keep trench banks as nearly vertical as possible for trenches made in paved or unpaved roadways and in no case shall trench width at the top exceed the outside diameter of the pipe at the barrel plus the dimensions in Table B.

TABLE B

<u>Diameter of Pipe</u>	<u>Maximum Trench Width at Top of Trench (Outside Diameter of Pipe at the Barrel Plus)</u>
4 through 24 inches	40 inches
27 through 36 inches	48 inches
42 through 72 inches	54 inches
Larger than 72 inches	60 inches

- G. Rights-of-Way or Easement Restrictions: Where pipelines are constructed in rights-of-way or easements, the work shall be performed in compliance with OSHA, however the maximum trench width shall be kept entirely within the limits of rights-of-way or easements.
- H. Excavation Width and Depth for Manholes and In-Line Structures: Make excavations for manholes to a nearly vertical plane beginning at bottom of excavation one-foot beyond manhole base outside diameter (six inches each side) to two-feet beyond manhole base outside diameter for top of excavation limit (one-foot each side).
 1. If surface pavement of any type is encountered (vehicle or pedestrian ways), cut such pavement to a rectangular shape as opposed to circular shape of manhole. Make limits of cut not to exceed one-foot beyond top of excavation limit as specified.
 2. Should bottom of excavation limit be exceeded either due to unsuitable material excavation or due to oversight, provide properly compacted foundation backfill (AASHTO No. 3 Coarse Aggregate conforming to PDT Section 703.2) up to the bottom of the excavation limit for the manhole base and pipes entering or leaving manhole.
 3. Excavate rock for manhole installation one foot outside the exterior lines of the manhole walls and to a depth of the outside bottom.
- I. Trench Width and Depth for Electrical Work: Excavate trenches for both single and banked conduit runs to not more than a maximum width required to accommodate the

conduit or conduits with concrete encasement, and to a depth so as to provide a minimum of two feet of cover.

1. Subgrade Preparation, Conduit Trenches: Prepare the bottom of trenches to provide uniform and continuous bearing and support for the conduit, unless concrete encasement or other type of bedding is shown on the Drawings or required by the Engineer.
 2. Conduit Trench Grades: Grade trenches a minimum of four inches per 100 feet. Grade trenches so conduit lines drain away from buildings except for conduit lines from one building to another, in which case grade conduit trenches level. Where conduit lines run to underground structures, grade trenches so conduits to drain to such.
 3. Direct Burial Cable Trenches: Excavate trenches, in both earth and rock, to accommodate both the cable and the Fine Aggregate bedding and cover as indicated on the Drawings.
- J. Excavation Below Subgrade: Do not excavate below depths indicated or specified except where unstable or unsuitable material is encountered at subgrade. Excavate such material to the increased depth as may be required by the Engineer and refill to the proposed subgrade with thoroughly compacted Foundation Backfill material.
1. If excavations are carried below indicated or specified subgrades without written permission, refill excavations to proper subgrade with thoroughly compacted Foundation Backfill material.
- K. Length of Open Trench: The Engineer shall have the right to limit the amount of trench opened in advance of pipe laying and the amount of pipe laid in advance of backfilling, but in no case shall these amounts exceed 300 feet and 100 feet respectively. Additional open trench limitations as follows:
1. Complete trench excavation at least twenty-five feet in advance of pipe laying and keep trenches free from obstructions, except that at the end of a work day or at the discontinuance of work, the pipe laying may be completed to within five feet of the end of the open trench.
 2. The Engineer is empowered to require trench refilling over completed pipe lines if in his judgment such action is necessary.
 3. If Work is stopped on a trench, except as required by the Engineer, and the excavation is left open for an unreasonable period in advance of construction in the opinion of the Engineer, the Engineer may order trench refilling at the Contractor's expense and not allow trench reopening until ready for actual use.

3.03 BACKFILLING

- A. Backfill Restrictions:
1. Do not use in backfilling work materials such as house ashes, putrescible refuse and such other materials considered unsatisfactory by the Engineer. Do not permit excavations to be used as dumping areas for refuse.
 2. Do not use frozen backfill materials or place backfill materials on frozen subgrade or trench surfaces.
 3. Should there be a deficiency of proper backfill material, provide acceptable

- borrow material.
4. Except for temporary use in backfilling, no permanent bulkheads or retaining walls will be allowed in the trenches over piping.
- B. Subgrade Preparation (Pipe Zone): Provide Pipe Zone Bedding as pipe foundations in trenches made in both earth and rock substrates.
1. Provide Concrete Encasement or Concrete Cradle, or other type of bedding, where and as shown on the Drawings, or required by the Engineer to be used instead of Pipe Zone Bedding.
 2. If maximum trench widths specified in Table A (shown previously) are exceeded, provide Concrete Cradle or Concrete Encasement in such locations.
 3. Construct Pipe Zone Bedding, Concrete Encasement and Concrete Cradle as specified and in accordance with Detail Drawings.
 - a. When constructing piping which enters or exits a manhole the pipe bedding material and requirements for proper compaction must be carefully followed in accordance with the STANDARD PRECAST CONCRETE MANHOLE WITH PRECAST CONCRETE BASE Detail Drawing.
 - b. When constructing pipe to repair an existing sewer pipe or making a connection with new pipe to existing pipe the pipe bedding material and requirements for proper compaction must be carefully followed in accordance with the PIPE REPAIR/RECONNECTION Detail Drawing.
 4. When the sewer main is constructed on subgrade which is in a filled area, the fill material and subgrade shall be compacted to 90 percent of maximum density obtained at plus or minus two percentage points of the optimum moisture content as determined by the ASTM D 698 method. Perform field determinations of density, when requested by the Engineer, according to ASTM D 1556 or D 2922.
- C. Backfilling Trenches: Perform trench backfilling, and backfilling excavations for manholes or other in-line structures, by methods which will result in thorough compaction of backfill material without displacement of the grade and alignment of the pipeline and its appurtenances and minimum settlement of backfilled material. Displacement of the pipeline and settlement of backfill shall be considered evidence of improper workmanship or inclusion of unsuitable backfill materials, or both, and will require regrading and realigning the pipeline and removing and re-compacting settled material. Exercise care to carry backfill up evenly within the trenches.
1. Initial Backfill: Following pipe bedding and piping and manhole or other inline structure installation, backfill trenches to a height at least one foot above the top of the pipe barrel with Initial Backfill material placed in four inch compacted layers. This backfill shall be carefully placed in trenches in such manner as not to damage or disturb the pipe.
 2. Remainder of Backfill in Unpaved Areas Outside Roadways: On-Site Backfill placed and compacted in six inch layers to bottom of topsoil. Exercise care to carry backfill up evenly on opposite sides of the piping. Replace topsoil to approximate depth of existing as final backfilling operation and crown to such height as required by the Engineer. Maintain crowned surface to the satisfaction of the Engineer, during the Guarantee Period.
 3. Remainder of Backfill in Roadways: Backfill remainder of the trench using

backfill materials specified below. Exercise care to carry backfill up evenly on opposite sides of the piping.

- a. Within the Right-of-Way Limits of State Highways: Within both paved areas and unpaved areas perform the backfilling work using materials and methods as specified in the PennDOT Highway Occupancy Permit.
 - b. Paved Roadways and Shoulders of Proposed and Existing Township Roadways: Aggregate Backfill compacted in six inch layers to the bottom of temporary or permanent pavement. Suitable On-Site Native Backfill may be used instead of Aggregate Backfill to a point matching the bottom of the planned pavement subgrade, upon approval by the Engineer, and after the Developer/Owner agrees to provide a 3-1/2 year extension to the sanitary sewer installation bond, in addition to posting an 18 month maintenance bond with the Township.
 - c. Unpaved Shoulders of Proposed and Existing Township Roadways: Aggregate Backfill compacted in six inch layers to a point matching the adjacent existing surface.
 - d. Bituminous Driveways: Aggregate Backfill compacted in six inch layers and specified replacement pavement.
 - e. Stone Driveways and Parking Areas: On-Site Backfill compacted in six inch layers to a point six inches below the adjacent existing topsoil surface. Install geotextile material and backfill the remaining six inches with stone surface replacement pavement.
 - f. Unimproved Streets: Upon approval by the Engineer Aggregate Backfill compacted in six inch layers to existing surface. Suitable On-Site Native Backfill may be used instead of Aggregate Backfill, installed to a point six inches below the adjacent existing surface, after the Developer/Owner agrees to provide a 3-1/2 year extension to the sanitary sewer installation bond, in addition to posting an 18 month maintenance bond with the Township. Install geotextile material and backfill the remaining six inches with stone surface replacement pavement.
4. Remainder of Backfill in Sidewalks: Aggregate Backfill compacted in six inch layers and specified replacement sidewalk.
 5. Additional Requirements for PVC Gravity Pipe Bedding and Backfill: Install Pipe Zone Bedding in accordance with the requirements of ASTM D 2321 using Class 1 material.
 - a. Ensure that sufficient Pipe Zone Bedding material is worked under the haunching of the pipe to provide adequate side support.
 - b. Prevent movement of pipe during placing of material under the pipe haunch. Walking or standing on pipe will not be permitted.
 - c. Excessive tamping of Initial Backfill material over the top of the pipe will not be permitted.
 - d. Do not use rolling equipment or heavy tampers to consolidate backfill until at least two feet of backfill is placed over the top of the pipe.
 6. Additional Requirements for PVC Pressure Pipe Bedding and Backfill: Install Pipe Zone Bedding in accordance with the requirements of ASTM D 2774.

D. Compacting: During the course of backfilling and compacting work, the Engineer

reserves the right to require the Developer/Owner to perform tests by a certified firm at various locations or depths of trenches, to determine whether the Contractor's compaction operations are meeting specified requirements. Any and all costs related to the testing will be borne by the Developer/Owner. Compact trench backfill as follows:

1. Solidly tamp each layer of Initial Backfill around the pipeline with proper tamping tools made especially for this purpose.
 2. Thoroughly compact Aggregate Backfill with a vibratory compactor of a type and size satisfactory to the Engineer (and the Pennsylvania Department of Transportation). Compacting of Aggregate Backfill by puddling or jetting will not be permitted.
 3. Use mechanical tampers to compact backfill materials to produce a density of backfill at the bottom of each layer of not less than 90 percent of maximum density obtained at plus or minus two percentage points of the optimum moisture content as determined by the ASTM D 698 method. Perform field determinations of density, when requested by the Engineer, according to ASTM D 1556 or D 2922.
 4. The use of puddling or jetting for compacting backfill in trenches is prohibited.
- E. Compacting Backfill in State Highways: Trench excavation and backfill within State Highway rights-of-way will be subject to inspection by representatives of the Commonwealth of Pennsylvania, Department of Transportation, and the work shall be performed in accordance with the requirements of that department even though such requirements may entail more labor or services than the methods herein described.

3.04 ANCILLARY WORK

- A. Earth Dams: In Pipe Zone Bedding installations, construct earth dams composed of Select Earth Backfill material. Construct earth dams in accordance with Detail Drawing. Place earth dam material by hand and compact with proper tools designed especially for such purpose.
1. Locations for Earth Dams:
 - a. Construct Earth Dams in main sewer trenches at 100 foot intervals.
 - b. Construct Earth Dams at a point not less than three feet upstream from inline structures.
 - c. Construct Earth Dams in trenches for service connections at a point not less than three feet from the main sewer trench.
 - d. Construct additional Earth Dams in trenches at such other locations required by the Engineer.
- B. Service Connection Laterals: Excavate depth of cut to invert as shown on approved Drawings or as predetermined by Engineer. Where required by Engineer, excavate entire length of lateral trench before laying pipe.
1. Rock Excavation: If rock is encountered within ten feet of buildings, remove by hydraulic hoe ram, jack hammer or other method other than blasting. Remove rock to one foot beyond end of lateral.
 2. Curb and Sidewalk Restoration: If curbs and sidewalks are disturbed during lateral installation work, restore such curbs and sidewalks to as new condition.

3. Markers (For New Installations): Do not backfill upper free end of service connection lateral until elevation and location points are inspected and approved by Engineer. Install a two by four-inch lumber marker set plumb and flush with invert of upper free end of lateral pipe. Extend top of marker a minimum of 3 feet above existing grade and paint marker green.
 4. Backfilling and compacting as specified previously.
- C. Backfilling Trenches for Electrical Work: Perform trench backfilling for conduits by methods which will result in thorough compaction of backfill material without displacement of the conduit and minimum settlement of backfilled material. Settlement of backfill shall be considered evidence of improper workmanship or inclusion of unsuitable backfill materials, or both, and will require removing and re-compacting settled material with no additional compensation paid.
1. Backfill single and banded conduits, not encased in concrete, using Select Earth Backfill placed to six-inches minimum compacted depth to a point six inches above the conduit. Backfill remainder of trench to the level of planned subgrade using On-Site Backfill materials placed in layers not exceeding six-inches in thickness after compaction.
 2. Backfill concrete encased conduits using On-Site Backfill materials placed in layers not exceeding six-inches in thickness after compaction.
 - a. In trenches under paved areas, use Aggregate Backfill placed in layers not exceeding four-inches in thickness after compaction to the bottom of the temporary or permanent paving.
 3. Backfill direct bury cable encased in Fine Aggregate placed to minimum compacted depth indicated. Backfill remainder of trench to the level of planned subgrade using Select Earth Backfill materials placed in layers not exceeding six-inches in thickness after compaction.
- D. Stream Crossings: Excavate trenches in stream crossings to the depth shown on the Drawings or otherwise required by the Engineer.
1. Material excavated may be used as backfill unless specifically prohibited by the state agency having jurisdiction.
 2. Make the necessary provisions for cofferdaming, dewatering and removal of excess excavated material.
 3. Maintain the flow in the stream.
 4. Where rock is encountered in the stream crossings, do not use forms to construct the concrete encasement; place concrete on firm rock below the pipe and against firm rock on both sides of the pipe to provide a firm bond between the encasement and the rock. Should the Contractor excavate beyond the dimensions specified previously for the concrete encasement, he shall furnish and place the additional concrete encasement beyond the dimensions shown on the Drawings.
 5. Install concrete encasement to minimum of five feet back from the top edges of the stream banks.
- E. Underground Warning Tape: For the purposes of early warning and identification of buried pipes during future trenching or other excavation, provide continuous identification tapes in all pipe trenches. Install in accordance with printed

recommendations of the tape manufacturer, and as specified herein:

1. As indicated on the standard detail drawings.
2. Provide warning tape in trenches for utilities specified previously.

F. Surface Restoration, Seeding: Perform the seeding surface restoration work during the time between March 1st and October 1st, except when environmental conditions warrant, the Engineer may extend the seeding dates.

1. Preparation: Furnish, place and finish grade On-Site Topsoil both within and outside rights-of-way as affected by construction. Place topsoil to at least four inches depth but not over 12-inches depth.
2. Tillage: Till topsoil using equipment and methods common to such work, and till soil to a two inch depth minimum.
3. Soil Supplement Addition: Apply soil supplements in a manner and at the rates consistent with acceptable trade practice for seeding work of similar type in the local of this project.
4. Seeding: Sow seed mixtures when air current is low and not more than five days after soil supplements have been applied. Sow seeds in two applications using either mechanical power seeders or mechanical hand seeders. Sow one-half of the seed mixture in one direction over designated areas and the remainder at right angles to the first sowing. Seeding rates at five pounds per 1,000 square foot areas.
5. Seed Cover: Embed seed mixtures into topsoil 1/4 inch using a light drag or rake and moving in directions parallel to the contour lines. Immediately after dragging or raking, compact seeded areas using a cultipacker or similar design lawn roller, weighing 60 to 90 pounds per linear foot of roller, and roll at right angles to existing slopes.
6. Lawn Mulching: Evenly apply mulch over seeded areas not more than 48 hours after seeding. Start mulching at windward side of relatively flat areas, or at the upper part of slopes. Spread mulch in a total coverage at a depth not less than 1-1/2 inches nor more than three inches.
7. Mulch Binding: Immediately following mulch spreading, apply mulch binder to anchor mulch to the soil. The number of passes over the mulch as needed to secure it firmly shall not exceed three passes with maximum applied binder not exceeding 10.0 gallons per 1,000 square feet.

G. Cleanup: After trenches and other excavations are refilled and the work completed, remove surplus excavated materials, rubbish or such other materials from the work in such manner as the Contractor may elect or provide, subject to the Engineer's approval. Dispose of such materials off the site in a lawful manner.

1. Remove surplus excavated material, rubbish and other construction debris and keep such removed to a point not more than two hundred feet from the head of the open trench, unless otherwise authorized by the Engineer.
2. Where surplus excavated material is lawfully disposed of on public property, spread the material evenly and leave the area in a neat, smooth, compacted condition.
3. Furnish and place topsoil, fertilize and seed grassed areas, both within and outside rights-of-way as affected by construction. Reseed and re-fertilize areas that fail to show a uniform stand of grass. Water, mow, rake, weed and otherwise maintain

- grass until final acceptance of Contract.
4. Restore the area covered by both temporary and permanent rights-of-way over private property to as near the original conditions as is practical. Bring area up to original grade, place topsoil, seed, re-plant or replace damaged or removed shrubbery, repair or replace walks, driveways, fences and other improvements.
 5. Place topsoil, lime, fertilizing and seed in a manner consistent with acceptable trade practices for the area involved.
 6. When the repaving over trenches and other excavations has been completed, sweep paved surfaces having been affected by the work using hand or power sweepers, and if required by the Engineer, flush with water to remove dust and small particles.
- H. Maintenance: The Contractor is solely responsible for injury or damage resulting from lack of trench maintenance during construction and the required maintenance period. If trench surfaces within any existing public roadway or dedicated street are not satisfactorily maintained or repairs begun within three days after written notice from Engineer, repairs may be made by Township and the cost charged against Developer or Developer's financial security.
1. Seeded Area Protection and Maintenance: Protect seeded areas from washouts by methods specified in this Section. Reseed washouts and bare spots that develop from inadequate protection or otherwise until a healthy, complete coverage stand of grass is obtained.
 - a. Use temporary barricades to protect lawn areas from foot traffic or other areas until a healthy, total coverage stand of grass is obtained. Barricade materials subject to Engineer's approval.

END OF SECTION

SECTION 02270 - EROSION AND SEDIMENT POLLUTION CONTROL

PART 1 GENERAL

1.01 REQUIREMENTS OF REGULATORY AGENCIES

- A. Engineer/Contractor Prepared Erosion and Sediment Pollution Control Plan:
 - 1. Prior to earth moving activities, prepare a soil erosion and sediment pollution control plan in accordance with rules and regulations adopted by the Pennsylvania Department of Environmental Protection (DEP).
 - 2. Detail requirements for the control plan are described in an Erosion and Sediment Pollution Control Program Manual that may be obtained from the Bureau of Soil and Water Conservation, Division of Soil Resources and Erosion Control, Harrisburg, Pennsylvania.
- B. Site Review: When required, arrange and conduct an on-site review of potential soil erosion problems with personnel of the Bureau of Soil and Water Conservation or with the Cumberland County Soil Conservation District.
 - 1. Select proper methods of soil erosion and sedimentation control acceptable to review agency.
 - 2. Describe selected methods on maps and in narrative report of Soil Erosion and Sedimentation Control Plan.
- C. Penalties: Fines and related costs resulting from failure to provide adequate protection against soil erosion and sedimentation are the obligation of the Contractor.
 - 1. Silt, sedimentation and mud leaving the site will be construed as damage to neighboring property and evidence of negligence on the part of the Contractor.
 - 2. Damages to neighboring property shall be rectified and restitution shall be paid by the Contractor.

1.02 SUBMITTALS

- A. Erosion and Sediment Pollution Control Plan: Prior to earth moving activities furnish two copies of plan approved by the Cumberland County Soil Conservation District.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General Requirements: Materials for erosion control work are as required in the County Soil Conservation District approved plan as prepared by the Contractor.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Conduct work in compliance with rules, regulations and requirements of the Pennsylvania DEP and the Cumberland County Soil Conservation District. Erosion and Sediment Pollution Control measures employed will be subject to approval and inspection by the Pennsylvania DEP and the Cumberland County Soil Conservation District.
- B. The Contractor shall keep on the Project one copy of the County Soil Conservation District approved Erosion and Sedimentation Control Plan.

END OF SECTION

SECTION 02298 - BORING AND JACKING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The work specified in this section consists of boring and jacking required to pass pipelines under public transportation or railroad rights-of-way.
- B. Related Sections:
 - 1. Shoring: Section 02151
 - 2. Trenching, Backfilling and Compacting: Section 02221
 - 3. Piped Wastewater Sewers: Section 02722
 - 4. Division 3 - Concrete

1.02 QUALITY ASSURANCE

- A. Workmen Qualifications:
 - 1. Use only personnel thoroughly trained and experienced in the skills required.
 - 2. Welds shall be made only by welders, tackers and welding operators who have been previously qualified by tests as prescribed in the Structural Welding Code AWS D1.1 of the American Welding Society to perform the type of work required.
- B. Design Criteria:
 - 1. Encasing conduit under highways shall be of sufficient strength to support all superimposed loads, including an American Association of State Highway and Transportation Officials H-20 Loading with 50 percent added for impact.
- C. Requirements of Regulatory Agencies:
 - 1. Work of this Section within State Highway right-of-way will be subject to inspection by representatives of the Commonwealth of Pennsylvania Department of Transportation (PDT), and the work shall be performed in accordance with the requirements of the latest edition of the Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 459, Occupancy of Highways by Utilities.
- D. Source Quality Control:
 - 1. Shop Tests: In accordance with Article 4, paragraph 4.5 of the General Conditions, factory test, pipe materials listed in the following. Each pipe manufacturer shall have facilities to perform listed tests. The Engineer reserves the right to require the manufacturer to perform such additional number of tests as the Engineer may deem necessary to establish the quality of the material offered for use.

<u>MATERIAL</u>	<u>METHOD</u>	<u>NUMBER OF TESTS</u>
Steel Pipe	ASTM A139 or ASTM A53	As specified in or ASTM 13 or ASTM A53 as applicable

2. Laboratory Tests: The Engineer reserves the right to require that laboratory tests also be conducted on materials that are shop tested. Furnish without compensation, labor, materials, and equipment necessary for collecting, packaging, and identifying representative samples of materials to be tested and the shipping of such samples to the Testing Laboratory. These laboratory tests will be paid for as provided in the Bid Form from the fund stipulated for the purpose.

1.03 REFERENCES

- A. American Association of State Highway and Transportation Officials (H-20): (AASHTO) Loading for Conduits Installed Under Streets, Road, or Highways.
- B. American Society for Testing and Materials:
 1. ASTM A 53, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc- Coated Welded and Seamless.
 2. ASTM A 120, Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
 3. ASTM A 139, Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 in. and over).
 4. ASTM C 32, Specification for Sewer and Manhole Brick (Made from Clay or Shale).
 5. ASTM C 33, Specification for Concrete Aggregates.
 6. ASTM C 150, Specification for Portland Cement.
 7. ASTM C 270, Specification for Mortar for Unit Masonry.
 8. ASTM F 467, Specification for Nonferrous Nuts for General Use.
 9. ASTM F 468, Specification for Nonferrous Bolts, Hex Cap Screws and Studs for General Use.
- C. American Welding Society: AWS D1.1 Structural Welding Code.
- D. Commonwealth of (PDT), Specifications Publication 408, as supplemented.
 1. PDT Section 703.2 Coarse Aggregate.
 2. PDT Section 703.3 Select Granular Material (2RC).

1.04 SUBMITTALS

- A. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, cuts or other data as required to provide a complete description of Products to be installed.

- B. Certificates: Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.
- C. Furnish to PDT for approval, detail drawings, accompanied by design calculations, for boring or jacking pits including sheeting and bracing therefor, steel pipe and boring or jacking procedure and grouting method and all such drawings and computations shall bear the seal of a Registered Professional Engineer.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Transport, handle and store materials and Products specified herein in a manner recommended by the respective manufacturers of such to prevent damage and defects.

1.06 SITE CONDITIONS

- A. Classification of Materials:
 - 1. Highway Crossing Boring or Jacking: No consideration will be given to the nature of materials encountered in the boring for Highway Crossings. Remove rock encountered during the boring operation except as provided in the following paragraphs.
 - a. Where rock is encountered during the boring of an encasing conduit which is such that in the judgment of the Engineer and the representative of the PDT the boring or jacking of the encasing conduit cannot be continued, discontinue boring and jacking. Construct the remaining portion of the pipe sewer across the highway by an open cut method meeting with the approval of the Engineer and the representative of the PDT.
 - b. If the pipe sewer is constructed in an open trench, do not provide an encasing conduit. Open cut construction to conform to the requirements of Sections 02221 and 02722.
- B. Scheduling:
 - 1. Perform boring or jacking operations continuously on a 24-hour basis if required by PDT.
- C. Environmental Requirements:
 - 1. As specified in Sections 02221 and 02722.
- D. Protection: As specified in Section 02221 and such added requirements included herein.
 - 1. Adequately support and protect utilities and facilities that are encountered in, or may be affected by, the work.
 - 2. Structure Supports: As specified in Section 02221.
 - 3. Accommodation of Traffic: As specified in Section 02221.

4. Explosives and Blasting: Not permitted in performance of work of this Section.
5. Excavation Conditions: As specified in Section 02221.
6. Excess Materials: As specified in Section 02221.

PART 2 PRODUCTS

2.01 ENCASING CONDUIT

- A. Steel Pipe: ASTM A 139, Grade B or ASTM A53, Grade B.
 1. Minimum Diameter: As shown on the Drawings.
 2. Minimum Wall Thickness: As shown on the Drawings.

2.02 SEWER PIPE AND FITTINGS

- A. Polyvinyl Chloride (PVC) Pipe: As specified in Piped Wastewater Sewer - Section 02722.

2.03 MISCELLANEOUS MATERIAL

- A. Concrete: As specified in Cast-In-Place - Section 03300.
 1. Class B: 3,000 psi.
 2. Class C: 2,000 psi.
- B. Lean Concrete: 2,000 psi compressive strength at 28 days with minimum cement content per cubic yard in accordance with current ready-mix plant standard practice.
 1. Reduced Aggregate: Aggregate with particle size not less than 1/8-inch or more than 1/2-inch in any dimension and a maximum of 5 percent of particles passing a #8 sieve.
- C. Aggregate Backfill:
 1. AASHTO No. 8 Coarse Aggregate conforming to PDT Section 703.2.
 2. Select Granular Material (2RC) conforming to PDT Section 703.3.
- D. Brick: Commercially manufactured brick made from clay or shale and burned, meeting requirements of ASTM C 32, Grade MS.
- E. Waterproofed Mortar: Mortar material composition shall meet the requirements of ASTM C 270 for Type M mortar with waterproofing admixture included.
 1. Acceptable Manufacturers:
 - a. Medusa Cement Company; Medusa Waterproofing Paste or Powder.
 - b. Grace Construction Materials; Hydratite.
 - c. Chem-Master Corporation; Hydrolox.
 - d. Or Equal.
- F. Grout (Sand/Cement):
 1. Portland Cement: ASTM C 150 Type II.

2. Sand: ASTM C 33, fine aggregate.
 3. Water: Potable.
 4. Grout Quality: Mixture of one part Portland Cement, three parts fine aggregate and water.
- G. Sand: ASTM C 33, fine aggregate.
- H. Treated Wood Blocking (Pipe Support in Conduit): Wood species of the allowable types under the WWPA or SPIB grading rules and stamped to indicate product compliance with U.S. Dept. of Commerce Product Standard PS-20-70.
1. Preservative treatment shall conform to American Wood Preserves Association Standard P-5 (0.60 pounds per cu. ft. of wood) for soil contact service; Wolman CCA Type C, or equal.
 2. Steel Bands: Use one inch wide (min.) stainless steel strapping to make the treated wood blocking attachment bands. Secure the bands in place with stainless steel compression style band clamps. Provide a minimum of two bands on each set of treated wood blocking.

PART 3 EXECUTION

3.01 INSPECTION

- A. Inspect Materials and Products before installing in conformance with the inspection requirements of the appropriate referenced standard.
- B. Remove rejected Materials and Products from the Project.

3.02 PREPARATION

- A. Excavation: As specified in Section 02221 and such added requirements included herein:
 1. Should the Contractor in constructing any boring or jacking pit excavate below the sub-grade for the pipe sewer, he will be required to backfill the area excavated below the sub-grade with Aggregate Backfill or with Concrete, as required by the Engineer, at no increase in Contract Price.

3.03 PERFORMANCE

- A. Installation Options:
 1. The Contractor shall have the option to install a larger diameter encasing conduit than is shown on the Drawings, provided the Contractor has secured prior written approval of the applicable agencies having jurisdiction. If the Contractor elects to install a larger diameter encasing conduit than shown on the Drawing, he shall maintain the required clearances under the railroad tracks, roadways, pipelines or other structures involved. Substitution of a larger

- diameter encasing conduit will be made without an increase in Contract Price.
2. The Contractor shall have the option to install the encasing conduit by the boring or jacking method. The Contractor is solely responsible for the means and methods chosen to perform the encasing conduit installation. No increase in Contract Price will be allowed for difficulties encountered in either boring or jacking operations.
- B. Boring: Boring shall conform to the applicable requirements of the regulatory agencies involved and such additional requirements specified herein.
1. Install the encasing conduit by the boring method to the limits indicated on the Drawings or such additional limits required by the Engineer or regulatory agencies.
 2. Preliminary work shall consist of excavating and shoring the boring pit.
 3. Provide devices at the front of the pipe to prevent auger and cutting heads from leading the encasing conduit. Unsupported excavation ahead of pipe is prohibited.
 4. Over-cut by cutting head not to exceed the outside diameter of the encasing conduit by more than one-half inch.
 5. The use of water or other liquids to facilitate casing placement and spoil removal is prohibited.
 6. If voids develop or if bored hole diameter is more than 1 inch greater than the outside diameter of the encasing conduit, place Grout to fill voids.
 7. Check conduit alignment in a manner and at time intervals as required by the Engineer. Check alignment and grade at least once during each shift as the work progresses.
 8. Completely bulkhead heading at interruptions in boring operation.
 9. Completely weld joints around the circumference between sections of steel pipe encasing conduit.
- C. Jacking: Jacking shall conform to the applicable requirements of the regulatory agencies involved and such additional requirements specified herein. Perform encasing conduit jacking without hand mining ahead of the conduit and without the use of any type of boring, auguring, or drilling equipment.
1. Install the encasing conduit by the jacking method to the limits indicated on the Drawings or such additional limits required by the Engineer or the regulatory agencies.
 2. Preliminary work shall consist of excavating and shoring an acceptable shaft on the down-slope side of the crossing and installation of a backstop and guiding apparatus.
 3. Design: Bracing and backstops shall be so designed and jacks of sufficient rating used so that the jacking can progress in a continuous operation except for adding lengths of pipe.
 4. Accurately place guiding apparatus on line and grade.
 5. Support the vertical face of the excavation as necessary to prevent sloughing.
 6. Use adequate soil support systems and bulkheads as required if subgrade conditions in the heading are unstable.

7. Jacking and excavation within the pipe shall proceed simultaneously with the ground being cut no more than 2 inch outside the pipe at the top and sides and not less than 2 inch above subgrade at the bottom.
 8. The use of water or other liquids to facilitate casing placement and spoil removal is prohibited.
 9. If voids develop, or if jacked hole diameter is more than 1 inch greater than the outside diameter of the encasing conduit, place grout to fill voids in manner approved by the regulatory agencies.
 10. Check conduit alignment in a manner and at time intervals as required by the Engineer. Check alignment and grade at least once during each shift as the work progresses.
 11. Completely bulkhead heading at interruptions in jacking operation.
 12. Completely weld joints around the circumference between sections of steel pipe encasing conduit.
- D. Laying and Supporting Pipe: Lay the pipe line in the encasing conduit as specified in Section 02722 and such added requirements included herein.
1. Support and maintain the alignment and grade of the pipe line using Treated Wood Blocking arranged in the manner as indicated on the Drawings. Strap the blocks sufficiently secure to prevent displacement during pipe installation but not so tight as to cause deformity of the pipe.
- E. Encasing Conduit Filling and Closing: After the pipe line has been installed in the encasing conduit and has been tested, fill the encasing conduit with lean concrete.
1. Close one end of encasing conduit with brick and mortar before filling encasing conduit. Close other end of encasing conduit with brick and mortar after filling encasing conduit or as operation dictates.
- F. Cleanup: As specified in Section 02221.

3.04 FIELD QUALITY CONTROL

- A. Testing: After laying pipe line in encasing conduit and before filling conduit conduct line acceptance testing as specified in Section 02722.

END OF
SECTION

SECTION 02500 - PAVING AND SURFACING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The work specified in this Section consists of the replacement paving operations on Township streets and State highways, and private driveways excavated or otherwise disturbed due to an installation in connection with the sanitary sewer system.
- B. Related Sections:
 - 1. Trenching, Backfilling and Compaction: Section 02221.
 - 2. Cast-In-Place Concrete: Section 03300.

1.02 REFERENCES

- A. The PDT Sections noted herein refer to sections contained in the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, as supplemented. The payment provisions do not apply to work to be performed under this Specifications Section.
 - 1. PDT Section 301 Plain Cement Concrete Base Course.
 - 2. PDT Section 305 Bituminous Concrete Base Course.
 - 3. PDT Section 309 Superpave Asphalt Mixture Design, HMA Base Course (Standard).
 - 4. PDT Section 350 Subbase.
 - 5. PDT Section 401 Plant Mixed Bituminous Concrete Courses.
 - 6. PDT Section 403 Recycled Plant-Mixed Bituminous Concrete Courses.
 - 7. PDT Section 409 Superpave Asphalt Mixture Design, HMA Wearing Course (Standard); Superpave Asphalt Mixture Design, HMA Binder Course (Standard); Superpave Asphalt Mixture Design, HMA Binder Course RPS.
 - 8. PDT Section 420 Bituminous Wearing Course ID-2 and Bituminous Wearing Course ID-2, RPS.
 - 9. PDT Section 460 Bituminous Tack Coat.
 - 10. PDT Section 461 Bituminous Prime Coat.
 - 11. PDT Section 630 Plain Cement Concrete Curb.
 - 12. PDT Section 676 Cement Concrete Sidewalks.
 - 13. PDT Section 703 Aggregates.
 - 14. PDT Section 704 Cement Concrete.
 - 15. PDT Section 721 Calcium Chloride.
 - 16. PDT Section 962, Painting Traffic Lines and Markings.
- B. Commonwealth of Pennsylvania Department of Transportation Bulletin 25.
- C. Commonwealth of Pennsylvania Department of Transportation Bulletin 27.
- D. Upper Allen Township Code: Chapter 217, Article 1 – Street Openings and Excavations

1.03 DEFINITIONS

- A. Specified Maximum Trench Width: The applicable maximum trench width specified in Table B in Section 02221.
- B. Street: Unless otherwise specifically qualified herein, the term Street as used in this Section is understood to mean an area used as a way of passage or parking for motor vehicles.

1.04 QUALITY ASSURANCE

- A. Source Quality Control: Maintain the quality of work by using the products of a qualified bituminous concrete producer and qualified plant operating workmen.
 - 1. Use products of a bituminous concrete bulk producer regularly engaged in production of hot-mix, hot-laid bituminous concrete conforming to the standards referenced herein.
 - 2. Use materials conforming to the requirements of the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, as supplemented.
- B. Workmen Qualifications: Provide at least one person thoroughly trained and experienced in the skills required and who readily understands the design and is completely familiar with the application of bituminous concrete paving work. During progress of bituminous concrete paving work the trained person shall be present to direct the performance of work.
 - 1. For actual finishing of bituminous concrete surfaces and operation of the equipment, use only personnel thoroughly trained and experienced in the skills required.
- C. Township Street Restoration Requirements: The removal, protection and replacement of paving on Township streets shall be performed in accordance with the requirements of Upper Allen Township Code, Chapter 217, Article 1 – Street Openings and Excavations.
- D. State Highway Requirements: Perform paving and surface restoration work in State highways in accordance with the Highway Occupancy Permit as issued to the Township by the Pennsylvania Department of Transportation.

1.05 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Dust Control: Provide effective dust control by sprinkling water, by the use of Calcium Chloride in accordance with PDT 721, or by other methods as approved by the Engineer. Use dust control measures where and when, and in a manner as required by the Engineer.
 - 2. Weather Limitations (ID-2 and BCBC Type Pavements): Terminate placement of

bituminous concrete surface courses of permanent pavement between October 15 and October 31, and do not resume placement prior to between April 1 and April 15; interim days between these date limits may be used for placement as determined by the Engineer depending upon weather temperature conditions.

- a. Do not install aggregate courses when ambient temperature is below or is expected to fall below freezing.
 - b. Do not use aggregate containing frost nor place aggregate courses on frozen subgrade.
 - c. Do not place bituminous concrete surface courses of permanent pavement when the ambient temperature is 40° F or lower; nor when the temperature of the pavement, base or binder on which it is to be placed is 40° F or lower.
3. Weather Limitations (State Highway HMA Superpave Type Pavements): Do not place HMA paving mixtures between October 31 and April 1 unless permitted otherwise in writing by the [Engineer or PennDOT's District Engineer]. See PDT 409.3 for individual Engineering District's date limitations for placement of HMA wearing courses.
- a. HMA Base Course: Do not place base course when surfaces are wet or when the temperature of either the air or the surface on which the mixture is to be placed is 35° F or lower.
 - b. HMA Wearing Course: Do not place base course when surfaces are wet or when the temperature of either the air or the surface on which the mixture is to be placed is 40° F or lower.
4. Paint Application Limitations: Adhere to manufacturer's data on air and surface temperature limits and relative humidity during application and curing of coatings.
1. Do not spray apply paint when wind velocity is above 15 mph.
 2. Schedule painting work to avoid dust and airborne contaminants.
 3. Apply paint during daylight hours only.
- B. Restrictions and Limitations Regarding Permanent Pavement Placement: The permanent replacement of street roadway and shoulder pavement shall be placed as soon as the trenches have been acceptably backfilled.
1. In the event the permanent pavement cannot be placed due to the weather limitations specified previously, provide temporary pavement.
- C. Protection: The Developer or responsible party performing the work shall assume responsibility for any injury or damage resulting from lack of required maintenance or repairs during Guarantee Period and shall Indemnify and save harmless the Township and Engineer from loss by reason of suit or action at law, based upon occurrence or omission occurring during this period.
1. Protect and maintain cut pavement edges until permanent replacement paving is placed.
 2. Protect paved surfaces outside of the pavement removal limits. Repair pavement outside removal limits, as may be damaged by construction operations, at no increase in Contract Price.
 3. Use such means as necessary to protect and maintain pavement materials before, during, and after installation to protect the installed work and materials of other

- trades.
4. In the event of failure of the work of this Section within the Guarantee Period, immediately make repairs and replacements. Upon failure to perform maintenance or repairs within three days after receiving written notice from the Township or Engineer, the Township may perform such maintenance or repairs and bill the Developer or responsible party performing the work or may call the Bond to released funds to perform the work, where applicable.
 5. Paint Products Storage: Take necessary precautions to ensure safe storage and use of paint materials and the prompt and safe disposal of waste. Store paint products protected from weather when these products may be affected by freezing.

PART 2 PRODUCTS

2.01 BASE AND SURFACE COURSE MATERIALS

- A. Subbase: Coarse Aggregate, Type C (or better) stone conforming to PDT Section 703.2, No. 2A aggregate.
- B. Bituminous Concrete Base Course (BCBC): Conforming to PDT Section 305 and Section 403 for RAP requirements.
- C. HMA Base Course: Superpave Asphalt Mixture Design, HMA Base Course (Standard) conforming to PDT Section 309. Mixture Design as approved by PennDOT.
- D. Bituminous Materials:
 1. Asphalt Cement: PG 64-22 conforming to PDT Section 702.
 2. Bituminous Tack Coat: Class AE-T Emulsified Asphalt conforming to PDT Section 460.
 3. Bituminous Prime Coat: Conforming to bituminous material requirements of PDT Section 461.2(a).
- E. Bituminous Wearing Course (ID-2 Wearing): Hot mixed, hot laid, Bituminous Wearing Course ID-2 conforming to PDT Section 420.
- F. HMA Wearing Course: Superpave Asphalt Mixture Design, HMA Wearing Course (Standard) conforming to PDT Section 409. Mixture Design as approved by PENNDOT.
- G. Aggregate Surface (Stone Driveway and Access Roadway): Select Granular Material (2RC) conforming to PDT Section 703.3.

2.02 MISCELLANEOUS MATERIALS

- A. Temporary Paving: Type 2-P Bituminous Stockpile Patching Material conforming to Section 484 of Bulletin 27.
- B. Calcium Chloride: Conforming to PDT Section 721.

- C. Cement Concrete: For curbs and sidewalks provide Class B (3,000 psi.) Concrete as specified in Section 03300.
- D. Traffic Zone Paint: Provide products meeting requirements of PDT Section 962 for the following:
 - 1. Yellow Traffic Zone Paint: Low-heat, rapid-dry formulation for center lines; reflective.
 - 2. White Traffic Zone Paint: Low-heat, rapid-dry formulation for edgelines and stop bars; reflective.
 - 3. Paint Quality: Paint material composition shall conform to AASHTO Type F paint formulation and AASHTO M-247, Type (standard gradation) for reflective media (glass beads).

2.03 PAVEMENT MIXES

- A. Composition of Mixtures: Binder and wearing course mixture composition shall conform to the requirements of PDT Section 401.
 - 1. Establish a job-mix formula prior to beginning work which shall not be changed during the progress of work without the Engineer's approval. Job-mixing tolerances shall not be presumed to permit acceptance of materials whose gradations fall outside the master ranges set in the specified PDT Sections.
 - 2. The approved job-mix formula shall lie within the specification limits and be suitable for the layer thickness and other conditions prevailing. It shall not be changed after work has started without the approval of the Engineer.

PART 3 EXECUTION

3.01 PREPARATION

- A. General Requirements for Pavement Removal: Cut existing pavement to neat lines equidistant from the centerline of the trench. Cut pavement with a mechanical saw.
 - 1. Remove pavement to a width equal to the specified maximum trench width plus two feet cut back; not less than one foot cut back on each side of the trench width as excavated.
 - 2. Where the pavement consists of a concrete base course and a bituminous surface course, remove the bituminous surface course for a width equal to the specified maximum trench width plus three feet and not less than 18-inches on each side of the trench width as excavated.
 - 3. If pavement is removed or disturbed for a greater width without written authorization of the Engineer, replace such pavement.
 - 4. At joints between existing pavements and new paving work, cut and neatly trim the edges of existing pavements in a manner subject to the Engineer's approval. Provide an application of asphalt cement at the locations where new bituminous paving joins existing bituminous paving.
 - 5. Remove temporary pavement and backfill to required depth for installation of permanent replacement pavement.

- B. Subgrade Over Trenches: Backfill and compact trenches as specified in Section 02221. Perform roadway grading of the trench surfaces just prior to subbase and paving installation.
- C. Subbase Construction: Install coarse aggregate Subbase in accordance with PDT Section 350. Install Subbase to after compacted thickness as matching the existing.

3.02 TEMPORARY PAVEMENT INSTALLATION

- A. General Requirements: When permanent pavement cannot be placed because of previously specified weather limitations on placing bituminous concrete pavement courses, provide temporary pavement over areas where existing pavement has been removed.
 - 1. After backfilling of any trench in paved rights-of-way is completed, install temporary paving over the entire trench width as excavated. Install temporary pavement to two inches thickness after compaction, with top surface flush with surface of adjacent pavement.
- B. State Highways: Install temporary pavement over areas where existing pavement has been removed. Install temporary pavement to two inches thickness after compaction, with top surface flush with surface of adjacent pavement.
 - 1. Temporary pavement in shoulders is the trench backfill.

3.03 PERMANENT REPLACEMENT PAVING INSTALLATION

- A. General Requirements: Methods of preparing mixture, placing mixture, compaction, and protection of in-place bituminous concrete for pavement shall comply with PDT Sections 305.3 and 401.3 for ID-2 and BCBC Type Pavements, as well as Upper Allen Township requirements exceeding these referenced PDT Sections.
 - 1. The specified thicknesses are the compacted thicknesses.
 - 2. Install shoulder pavement with top surface flush with surface of adjacent existing, replacement or overlay pavement.
 - 3. Install surface course of replacement pavement with top surface flush with surface of adjacent pavement.
 - 4. Install permanent replacement paving over areas where the paving has been removed.
 - 5. Prior to replacing pavement on areas that have been milled, condition the existing pavement in accordance with PDT Section 401.3 (f).
- B. Bituminous Concrete Base Course Installation: Construct BCBC in accordance with the requirements of PDT Section 305.
 - 1. Where roadways receive trench restoration only, install the Bituminous Concrete Base Course with the top surface below the surface of the adjacent pavement a distance equal to the thickness of the replacement surface course pavement.
 - 2. BCBC Width Thickness, Township Streets: Paving installed trench width plus specified cut back; 4-inch BCBC.

- C. HMA Base Course: Construct in accordance with requirements of PDT Section 309.
 - 1. Where roadways receive trench restoration only, install HMA Base Course with top surface below surface of adjacent pavement a distance equal to thickness of replacement surface course pavement.
- D. ID-2 Wearing Course Installation: Construct bituminous concrete wearing course in accordance with the requirements of PDT Section 420.
 - 1. Use Bituminous Tack Coat material to seal joints in wearing courses as specified in PDT Section 401.3 (j) 3.
 - 2. Install Wearing Course to a minimum thickness of 1-1/2-inches.
- E. HMA Wearing Course: Construct in accordance with requirements of PDT Section 409.
 - 1. Install HMA wearing course with top surface flush with surface of adjacent pavement.
- F. Shoulder Restoration: Perform trench backfilling to elevation of adjacent existing shoulder surface and grade, shape and roll entire width of disturbed shoulder area adjacent to the trench. Replace aggregate as removed.
 - 1. Apply Bituminous Prime Coat to full width of shoulder, per requirements of PDT Section 653.3 (b).
 - 2. After prime coat curing, apply Bituminous Surface Treatment in two separate applications per requirements of PDT Section 653.3 (c).
 - 3. Construct successive layers of Bituminous Surface Treatment so that the finished surface, after compaction, is flush with adjacent finished pavement.
- G. Aggregate Surface for Access Roadway: Construct the aggregate surface in accordance with PDT Section 677. Install aggregate surface on prepared subsurface to after compaction thickness as scheduled.

3.04 MISCELLANEOUS MATERIALS INSTALLATION

- A. Pavement Marking (Traffic Zone Paint):
 - 1. Paint Application: Strictly follow paint manufacturer's label instructions for mixing, thinning, proper spreading rate and drying time.
 - a. In no case shall film thickness be less than manufacturer's recommendations nor shall area coverage per gallon exceed manufacturer's recommendations.
 - b. Prior to pavement marking, clean pavement surface free of contaminants that will prohibit paint adhesion.
 - c. If material has thickened or must be diluted for application, the coating shall be built up to the same film thickness achieved with undiluted material. Do not use thinner to extend coverage of the paint.
 - d. Regardless of the surface condition, apply paint to achieve a suitable finish either by decreasing the coverage rate or by applying additional coats of paint.
 - 2. Lines and Markings: Apply lines and markings in accordance with PDT Section 962.

- a. Apply wet paint lines as indicated with an allowable width tolerance of plus or minus 1/8-inch.
- b. Spot the location of the final pavement markings by applying pavement spots at 25 foot intervals. Have the Engineer approve the final location of the spots before applying the traffic lines.
- c. Paint lines accurately with sharp, clearly defined edges. Paint solid colored areas free of skips and holidays. Make line work straight and uniformly spaced.
- d. Provide temporary satisfactory barriers for at least 30 minutes, or until the paint is dry and track free from vehicular traffic. Repaint marked or damaged areas.

3.05 MAINTENANCE

- A. Continuously maintain temporary pavement until it is replaced with permanent pavement.
- B. Maintain the work done under this Section for a period as stated in the Agreement where applicable. Maintenance shall include the repair or removal and replacement of such work which has failed, or wherever surface depressions have developed. Materials and methods used to repair or replace such work to conform to the applicable requirements of this Section.
- C. Should the Contractor fail to perform required maintenance or repairs within three days after receiving written notice from the Township or Engineer, the Township may perform such maintenance or repairs and bill the Developer or responsible party performing the work or may call the Bond to released funds to perform the work, where applicable.

END OF SECTION

SECTION 02601 - MANHOLES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The work specified in this Section consists of constructing the various types and sizes of manholes required.
- B. Related Sections:
 - 1. Trenching, Backfilling and Compacting: Section 02221
 - 2. Cast-In-Place Concrete: Section 03300.
 - 3. Grout: Section 03600.

1.02 REFERENCES

- A. American Society for Testing and Materials.
 - 1. ASTM A 48, Specification for Gray Iron Castings.
 - 2. ASTM A 276, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
 - 3. ASTM A 307, Specification for Carbon Steel Externally Threaded Standard Fasteners.
 - 4. ASTM A 615, Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 5. ASTM C 144, Specification for Aggregate for Masonry Mortar.
 - 6. ASTM C 150, Specification for Portland Cement.
 - 7. ASTM C 207, specification for Hydrated Lime for Masonry Purposes.
 - 8. ASTM C 270, Specification for Mortar for Unit Masonry.
 - 9. ASTM C 361, Specification for Reinforced Concrete Low-Head Pressure Pipe.
 - 10. ASTM C 443, Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - 11. ASTM C 478, Specification for Precast Reinforced Concrete Manhole Sections.
 - 12. ASTM C 497, Standard Methods of Testing Concrete Pipe, Manhole Sections, or Tile.
 - 13. ASTM C 923, Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
 - 14. ASTM D 695, Test Method for Compressive Properties of Rigid Plastics.
 - 15. ASTM D 1248, Specification for Polyethylene Plastics Molding and Extrusion Materials.
 - 16. ASTM D 2146, Specification for Propylene Plastic Molding and Extrusion Materials.
 - 17. ASTM D 2240, Test Method for Rubber Property-Durometer Hardness.
 - 18. ASTM D 4101, Specification for Propylene Plastic Injection and Extrusion Materials.
- B. American Association of State Highway and Transportation Officials (AASHTO) Standards as referenced throughout these Specifications.

- C. American Water Works Association:
 - 1. AWWA C 302, AWWA Standard for Reinforced Concrete Water Pipe-Noncylinder Type, Not Prestressed.
- D. Federal Specifications:
 - 1. Fed. Spec. SS-S-210A, Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints (Type 1 Rope Form).

1.03 SUBMITTALS

- A. Shop Drawings and Product Data: Submit manufacturer's published detail drawings, modified to suit design conditions if required, catalog cuts, Contractor prepared drawings as applicable, and such other data as required to provide complete descriptive information.
- B. Certificates: Submit certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.
 - 1. Manufacturer's sworn certification that components and products will be manufactured in accordance with specified reference standards for components and products.
 - 2. Manufacturer's sworn certification that manhole frame and cover tensile test bars were poured from the same iron as castings they represent.

1.04 QUALITY ASSURANCE

- A. Source Quality Control: Maintain uniform quality of products and component compatibility by using the products of one manufacturer for precast reinforced concrete manholes.
 - 1. Obtain certificate of construction compliance with ASTM C 478 from the precast reinforced concrete manhole manufacturer. Submit this certificate as part of required submittals.
 - 2. Obtain certificate of material compliance with ASTM A 48, Class 30 tensile strength from the manhole frame and cover manufacturer. Furnish certification that tensile test bars were from same pour as castings. Submit the certificate as part of required submittals.
- B. Shop and Laboratory Tests: As a condition of the Contract, the materials stated herein require periodic testing according to methods referenced, or as required by the Engineer.
 - 1. Laboratory Tests: Submit three manhole frame and cover tensile test bars for each 50 manhole frames and covers, or less if the total required is less than 50. Submit one machined test bar ready for testing. Engineer will verify certifications, release one bar for the Machined Bar Tensile Test, and retain two remaining bars.
 - a. Testing Laboratory shall furnish both Engineer and Contractor two copies of test result reports. These reports will be considered as sufficient evidence of acceptance or rejection of materials represented.
 - 2. Shop Tests: The manhole component manufacturers shall have the capability to

perform the number of tests that the Engineer may require to establish the quality of the proposed manhole components. Manufacturers shall furnish to the Engineer certified test records or reports with sworn statement of tests made as specified.

- a. Precast Reinforced Concrete Manholes: Conduct tests as specified in ASTM C 478.
 - b. Manhole Frames and Covers: Test for AASHTO H-20 highway loading. Test one manhole cover of each design submitted for approval.
3. Certified Test Records: The Engineer reserves the right to accept certified test records or reports of previously conducted tests.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Handling: Transport and handle precast reinforced concrete manhole components, and other products specified herein, in a manner recommended by their respective manufacturers to prevent damage and defects.
 1. Through-wall lifting holes are not permitted in manhole component construction.
- B. Storage: Store precast reinforced concrete manhole components in accordance with their manufacturer's recommendations to prevent joint damage and contamination.
 1. Exercise such particular care in storage of the specified appurtenant products as recommended by their respective manufacturers.

1.06 SITE CONDITIONS

- A. Environmental Requirements:
 1. Do not set or construct manhole bases on subgrade containing frost.
 2. To improve workability of Preformed Plastic Sealing Compound during cold weather, store such at temperature above 70 degrees Fahrenheit or artificially warm compound in a manner as recommended by the compound manufacturer.
 3. During warm weather stiffen Preformed Plastic Sealing Compound by placing under cold water or by other means as recommended by the compound manufacturer.
- B. Manhole Size Parameters: The typical inside diameter of manholes is set at four feet. Larger diameter manholes shall be required where the following conditions prevail:
 1. The angle of pipes entering the manhole is such that the wall space between the pipe openings is less than one foot.
 2. The manhole is scheduled to contain flow measuring instrumentation or other flow measuring devices.
 3. Where the depth of the manhole is greater than 15 feet as measured from invert of manhole channel to manhole rim elevation.
 4. Where an inside drop pipe and bowl system is installed.
- C. Manhole Location/Elevations: When a manhole is located outside a paved area, the finished elevation of the top of frame and cover shall be set twelve inches above finished grade, unless otherwise approved by Engineer.

- D. Protection, Public: If public safety is endangered during the progress of the work, provide adequate protective measures to protect public pedestrian and vehicular traffic where necessary.
 - 1. Signs, signals and barricades used shall conform to requirements of federal, state and local laws, rules, regulations, precautions, orders, and decrees.
- E. Protection, Workers: Provide safe working conditions within the manholes at all times. This includes temporary ventilation and protective clothing where and as required.
 - 1. Confined Spaces: Perform the work in adherence to statutes of appropriate local, state and federal health and labor laws including OSHA Confined Space entry.

PART 2 PRODUCTS

2.01 BASIC MATERIALS

- A. Cast-In-Place Concrete Products: As specified in Section 03300.
 - 1. Use Class A (4,000 psi) quality concrete, unless otherwise indicated on the drawings, or as directed by the Engineer.
- B. Non-Shrink, Non-Metallic Grout: As specified in Section 03600.
- C. Epoxy Bonding Compound: Provide a high-modulus, low viscosity, moisture insensitive epoxy adhesive having the following characteristics.
 - 1. Mix Ratio: 100 percent solids, two-component; mixed one part by volume component B to two parts by volume component A.
 - 2. Ultimate Compressive Strength: 13,000 psi after cure at 73 degrees F. and 50 percent relative humidity determined in accordance with ASTM D 695.
 - 3. Acceptable Manufacturers:
 - a. Sika Corporation: Sikadur Hi-Mod.
 - b. Euclid Chemical Company; No. 452 Epoxy System.
 - c. A. C. Horn, Inc.; Epoxitite Binder.
 - d. Or equal.
- D. Acrylic Polymer Bonding Compound: Provide an acrylic polymer water based liquid mixture to improve adhesion, cohesion, tensile, compressive and flexural strength.
 - 1. Mix Ratio: The normal ratio of product to potable water is 1:3. Where increased physical and chemical resistance requirements are more stringent, increase the mixing ratio to 1:2 or 1:1. The product may also be used straight.
 - 2. Acceptable Manufacturers:
 - a. Thoro Consumer Products; Acryl 60.
 - b. Approved equal.

2.02 MANHOLE MATERIALS

- A. Manhole Steps: Manhole step designs are as indicated on Drawings. A mixture of step types in any one manhole is not allowed.

1. Reinforced Plastic Step: Composed of a 2-inch size, Grade 60, ASTM A 615 deformed steel reinforcing bar completely encapsulated in Grade 49108, ASTM D 4101 polypropylene copolymer compound, Type II; M. A. Industries, Inc., Type PS4, or equal.
 2. Aluminum Step: Aluminum Alloy AA Designation 6061-T6. Coat that portion of aluminum step being embedded in concrete with heavy bodied bituminous paint.
- B. Manhole Frames and Covers: Gray iron castings conforming to ASTM A 48, Class No. 30, designed for AASHTO Highway Loading Class H-20. Provide castings of uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion or other defects. Frame and cover design and dimensions are as indicated on the Detail Drawings.
1. Finish: Bearing surfaces machined to prevent rocking and rattling under traffic. Casting finished to meet AASHTO Specification M 306, 4.3.3 Painting, Welding, Plugging - Not Allowed.
 2. Identification: Custom manhole cover with the words UPPER ALLEN TWP. SANITARY SEWER cast integrally on cover as indicated on the Detail Drawings.
 3. Frame Hold-down Bolts, Nuts and Washers: Provide a minimum of two (2) AISI Type 316 stainless steel $\frac{3}{4}$ " diameter nuts, bolts and washer conforming to ASTM A 276.
 4. O-ring Cover Gasket: One piece O-ring gasket factory installed in a machined rectangular or dovetail groove in the bearing surface of the frame or cover.
 - a. Gasket material of neoprene composition having good abrasion resistance, low compression set, Type D 40 durometer hardness determined in accordance with ASTM D 2240 and suited for use in sanitary sewer manholes.
 - b. Gluing of gasket is not permitted.
 5. Tensile Test Bar: Size B, cast separately, but poured from same iron as castings they represent.
 6. Acceptable manufacturer:
 - a. East Jordan Iron Works, Middletown, DE.
 - b. Approved equal.
- C. Watertight Manhole Frame and Cover: Conforming to above specified General Requirements with the following additional requirements:
1. Cover Hold-down Bolts: AISI Type 316 stainless steel conforming to ASTM A 276 for bolts and washers, or manufacturer's standard bronze bolts and washers.
- D. Manhole Component Seals: The option is permitted to provide either type manhole component seal as specified herein; however, only one type is permitted in the project.
1. Preformed Plastic Sealing Compound: Conforming to Fed. Spec. SS-S-210A, Type 1, Rope Form, of either bitumastic base compound or butyl rubber base compound, and shipped protected in a removable two-piece wrapper.
 - a. Dimensions: Size the cross-section of rope form to provide squeeze-out of material around entire interior and exterior circumference of each manhole section joint when joint is completed.
 - b. Acceptable Manufacturers:

- 1) K. T. Snyder Company, Inc.; RAM-NEK.
 - 2) K. T. Snyder Company, Inc.; RUB'R-NEK.
 - 3) Hamilton Kent Manufacturing Company; KENT-SEAL NO. 2.
 - 4) Or approved equal.
2. Rubber Compression Gasket: Provide gasket of material composition conforming to ASTM C 361 or ASTM C 443

2.03 PRECAST REINFORCED CONCRETE MANHOLE COMPONENTS

A. Materials and Fabrication: Conforming to requirements specified in ASTM C 478 except as follows:

1. Portland Cement: Composition and compressive strength conforming to ASTM C478 except use ASTM C150, Type I or Type III with Xypex Concentrate Admix C-2000 (for sulphate resistance), or ASTM C 150 Type II cement or Type I with portland blast-furnace slag cement or portland-pozzolan cement conforming to ASTM C595, except that the pozzolan constituents of the Type IP portland-pozzolan cement shall be fly ash and shall not exceed 25% by weight.
2. Casting and Curing: Wet cast and steam curing process in accordance with Section 3.6.11 and 3.7.2 of AWWA C 302.
3. Manhole Steps: Factory installed in manhole components, pre-aligned vertically, spaced on equal centers, and located the minimum distance from ends of risers and top sections as indicated on Drawings.
4. Manhole Component Seals: Manhole component joints factory formed for self-centering concrete to concrete bearing employing either a rubber compression gasket or preformed plastic sealing compound.
 - a. Rubber Compression Gasket: Of material composition conforming to ASTM C 361 or ASTM C 443.
 - b. Preformed Plastic Sealing Compound: As specified under Manhole Materials.
5. Manhole Component Design: Designs shall conform to ASTM C 478. Base, tapered and straight riser section, and top section dimensions and diameters, not consistent with ASTM C 478, are as indicated on Drawings.
6. Lifting Holes and Lugs: Through-wall lifting holes not permitted in manhole component construction. Factory-install lifting keys or lugs integrally in manhole components.

B. Precast Bases and Riser Sections: Design, materials and construction as specified previously under Materials and Fabrication.

C. Pipe Openings: Custom preformed during manufacturing in each base and riser section requiring a pipe opening. Preform the opening to accommodate the size of pipe and pipe opening seal required.

1. Prefabricated Pipe Opening Seals: Resilient gasket type, conforming to requirements specified in ASTM C 923.
2. Existing Manhole Pipe Connections: Core drill manhole wall to accommodate the size of pipe and pipe opening seal being used. Watertight seal to be provided by

suitable means utilizing a pipe to manhole adapter or an expandable type modular seal, in accordance with the Detail Drawings.

- a. Acceptable Manufacturers:
 - i. Trelleborg: Kor-N-Seal, 106/406 Series Pipe-to-Manhole Connector
 - ii. EnPro Industries – GPT – Link Seal Modular Seal

- D. Precast Top Sections: Designs as required by the Drawings, and of materials and construction as specified herein, except additional and differing requirements as follows:
 1. Hold Down Bolt Inserts: Factory cast the inserts in the top section with no fewer than two 3/4-inch threaded inserts or slotted inserts to accommodate manhole frame hold down bolts. Provide threaded inserts of three inches depth and designed for an ultimate load in tension of 12,500 pounds. Inserts factory plugged for shipping. Coordinate insert locations in the top sections to match the bolt hole locations in the manhole cover frames.
 2. Flat Slab Tops: Thickness versus diameter is as indicated on the Detail Drawings. Tops factory formed to properly accept and support required manhole cover frame and properly formed underside to join the top section to the riser section in a matching joint.
 3. Eccentric Cone Tops: Provide precast tops of the same minimum wall thickness and with same area of circumferential steel reinforcement as riser sections.
- E. Grade Rings: Leveling and adjusting units of one through six inches, thickness, and of materials and construction as specified.
 1. Precast Concrete Grade Rings: Provide precast concrete grade rings with hold down bolt holes matching location of bolt holes in manhole cover frame. The design shall provide for full bearing of manhole cover frame.
 2. Rubber Grade Rings: Provide recycled rubber adjustment risers of materials and construction as specified, with manufacturers name and location of the manufacturer clearly marked on the inside surface. The adjustment riser shall consist of no less than 80% by weight, recycled rubber from tires and no less than 10% by volume shredded fiber. The design shall provide for full bearing of manhole cover frame. A minimum of two holes to be drilled 180 degrees apart matching location of bolt holes in manhole cover frame. Rubber grade rings only allowed for use within paved surfaces and where applicable shall be tapered to match pavement grade.

Physical Properties	Test Requirements	Test Number
Hardness, molded surface	75 plus/minus 5	ASTM D2240
Density (g/cm ³)	1.098 plus/minus 0.05	ASTM C642-90
Tensile Strength (psi)	232	ASTM D2240
Weathering 70 hr. @ 70 degrees C		ASTM 573-88
Hardness	100%	
Tensile Strength	100%	
Compressive Strength	100%	
Elongation	100%	

Low Temperature Brittleness (Not brittle at minus 40 degrees C)	Pass	ASTM D2137
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1. Acceptable Manufacturers:
 - a. GNR Technologies, Infra-Riser.
 - b. Or equal.
- F. Waterproof Coating: Provide asphalt compound coating of either the solvent type or the emulsion type to exterior manhole surfaces. However, mixtures of the two types in the Project is not permitted.
1. Solvent Type: Brush or spray-on asphalt compound, cold-applied and conforming to Federal Specification SS-A-701 B.
 2. Emulsion-Type: Brush or spray-on asphalt-base, clay emulsion with fibers, cold-applied and conforming to Federal Specification SS-R-1781.
 3. Acceptable Manufacturers:
 - a. W. R. Meadows, Inc.; SEALMASTIC.
 - b. Cooper Creek.
 - c. Or equal.
 4. Application: The coating may be either shop or field applied. Apply coating to the exterior of manhole components.
 - a. Apply coating in two coats at the rate of 75 to 100 square feet per gallon per coat. Allow 24 hours drying between coats.
- G. Corrosion Protection Coating: Provide corrosion protection to the interior surface of precast manhole sections and bases where indicated on the plans or as directed by the Engineer. Precast components may be coated at the factory or on-site using a non-flexible epoxy resin protective coating and sealant as specified below.
1. Materials:
 - a. Utilize a 100% solids, solvent-free two-component epoxy resin system thixotropic in nature and filled with select fillers to minimize permeability and provide sag resistance for productive application. Coating shall have the following properties:

Product type:	Amine cured epoxy
Solids Content (vol %):	100
Mix Ratio:	3:1
Flexural Modulus, psi:	600,000
Compressive Strength, psi:	12,870
Tensile Strength, psi:	6,640
Tensile Elongation, %:	1.5%
Bond Strength - Concrete:	>Tensile Strength of Concrete
Chemical Resistance to	
Municipal Wastewater:	Immersion Service
Sulfuric Acid, 10%:	Immersion Service
Sodium Hydroxide, 20%:	Immersion Service

2. Acceptable Manufacturers:
 - a. Raven Lining Systems' Raven 405 epoxy coating system.
 - b. Sika Corporation; SikaGard 62 High-Build Epoxy Coating.
 - c. Parson Environmental; Parsonpoxy SEL-80 100% Solids Modified Epoxy Coating.
 - d. Tnemec Company, Inc.; 104 HS Epoxy, minimum dry film thickness 12 to 16 mils.
 - e. Royston Laboratories, Inc.; Roypex, two coats, dry film thickness 7 to 9 mils.
 - f. Approved equal.

H. Inside Drop System: All new and/or existing manhole structures employing inside drops shall be outfitted with Inside Drop Components. The bowl size shall be determined by incoming pipe size and flow rates. The bowl shall be installed as per manufacturer's instructions using stainless steel fasteners. The appropriately sized drop pipe of SDR 35 PVC shall be securely attached to the manhole wall using stainless steel adjustable clamping brackets and stainless steel fasteners. Bracket interval shall be 4 feet maximum with a minimum of 2 brackets total. The connection of drop bowl to drop pipe shall be by flexible external pipe coupler. The turn-out at the base end of the drop pipe shall be accomplished with an appropriately angled PVC pipe elbow fitting, as determined by the Engineer.

1. Acceptable manufacturers:
 - a. Duran, Inc. – Reliner
 - b. Or Approved Equal

I. Inside Drop Pipe Supports: Stainless steel adjustable pipe supports are to be used in conjunction with inside drop pipe systems and are to be secured to the concrete manhole walls with stainless steel expansion type anchor bolts and fasteners. Brackets are to be non-corrosive 11-gauge 304 stainless steel. The brackets are to be secured with 3/8 inch stainless steel expansion type anchor bolts and fasteners.

1. Acceptable manufacturers:
 - a. Reliner/Duran, Inc.
 - b. Or Approved Equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Field Inspection: Inspect precast reinforced concrete manhole components in accordance with requirements of ASTM C 478 regarding repairable defects and defects subject to rejection by the Engineer.

3.02 PREPARATION

- A. Earthwork: Perform earthwork for manhole installation as specified in Section 02221.
 1. Keep pipe and manhole interiors cleared of debris as construction progresses.
 2. Existing Paving Removal: Using a mechanical saw, cut existing paving to neat

lines equidistant from the center line of the manhole. Remove paving as specified under Section 02500.

- B. Waterproof Coating Touch-Up: Touch-up chipped, cracked, or abraded surfaces and finished joints with two coats of the factory applied waterproof coating material.
- C. Corrosion Protection Coating Touch-Up: Touch-up chipped, cracked, or abraded surfaces and any other surface damage using the same material as the factory applied protection coating.

3.03 MANHOLE CONSTRUCTION METHODS

- A. Construction Options: The option is permitted to construct either cast-in-place concrete manhole bases or to provide precast concrete manhole bases; except where only cast-in-place bases are required.
- B. Cast-In-Place Concrete Manhole Base: Cast-in-place manhole bases are not permitted.
- C. Precast Concrete Manhole Bases: Install bases on a 6-inch deep compacted layer of aggregate meeting requirements of First Class Bedding as specified in Section 02221.
- D. Length of Pipe Connections into Manholes: Use pipes no longer than six feet in length when connecting to manholes, unless otherwise approved by the Engineer.
- E. Concrete Channel Fill: When factory preformed channels are not provided in precast bases, field pour and form concrete channel fill for each manhole base.
 - 1. Form inverts directly in concrete channel fill.
 - 2. Accurately shape invert to a semi-circular bottom conforming to inside of connecting pipes, and steel trowel finish to a smooth dense surface.
 - 3. Make changes in size and grade gradually.
 - 4. Make changes in direction of entering sewer and branches to a true curve of as large a radius as manhole size will permit.
 - 5. In terminal manholes, install concrete channel fill with formed channel extending from down stream pipe opening directly across the base to future pipe opening on upstream side of the base.
 - 6. Make slopes gradual outside the invert channels.
 - 7. Use Class A (3000 psi) concrete as specified in Section 03300, unless indicated otherwise on Drawings, or approved by Engineer.
 - 8. When precast bases with preformed channels are used, fill the annular space at the pipe connections, on both sides of the wall, with non-shrink non-metallic grout as specified in Section 03600.
- F. Manhole Wall Erection: Provide precast reinforced concrete straight riser, tapered riser and top sections necessary to construct complete manholes. Fit the different manhole components together to permit watertight jointing and true vertical alignment of manhole steps.

1. Use Preformed Plastic Sealing Compound between sections, install sealing compound in accordance with manufacturer's recommendations, and join sections in accordance with written instructions of manhole component manufacturer.
 - a. Prime joint surfaces if required by sealing compound manufacturer.
 - b. If sealing compound is installed in advance of section joining, leave exposed half of two piece protective wrapper in place until just prior to section joining.
 - c. Use sealing compound as the sole element utilized in sealing section joints from internal and external hydrostatic pressure.
 - d. Following manhole section installation, trim sealing compound flush with interior face of manhole. Remove excess sealing compound from manhole, do not allow it to enter sewer system.
 - e. Make pipe connections into manhole walls as specified for pipes connecting into manhole bases.
- G. Manhole Frame and Cover Installation: Where required, make final adjustment of frame to elevation using Grade Rings (riser or leveling rings). Set manhole frame and cover to conform to roadway grade and crown. Set top of manhole frame and cover 1/8-inch below finished paving elevation. Manhole frame and cover and grade ring materials and installation must conform to Detail Drawings.
 1. Precast Concrete Grade Ring Installation: Install precast concrete grade rings as required and without exceeding the maximum allowable distance of 24-inches from the casting rim to the first manhole step. Grade rings are to be sealed between adjacent grade rings, the bottom of the casting, or the top of the precast concrete wall section using a double application of preformed plastic sealant material.
 2. Rubber Grade Ring Installation: Install rubber grade rings in accordance with the manufacturer's written instructions using continuous beads of polyurethane base sealant on the concrete manhole surface, between each grade ring, and between the last grade ring and the manhole cover frame casting. Perform the manhole cover frame casting bolt-down operation following the grade ring installation.
 - a. Rubber grade rings permitted for use in paved areas only.
 - b. Tapered rubber grade rings should be used where ever it is necessary to conform to roadway grade and crown.
 3. Frame and Cover Anchorage: Anchor manhole frames in place on manhole top section, or on leveling units, after installing 1/2-inch thick preformed plastic sealing compound on bearing surface of manhole frame. Remove excess sealing compound squeeze-out after manhole frame is bolted in place.
 - a. Anchor Bolt Length: Size bolts according to the following:
 - i. Sufficient length to properly pass through leveling units, if any.
 - ii. Sufficient length to engage full depth of manhole top section inserts.
 - iii. Sufficient length to allow enough threaded end to pass through manhole frame to properly tighten nut and washer.
 - b. Tighten manhole frame bolts after mortar has cured.
 - c. Install manhole covers using the proper bolts as provided with the covers for the waterproof installations.

- H. Application of Sealant Material to Manhole Risers: Generally the interior and exterior of manhole riser sections (grade rings) are to be unsealed/uncoated. If it becomes necessary to seal riser sections in order to pass a manhole vacuum test, it may be permissible to apply an epoxy resin protective coating in accordance with manufacturer's instructions. Application of cementitious or other coatings will not be permitted.
- I. Future Connection Requirements: Make provisions for future connections to manholes by installing a five foot length of pipe out of the manhole with a pipe bell on the upstream end of the pipe.
 - 1. Plug the bell end of the pipe opening using a properly designed pipe plug as specified in Section 02722.
 - 2. Install the pipe plug to meet the specified exfiltration limits and to allow future removal without damage to the pipe or manhole.
 - 3. If stub connection is within an area of future roadway which will be paved prior to extending stub, then stub will need to be extended to outside the limits of paving at the proper slope and alignment.
 - 4. Do not grout annular space around pipe on inside of manhole if pipe not set to final grade and alignment.
- J. Drop Manholes: All drop manholes are to be inside drop systems constructed in accordance with the Detail Drawings. The minimum manhole diameter for an inside drop manhole is five feet.

3.04 INTERFACING EXISTING CONSTRUCTION

- A. Bypassing Provisions: As work of this Section, maintain flow in the existing sewer both during construction operations and until concrete is cured in newly formed invert channels.
 - 1. Provide a fail-safe (and properly sized) temporary means and method of continued wastewater system service. The means and methods are at the Contractor's discretion.
 - 2. Do not permit ground or surface water to enter the existing wastewater sewer facilities during the construction or the bypass work.
 - 3. Do not flush, drain or deposit water or debris from the new manhole construction into the existing sanitary sewer facilities.
- B. Constructing Manholes on Existing Sewers: Where new manholes are constructed on existing sewers, the Contractor must use the specified precast bases.
 - 1. When existing pipe is broken or damaged as a result of work in this Section, replace such pipe with new PVC pipe material matching the inside diameter of existing pipe. Use compatible joint materials or flexible pipe coupling as indicated on the Detail Drawings.
 - 2. Connect new pipe to the specified new manhole bases, or new in-line structures, to the first joint outside the manhole base.
 - 3. Saw-cut piping to be removed. Chipping or breaking pipe as a cutting method is not acceptable.
 - 4. Install a watertight plug in the new sewer piping entering the new manhole.

Maintain the plug until all debris and accumulated water has been removed from the new sewer facilities and the new sewer facilities have passed all specified acceptance tests.

3.05 FIELD QUALITY CONTROL

- A. General Requirements: Test each manhole constructed in the Project by the methods specified herein. If the manhole is constructed on an existing sewer where sewage flow must be maintained, the manhole test may be waived at the Engineer's discretion.
 - 1. Conduct tests in presence of, and to complete satisfaction of the Engineer.
 - 2. Provide tools, materials (including water), equipment and instruments necessary to conduct the manhole testing specified herein.
 - a. 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.
 - i. Provide an extra vacuum gauge of known accuracy to frequently check test equipment and apparatus.
 - ii. Vacuum testing equipment and associated testing apparatus are subject to Engineer's approval.
 - iii. Provide seal plate with vacuum piping connections for inserting in manhole frame.
 - 3. Prior to testing, clean manholes thoroughly and seal openings, both to the complete satisfaction of the Engineer. Seal openings using properly sized plugs.
 - 4. Perform testing with the cast iron manhole frames installed. Include the joints between the precast manhole and riser components and the cast iron manhole frame in the test.
 - 5. 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 the backfilling has been completed.
- B. Vacuum Test Procedure: Perform vacuum testing in accordance with the testing equipment manufacturer's written instructions and the following:
 - 1. Draw a vacuum of ten inches of mercury and close the valves.
 - 2. Consider manhole acceptable when vacuum does not drop below nine inches of mercury for the following manhole sizes and times:
 - a. Four foot diameter: 60 seconds.
 - b. Five foot diameter: 75 seconds.
 - c. Six foot diameter: 90 seconds.
 - d. Eight foot diameter: 120 seconds.
- C. Repair and Retest:
 - 1. General Requirements: Determine source or sources of leaks in manholes failing acceptable limits.
 - a. Repair or replace defective materials and workmanship, as is the case, and conduct such additional Manhole Acceptance Tests, and such subsequent repairs and retesting as required until manholes meet test requirements.
 - b. Materials and methods used to make manhole repairs shall meet with

Engineer's approval prior to use.

2. Retest for Frame Adjustment: Retest manhole if frame is adjusted to accommodate final paving or if frame is disturbed during conduct of the work.

END OF SECTION

SECTION 02722 - PIPED WASTEWATER SEWER

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The work specified in this Section consists of constructing the various types and sizes of the piped wastewater sewers and appurtenances and connecting to manholes or other structures within the pipeline alignment.
- B. Related Sections:
 - 1. Trenching Backfilling and Compacting: Section 02221.
 - 2. Manholes: Section 02601.
 - 3. Grout: Section 03600.

1.02 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A 21.10, Gray-Iron and Ductile-Iron Fittings, 2 through 48 inches, for Water and Other Liquids.
 - 2. ANSI A 21.11, Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
 - 3. ANSI A 21.50, Thickness Design of Ductile-Iron Pipe.
 - 4. ANSI A 21.51, Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
- B. American Society for Testing and Materials.
 - 1. ASTM A 48, Specification for Gray Iron Castings.
 - 2. ASTM C 76, Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
 - 3. ASTM C 144, Specification for Aggregate for Masonry Mortar.
 - 4. ASTM C 150, Specification for Portland Cement.
 - 5. ASTM C 361, Specification for Reinforced Concrete Low-Head Pressure Pipe.
 - 6. ASTM C 443, Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - 7. ASTM C 923, Specification for Resilient Concrete Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
 - 8. ASTM C 924, Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
 - 9. ASTM D 1784, Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - 10. ASTM D 2000, Standard Classification System for Rubber Products in Automotive Applications (SAE Recommended Practice J200).
 - 11. ASTM D 2321, Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
 - 12. ASTM D 3034, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

13. ASTM D 3212, Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
14. ASTM F 477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
15. ASTM F 679, Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
16. ASTM F 789, Specification for Type PS-46 Poly (Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings.
17. ASTM F 794, Specification for Poly (Vinyl Chloride) (PVC) Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

C. American Water Works Association:

1. AWWA C 100, Cast-Iron Pressure Fittings.
2. AWWA C 104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
3. AWWA C 151, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
4. AWWA C 301, Prestressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids.
5. AWWA C 302, Reinforced-Concrete Water Pipe-Noncylinder Type, Not Prestressed.
6. AWWA C 600, Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances.

D. Uni-Bell Plastic Pipe Association:

1. UNI-B-6, Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe.
2. UNI-B-9, Recommended Performance Specification for Polyvinyl Chloride (PVC) Profile Wall Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

1.03 SUBMITTALS

- A. Shop Drawings and Product Data: Submit completely dimensioned shop drawings, catalog cuts and such other data as required to provide complete descriptive information for the following:
1. Pipe and Fittings
 2. Piping Specialties
 3. Service Connection Pipe and Fittings
- B. Certificates: Submit certified records or reports of results of shop tests, with such records or reports containing a sworn statement that shop tests have been performed as specified.
1. Manufacturer's sworn certification that pipe will be manufactured in accordance with specified reference standards for each pipe type.

1.04 QUALITY ASSURANCE

A. Design Criteria:

1. Use only one type and class of pipe in continuous line of sewer between structures, unless otherwise indicated on the Drawings.
2. Use only pipe and fittings designed to withstand imposed trench loadings and prevailing site conditions at the various locations.
3. Provide a minimum depth of cover of five feet for pipe sewers. Where less cover is provided, it may be necessary to protect the pipe with concrete encasement or by some other means, as determined by the Engineer.
4. Whenever concrete encasement of the sewer is required, the entire length of sewer between manholes shall be Ductile Iron pipe, unless otherwise approved by the Engineer.

B. Source Quality Control:

1. Shop Tests: In accordance with Article 1.06 of the General Instructions, factory tests of pipe materials listed below, shall have been performed. Each pipe manufacturer shall have facilities to perform the listed tests. The Engineer reserves the right to require the manufacturer to perform such additional number of tests as the Engineer may deem necessary to establish the quality of the material offered for use.

<u>MATERIAL</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Polyvinyl Chloride Pipe PVC	ASTM D 3034 or ASTM F 789	As specified in ASTM D 3034 or ASTM F 789
Ductile Iron Pipe	ANSI A 21.51	As specified in ANSI A 21.51.
Reinforced Concrete Pipe	ASTM C 76	As specified in ASTM C 76.
Prestressed Concrete Cylinder Pipe	AWWA C 301	As specified in AWWA C 301.

2. Laboratory Tests: The Engineer reserves the right to require that laboratory tests also be conducted on materials that are shop tested, at no cost to the Township. This shall include labor, materials, and equipment necessary for collecting, packaging, and identifying representative samples of materials to be tested and the shipping of such samples to the Testing Laboratory.
3. The Engineer reserves the right to accept certified test records or reports of previously conducted tests covering the above stated tests.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Transport, handle and store pipe materials and the associated materials specified herein, in the manner recommended by the respective materials manufacturers so as to prevent damage and defects to their respective materials.

1.06 SITE CONDITIONS

A. Environmental Requirements:

1. Keep trenches dewatered until pipe joints have been made and concrete cradle and encasement (as required) have cured.
2. Do not lay pipe in water or on bedding containing frost.
3. Do not lay pipe when weather conditions are unsuitable for pipe laying work, as determined by the Engineer.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

- A. Elastomeric Gaskets: Provide gaskets conforming to ASTM F 477 requirements for material specifications and capable of providing a watertight seal. Additionally, provide gaskets that have been tested as suitable for continuous contact with domestic sewage.
- B. Solid Wall Polyvinyl Chloride (PVC) Pipe: Provide pipe which is permanently marked with manufacturer's trademark, size and ASTM conformance designation.
1. Pipe, Solid Wall, Size 6 through 15 Inch Diameters: Type PSM SDR-35 conforming to ASTM D 3034 requirements, or Type PS-46 conforming to ASTM F 789 requirements for pipe sizes above 15 inch to 18 inch diameter.
 2. Pipe, Solid Wall, Size 18 through 27 Inch Diameters: Type PS-46 conforming to ASTM F 679 requirements.
 3. Fittings: Commercially manufactured molded fittings made from PVC compounds having a cell classification of 12454-B, 12454-C, or 13343-C as defined in ASTM Specification D 1784.
 4. Joints: Push-on style joint, with elastomeric gasket, conforming to ASTM D 3212 requirements for joint design; gasket conforming to ASTM F 477 requirements for material specifications, providing a watertight seal.
 - a. Pipe bell design shall incorporate the gasket locked in a groove so as to prevent gasket displacement when pipes are joined.
- C. Closed Profile Polyvinyl Chloride (PVC) Pipe: Provide pipe which is permanently marked with manufacturer's trademark, size and ASTM conformance designation.
1. Pipe, 21 through 48 Inch Diameters: Manufactured to a controlled inside diameter, with integral bell and elastomeric seal joints, and conforming to ASTM F 794 requirements.
 2. PVC Compounds: Complying with the requirements for a minimum cell classification of 12364A as defined by ASTM D 1784.
 3. Fittings: Fabrications made by the pipe manufacturer, using closed profile pipe meeting ASTM F 794 requirements, and formed by fusion heat welded mitered joints. Molded fittings and fabricated fittings made up by solvent cement mitered joints are not acceptable.
 4. Joints: Push-on style joint, with elastomeric gasket, conforming to ASTM D 3212 requirements for joint design; gasket conforming to ASTM F 477 requirements for

material specifications, providing a watertight seal. Gaskets factory installed and chemically bonded to the pipe to prevent gasket displacement when pipes are joined.

D. Ribbed Wall PVC Pipe: Not allowed.

E. AWWA C900 PVC Pipe:

1. Materials: Comply with ASTM D1784 for Type 1, Grade 1, cell classification 12454.
2. Pipe Joint Standard: ASTM D3139
3. Dimensions / Testing: All pipe meets or exceeds all performance specifications set forth in the current version of the AWWA C900 standard.
4. Color of the Pipe: Green
5. Markings on the Pipe: Identification of nominal pipe size (CI diameter), PVC, dimension ratio, AWWA pressure class, test pressure for hydrostatic tested pipe, AWWA designation number (AWWA C900), manufacturer's name, code, and labeled "Sanitary Sewer".
6. Gaskets: All gaskets used in the pipe must meet ASTM F477 standards.

F. Ductile Iron Pipe (DIP) Epoxy Lined: Conforming to ANSI A21.50 and ANSI A 21.51 requirements land the following:

1. Wall Thickness Class, Buried Pipe: As indicated on Drawings or as determined by the Engineer.
2. Fittings: Gray iron or ductile iron conforming to ANSI A21.10 requirements. Fittings larger than 48 inches shall conform to AWWA C100 Class B requirements.
3. Rubber-Gasket Joints, Buried Pipe: Conforming to ANSI A21.11 requirements. For buried pipe installation, provide push-on or mechanical joints except where other types of joints are indicated on the Drawings or required by the Specifications or regulatory agency.
4. Pipe and Fitting Coating: Manufacturer's standard asphaltic coating, approximately one mil thick in accordance with AWWA C151, applied to the outside of pipe and fittings.
5. The Standard of Quality is Protecto 401 Ceramic Epoxy. The material shall be an amine-cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. Any request for substitution must be accompanied by a successful history of lining pipe and fittings for sewer service, a test report verifying the following properties, and a certification of the test results.
 - a. A permeability rating of 0.00 when tested according to Method A of ASTM E-96-66, Procedure A with a test duration of 30 days.
 - b. The following test must be run on coupons from factory-lined ductile iron pipe:
 - i. ASTM B-117 Salt Spray (scribed panel) - Results to equal 0.0 undercutting after two years.
 - ii. ASTM G-95 Cathodic Disbondment 1.5 volts @ 77°F. Results to equal no more than 0.5mm undercutting after 30 days.
 - iii. Immersion Testing rated using ASTM D-714-87.

- 1) 20% Sulfuric Acid - No effect after two years.
 - 2) 140°F 25% Sodium Hydroxide - No effect after two years.
 - 3) 160°F Distilled Water - No effect after two years.
 - 4) 120°F Tap Water (scribed panel) - 0.0 undercutting after two years with no effect.
- c. An abrasion resistance of no more than 3 mils (.075mm) loss after one million cycles using European Standard EN 598: 1994 Section 7.8 Abrasion Resistance.
- G. Reinforced Concrete Pipe (RCP): Provide pipe with Rubber and Steel, or Rubber and Concrete joints; however a mixture of joint types will not be accepted.
1. Pipe Construction: Conforming to ASTM C 76, Class III requirements, of Wall B minimum, except where indicated otherwise on Drawings, and having an interior surface roughness coefficient measured in Kutters 'n' not exceeding 0.013. Pipe acceptance is based on Paragraph 5.1.1 of ASTM C 76 Acceptance on the Basis of Plant Load-Bearing Tests, Materials Tests, and Inspection of Manufactured Pipe for Visual Defects and Imperfections, and written certification of conformity to the following. Submit such certification two weeks prior to pipe delivery. Pipe shall also meet the following criteria:
 - a. Manufactured with Type II Portland Cement conforming to ASTM C 150.
 - b. Cured to meet specified compressive strength.
 - c. Manufactured with circular reinforcement with both bell and spigot ends reinforced. Bell and spigot reinforcement welded to barrel reinforcement.
 2. Fittings and Specials: Manufactured in conformance to requirements of Section 4, AWWA Standard C 302 with wall thickness being equal to adjoining pipe barrel, and manufactured with circular reinforcement.
 3. Rubber and Steel Joints: Formed of steel joint rings on tongue and groove ends or on bell and spigot ends, both with round rubber gasket contained in an external groove in the tongue or spigot end ring. The joint and rubber gasket shall conform to requirements specified in Section 3.3 and 3.4 respectively of AWWA Standard C 302; additional requirements as follows:
 - a. The exposed portion of the steel joint rings shall have a factory applied coal tar epoxy, or epoxy-polyamide, protective coating applied to 8 mils dry film thickness. The pipe manufacturer shall prepare the steel surfaces and apply the coating in strict conformance with the coating manufacturer's instructions. Field applied coatings not acceptable.
 - b. The bell end of the pipe shall have a factory applied grout retaining diaper anchored in place with corrosion resistant straps. The diaper is inverted for final placement in the field finishing operations of the joint.
 - c. Provide joint grout for finishing the joint which grout shall consist of one part Portland cement conforming to ASTM C 150, and three parts sand conforming to ASTM C 144, and water in sufficient quantity to mix the grout to a consistency of thick cream free of lumps.
 4. Rubber and Concrete Joints: Formed of concrete and sealed with round rubber gasket contained in an external groove in the concrete of the tongue or spigot end. Joint and rubber gasket shall conform to requirements specified in ASTM C 361.

- H. Prestressed Concrete Cylinder Pipe (PCCP): Provide pipe manufactured of Type II Portland Cement conforming to ASTM C 150, and calcerous aggregate (limestone), as well as the following additional requirements:
1. Pipe Construction: Manufactured according to AWWA Standard C 301, either by horizontal centrifugation, or vertical wet casting with inside and outside forms, or dry pack casting; according to AWWA C 301 3.6.9, 3.6.10, or 3.6.11, respectively.
 - a. Minimum wire shall be No. 6 with maximum class of Class III.
 - b. Minimum cylinder thickness shall be 16 ga. Exterior coating shall have maximum sand-cement ratio of 2 2 to one.
 2. Fittings: Manufactured in conformity with AWWA C 301, Section 4.
 3. Joints: Bell and spigot design, steel joint ring and round rubber gasket, each conforming to AWWA C 301 and the following:
 - a. The exposed portion of the steel joint rings shall have a factory applied coal tar epoxy, or epoxy-polyamide, protective coating applied to 8 mils dry film thickness. The pipe manufacturer shall prepare the steel surfaces and apply the coating in strict conformance with the manufacturer's instructions. Field applied coatings not acceptable.
 - b. The bell end of the pipe shall have a factory applied grout retaining diaper anchored in place with straps. The diaper is inverted for final placement in the field finishing of the joint.
 - c. Provide joint grout for finishing the joint which shall consist of one part Portland cement conforming to ASTM C 150, and three parts sand conforming to ASTM C 144, and water in sufficient quantity to mix the grout to a consistency of thick cream free of lumps.

2.02 PIPING SPECIALTIES

- A. Flexible Pipe Couplings: Provide flexible pipe couplings designed for making differing pipe materials connections, and for making transition/reductions of differing pipe material connections.
1. Coupling Construction: Composed virgin polyvinyl chloride (PVC) material which meets the performance requirements of Commercial Standard Specification CS 226-59. Couplings designed for pipe outside diameter coupling shall incorporate recesses to contain two stainless steel bands. Couplings provided with two pre-assembled AISI Type 305 stainless steel bands.
 2. Shear Rings: Provide band-type construction shear rings designed to reduce the possibility of shear failure of the Flexible Pipe Coupling. Shear rings fabricated of AISI Type 300 series stainless steel sheet and provided complete with pre-assemble AISI Type 305 stainless steel screw bands. Provide the proper style shear ring, including bushings as necessary, as is suited to the particular Flexible Pipe Coupling being used.
 3. Acceptable Manufacturers:
 - a. FERNCO Inc., Distributed by the General Engineering Company.
 - b. Or equal.
- B. Sleeve Type Pipe Seal: Use sleeve type pipe seal in making a core-drilled connection of

piping to existing manholes or structures. Pipe seal construction as follows:

1. In general, the pipe seal shall conform to the requirements of ASTM C 923 and shall incorporate a positive compression fit of the gasket to both the manhole and the pipe.
 2. Acceptable Manufacturers:
 - a. Press-Seal Gasket Corp., Concrete Products Supply Co.; PSX Seal.
 - b. Or equal.
- C. Modular, Mechanical Type Pipe Seal: Use modular, mechanical type pipe seal in making a core-drilled connection of piping to existing manholes or structures. Pipe seal construction as follows:
1. The seal shall consist of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening.
 2. The elastomeric element of the seal shall be sized and selected in accordance with the seal manufacturer's recommendations. Elastomeric element shall conform to ASTM D 2000 requirements for EPDM material.
 3. The hardware provided in the seal shall be as recommended by the seal manufacturer for buried service such as will exist at the project site.
 4. Acceptable Manufacturers:
 - a. Thunderline Corporation; Link-Seal.
 - b. Or equal.
- D. PVC Waterstop: Use PVC waterstop in making a grouted connection of piping to existing manholes or structures. Waterstop construction as follows:
1. Gasket type waterstop composed of virgin polyvinyl chloride (PVC) material which meets the performance requirements of U.S. Commercial Standard Specification CS 226-59.
 2. Acceptable Manufacturers:
 - a. FERNCO Inc., CMA Concrete Manhole Adapter, Distributed by the General Engineering Company.
 - b. Or equal.

2.03 SERVICE CONNECTION PIPE AND FITTINGS

- A. Solid Wall Polyvinyl Chloride (PVC) Pipe: SDR-35 PVC pipe as specified previously under Pipe and Fittings; six inch diameter.
- B. PVC Pipe Fittings: As specified previously.
- C. Pipe Plugs: PVC pipe plugs designed for permanent installation and removable. Obtain plugs for various types of pipe used from the respective pipe manufacturer.
- D. Cleanout Cap Protection Casting: Gray iron casting confirming to ASTM A 48, Class No. 35; designed for AASHTO Highway Loading Class HS-20. Casting shall be a product of the U.S.A.
 1. Finish: Cover bearing surface factory machined to prevent movement under

traffic. Casting surfaces factory cleaned and coated with manufacturer's standard asphalt-base coating (non-tacky drying).

2. Acceptable Manufacturers:
 - a. East Jordan Iron Works, Inc.; Model No. 1007-S.
 - b. Neenah Foundry Company.
 - c. Or equal.

E. Tapping Sleeve: Two section type for bolting over pipe with flange face outlet, designed for field tap-machine opening.

1. Sleeve Body: CF8 Cast Stainless Steel, equivalent to 18-8 Type 304 Stainless Steel, Grade C requirements; AWWA C207 Class D, ANSI 150 pound drilling outlet; and fusion bonded inside and out epoxy coating to 12 mil average thickness.
2. Bolts and Nuts: Stainless Steel, type 304. Extra strength alloy steel bolts with semi-finished hexagon nuts conforming to ANSI A21.11 requirements.
3. Gasket: Full circumferential synthetic rubber compound gasket for sewage service. The gasket shall have a gridded surface, be a full 1/4-inch thick with 304 stainless steel bridge plate molded flush into the gasket.
4. Acceptable Manufacturers:
 - a. Rockwell International Company; No. 622 Tapping Sleeve.
 - b. JCM Industries, Inc.; No. 432 Tapping Sleeve.
 - c. Or equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Field Inspection: Inspect each section of new pipe and each pipe fitting before laying in conformance with the inspection requirements of the appropriate referenced standard.
- B. Rejected Products: Remove rejected Products from the Project site and replace with new Products at no increase in Contract Price.
 1. Pipe and fittings already laid and later found defective will not be accepted and shall require replacement at no increase in Contract Price.

3.02 PREPARATION

- A. General Requirements: Clean piping interior prior to laying pipe and following pipe laying and keep open ends of piping and pipe attachment openings capped or plugged until actual connection or actual pipe testing.
 1. Provide the protective means to prevent water and debris from washing into the pipe.
- B. Earthwork: Perform earthwork for gravity sewer installation as specified in Section 02221.
 1. Bedding materials and concrete work for pipe bedding as specified in Section 02221.

2. Excavate trenches in rock at least 25-feet in advance of pipe laying. Protect pipe ends from rock removal operations.

3.03 SEWER MAIN RECONSTRUCTION

- A. General Requirements: Use proper and suitable tools and appliances for the proper and safe handling, lowering into trench and laying of pipes.
 1. Lay pipe proceeding upgrade true to line and grades given. Lay bell and spigot pipe with bell end upgrade. Lay tongue and groove pipe with groove end upgrade. No wedging or blocking permitted in laying pipe unless by written order of Engineer.
 2. Exercise care to insure that each length abuts against the next in such manner that no shoulder or unevenness of any kind occurs along inside bottom half of pipe line.
 3. Before joints are made, bed each section of pipe full length of barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe previously laid and the existing pipe grade alignment. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place. Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded full length of its barrel.
 4. Walking or working on the installed pipe line, except as necessary in tamping and backfilling, is not permitted until trench is backfilled one-foot deep over top of pipes.
 5. Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying.
 6. Replacement of Damaged Sewer Main Segments: Remove existing damaged pipe to the limits as directed and replace with new PVC Pipe as specified previously.
 - a. When the existing pipe ends are pipe bells, remove the bell by cutting with an approved pipe cutting apparatus or mechanical saw. Removing the pipe bell or other pipe section hammering or chiseling is not permitted.
 - b. Make connection of new PVC Pipe to remaining existing pipe using Flexible Pipe Couplings. Provide reducing style Flexible Pipe Coupling where required to accommodate differing pipe material diameters.
- B. PVC Pipe Laying and Joining: Perform PVC pipe laying and joining in strict accordance with manufacturer's installation instructions, reference standards as included, and such additional requirements as specified herein:
 1. Watertightness: Make joints absolutely watertight and immediately repair detected leaks and defects. Methods of repair subject to Engineer's approval.
 2. Laying/Joining Specified Types of Plastic Pipe: Installation and joint assembly shall be according to ASTM D 2321 requirements, and for Class I bedding material as included therein.

3.04 SERVICE CONNECTION RECONSTRUCTION

- A. General Requirements: Perform service connection reconstruction as specified for Sewer Main Reconstruction, as to the extent as directed for each individual condition.

1. Line and Grade: Lay service connections true to line and grade of the existing piping.
 2. 2-Way Cleanouts (Test Tees): Install a six by six by six inch PVC SDR 35 sweeping, 2-way cleanout in the service connections where none are present. Close two outlets of 2-way cleanout with plugs, where applicable. Type of plug used and method of installation subject to Engineer's approval.
 3. In general, where depth of sewer invert is 12-feet or more, or elsewhere as designated by the Engineer, install service connections to enter the sewer as detailed for Service Connection-Deep Sewer. Construct of same material used for service connections.
- B. Service Connection Piping Replacement: For the section of service connection piping being replaced, use 6-inch diameter PVC Piping and Flexible Pipe Couplings to connect to the remaining existing service connection piping. Use 4-inch by 6-inch eccentric increaser to connect new 6-inch lateral to existing 4-inch building sewer.
- C. Connections to Sewer Main: Use commercially manufactured PVC wye or tee fittings and bend fittings as specified previously for service connection outlet on the sewer main.
1. Set PVC wye or tee fitting outlets on the sewer main at proper vertical angles as required to bring service connections to the proper depth.
 2. Replace sufficient length of existing sewer main to provide space for the new wye or tee fitting and watertight connections to the existing sewer main.
- D. Connections of Piping to Existing Manholes or Structures: The option is allowed to construct pipe connections to existing manholes or structures by one of the methods stated herein, except where indicated otherwise on the Drawings. A mixture of connection methods is not allowed.
1. Core-drilled Opening Utilizing Sleeve Type Pipe Seal: Core-drill the required opening or openings using the proper equipment for the work. Make openings of sufficient size to accommodate the Pipe Seal.
 2. Core-drilled Opening Utilizing Modular, Mechanical Type Pipe Seal: Core-drill the required opening or openings using the proper equipment for the work. Make openings of sufficient size to accommodate the Pipe Seal.
 3. Cut-in Opening Utilizing PVC Waterstop and Grout: Cut required opening or openings by such methods so as to prevent cracking and spalling concrete. Make openings of sufficient size to accommodate the pipe with PVC Waterstop installed and one inch of annular grout space. Grout annular space using Non-Shrink Non-Metallic Grout as specified in Section 03600. Make connection watertight.
 4. New Invert Channel: Regardless of the connection to existing manhole option selected, form a new invert channel in the existing manhole base to properly conduct the flow through the existing manhole. Do not permit groundwater, surface water or debris to enter the existing facilities through the new connection.

3.05 FIELD QUALITY CONTROL

- A. General Requirements: Conduct the tests specified herein so that each pipe line installed in the Project is tested to the Engineer's satisfaction. Conduct tests in the presence of and to the satisfaction of the Engineer.
 - 1. Notification: The Contractor shall give the Engineer a minimum of 48 hours advance notification of the date of the testing specified herein.
- B. Testing Equipment: Provide tools, materials (including water), apparatus and instruments necessary for pipe line testing. Use air compressing apparatus equipped with a control panel with necessary piping, control valves and gauges to control air flow rate to the piping section under test, and also the air pressure within the test seal plugs.
 - 1. to prevent accidental overloading of piping test section, provide air compressing apparatus with an approved pressure relief device set to relieve at ten psi.
 - 2. Provide an extra pressure gauge of known accuracy to frequently check test equipment and apparatus.
 - 3. Provide GO-NO-GO Mandrel and incidental equipment for Deflection Test. Mandrel to conform to following requirements:
 - a. Cylindrical in shape with an odd number of arms (not less than nine arms) spaced evenly around the mandrel.
 - b. Minimum contact length of mandrel arms with pipe wall not less than the nominal diameter of the pipe being tested.
 - c. Mandrel diameter 95 percent of inside pipe diameter.
 - 4. Provide all other equipment, materials, and labor necessary to conduct Contractor required tests.
- C. Cleaning Prior to Tests: Before tests are conducted, flush piping including sewers, branches and service connections until free of all forms of dirt and construction debris.
- D. Initial Section Test: To demonstrate acceptability of installed pipe materials and workmanship, construct and air test one sewer section from manhole to manhole using the pipe provided in the Contract. Pretesting such section prior to actual Initial Section Test not permitted.
 - 1. Conduct Initial Section Test in same manner as Line Acceptance Test specified in a following paragraph.
 - 2. Conduct the Initial Section Test for each size and type pipe material used in the Project prior to continued installation of same pipe.
 - 3. Provide pipe manufacturer's representation during laying, backfilling and testing of Initial Sections Tests.
 - 4. The Engineer has the option to order the same Initial Section Test for a section of sewer in each 3,000 lineal feet of sewer line of a particular size and material.
 - 5. Conduct same Initial Section Test for one manhole to manhole sewer section of each 3,000 lineal feet of sewer.
 - 6. Failure of an Initial Section Test will be sufficient cause for the Engineer to reject manufacturer and supplier of pipe regardless of cause of failure.
 - 7. Sewer sections successfully tested as Initial Section Test will be retested under Line Acceptance Test.
- E. Line Acceptance Test: After a section of sewer and its service connections is constructed between adjacent manholes, backfilled and successfully cleaned, perform a

low pressure air Line Acceptance Test in accordance with the following and the procedures and Standards listed therein:

1. Plug free ends of branches and service connections.
 2. Seal Sewer piping at upstream and downstream manholes with pneumatic type plugs. Test plug seal before actual use by such methods as recommended by the plug seal manufacturer.
 3. Introduce low pressure air slowly into sealed sewer section until internal air pressure is four psig greater than the average ground water pressure acting on the pipe.
 4. Allow two minutes minimum for air temperature to stabilize, adding only required air to maintain pressure.
 5. After stabilization period (3.5 psig minimum in pipe) disconnect air supply and determine rate of air loss by measuring time interval required for 3.5 psig to decrease to 2.5 psig greater than the average groundwater pressure acting on the pipe.
 6. To determine the groundwater pressure acting on the pipe being tested, divide the height in feet of the groundwater above the invert of the pipe by 2.3. Add the result to the previously specified test pressures (i.e., If maximum groundwater height is 11.5 feet above the pipe invert, the groundwater pressure is five psig. This increases the 3.5 psig and 2.5 psig to 8.5 psig and 7.5 psig, respectively.) Test pressure not to exceed ten psig regardless of height of groundwater over the pipe.
 7. Consider sewer line Acceptable when a 1.0 psig pressure drop does not occur within the test time specified in the AIR TEST TABLES immediately following this Section.
 8. Test Standards:
 - a. PVC Pipe, Solid Wall: Test according to UNI-B-6.
 - b. PVC Pipe, Profile Wall: Test according to UNI-B-9.
 - c. RCP, PCCP, DIP: Test according to ASTM C 924.
 9. For sections of sewer containing service connections which service existing buildings, perform Line Acceptance Test by testing one joint at a time.
 - a. Equipment: Use joint testing apparatus such as the Cherne Joint Tester, Cherne Industrial, Inc., Edina, Minnesota or equal.
 - b. Consider joint acceptable when the pressure loss is less than one pound in one minute immediately following air stabilization.
 - c. Use air pressure for testing joint as previously specified.
- F. Deflection Test: In addition to the infiltration test, conduct deflection tests on PVC pipe. Test each PVC pipe sewer main installed.
1. Conduct deflection testing not less than 30 days nor more than 60 days after section of pipe sewer main and service connection between adjacent manholes is backfilled.
 2. Pull mandrel through pipe section manually; powered pulling devices not permitted.
 3. Consider sewer line section which mandrel cannot pass through, to have more than maximum allowable deflection of five percent.

- G. Repair and Retest: When section or sections of sewer fails to meet test requirements specified previously, determine source or sources of leakage, repair or replace defective material, and if as result of improper workmanship, correct such workmanship.
 - 1. Take up and relay pipe sewer line section that has more than the maximum allowable deflection.
 - 2. Conduct additional tests required to demonstrate that sewer line meets specified tests requirements.
- H. Televisual Inspection by Township (Township Option): The Township will perform televisual inspection of main line at the Township's option.

END OF SECTION 02722

TABLE 1

AIR TEST TABLE

SPECIFICATION TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED

Pipe Diameter (inches)	Minimum Time (minutes:seconds)	Length for Minimum Time (feet)	Time for Longer Length (seconds x length,feet)	Specification Time for Length (L) Shown (minutes:seconds)							
				100 feet	150 feet	200 feet	250 feet	300 feet	350 feet	400 feet	450 feet
4	1:53	597	.19 x Length	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 x Length	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760 x Length	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 x Length	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 x Length	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	1.671 x Length	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 x Length	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 x Length	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 x Length	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 x Length	14:25	21:38	28:51	36:04	43:16	50:30	57:42	46:54

SECTION 02724 – FORCE MAINS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The work specified in this Section consists of constructing the piped wastewater force mains and appurtenances thereto, and constructing the various structures within the pipeline.
- B. Related Sections:
 - 1. Trenching, Backfilling and Compacting: Section 02221.
 - 2. Manholes: Section 02601.
 - 3. Cast-In-Place Concrete: Section 03300.
 - 4. Grout: Section 03600.

1.02 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A 21.10, Gray-Iron and Ductile-Iron Fittings, 2 through 48 inches, for Water and Other Liquids.
 - 2. ANSI A 21.11, Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
 - 3. ANSI A 21.15, Flanged Cast-Iron and Ductile-Iron pipe with Threaded Flanges.
 - 4. ANSI A 21.50, Thickness Design of Ductile-Iron Pipe.
 - 5. ANSI A 21.51, Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
 - 6. ANSI A 21.53, Ductile-Iron Compact Fittings, 3 in. Through 12 in. For Water and Other Liquids.
 - 7. ANSI B 16.1, Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
 - 8. ANSI B 16.21, Nonmetallic Gaskets for Pipe Flanges.
 - 9. ANSI B 18.2.1, Square and Hex Bolts and Screws, Including Askew head Bolts, Hex Cap Screws, and Lag Screws.
 - 10. ANSI B 18.2.2, Square and Hex Nuts.
- B. American Society for Testing and Materials.
 - 1. ASTM A 47, Specification for Malleable Iron Castings.
 - 2. ASTM A 48, Specification for Gray Iron Castings.
 - 3. ASTM A 167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 - 4. ASTM A 183, Specification for Carbon Steel Track Bolts and Nuts.
 - 5. ASTM A 240, Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Fusion-Welded Unfired Pressure Vessels.
 - 6. ASTM A 283, Specification for Low and Intermediate Tensile Strength Carbon Steel Plates of Structural Quality.
 - 7. ASTM A 320, Specification for Alloy Steel Bolting Materials for Low-Temperature Service.

8. ASTM A 536, Specification for Ductile Iron Castings.
9. ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
10. ASTM B 85, Specification for Aluminum-Alloy Die Castings.
11. ASTM B 371, Specification for Copper-Zinc-Silicon Alloy Rod.
12. ASTM B 438, Specification for Copper-Base Sintered Bearings (Oil-Impregnated).
13. ASTM B 584, Specification for Copper Alloy Sand Castings for General Applications.
14. ASTM D 1248, Specification for Polyethylene Plastics Molding and Extrusion Materials.
15. ASTM D 1599, Standard Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.
16. ASTM D 1784, Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride)(CPVC) Compounds.
17. ASTM D 2241, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).
18. ASTM D 2774, Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Pipe.
19. ASTM D 2837, Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
20. ASTM D 3139, Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
21. ASTM D 3261, Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
22. ASTM D 3350, Polyethylene Plastic Pipe and Fittings Materials, Spec. for.
23. ASTM F 714, Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
24. ASTM F 477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. American Water Works Association:

1. AWWA C 104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C 151, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
3. AWWA C 509, Resilient-Seated Gate Valves, 3 Through 12 NPS, for Water and Sewage Systems.
4. AWWA C 550, Protective Interior Coatings for Valves and Hydrants.
5. AWWA C 600, Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances.
6. AWWA C 900, Polyvinyl chloride (PVC) Pressure Pipe, 4-inch Through 12-inch, for Water. In this size pipe range, PVC will only be used when the force main has low flows and hydrogen sulfide gas is an issue and Engineer approval is granted. Otherwise, all pipes will be ductile iron.

1.03 SUBMITTALS

- A. Shop Drawings and Product Data: Submit completely dimensioned shop drawings,

catalog cuts and such other data as required to provide complete descriptive information for the following:

1. Force Main Pipe and Fittings
2. Piping Specialties
3. Sewage Valve
4. Gate Valves
5. Air Release and Cleanout Chambers
6. Forcemain Locator Assembly

- B. Certificates: Certificates shall be records or reports of shop tests which are factory certified that such records and reports are for the products tested (DIP) as specified herein. Sworn certifications shall bear the seal of a Registered Professional Engineer.
1. Provide certification of the pipe being in accordance with specified reference standards for each pipe type being used in the project.

1.04 QUALITY ASSURANCE

- A. Design Criteria: In addition to the design requirements of the Pennsylvania Department of Environmental Protection (DEP), comply with the following:
1. Use only one type and class of pipe in any continuous force main between structures, unless otherwise indicated on the Drawings.
 2. Use pipe and fittings designed to withstand imposed trench loadings and conditions at the various locations.
- B. Source Quality Control:
1. Shop Tests: In accordance with Article 1.06 of the General Instructions, factory test pipe materials listed in the following. Each pipe manufacturer shall have facilities to perform listed tests. The Engineer reserves the right to require the manufacturer to perform such additional number of tests as the Engineer may deem necessary to establish the quality of the material offered for use.

<u>MATERIAL</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Polyvinyl Chloride Pipe	ASTM D 2241	As specified in ASTM D 2241.
Polyvinyl Chloride Pipe	AWWA C 900	As specified in AWWA C 900.
Ductile Iron Pipe	ANSI A 21.51	As specified in ANSI A 21.51.

2. Certificates: The Engineer reserves the right to accept certified test records or reports of previously conducted tests covering the above stated tests.
3. Laboratory Tests: The Engineer reserves the right to require that laboratory tests also be conducted on materials that are shop tested certified. The Contractor shall be fully responsible for collecting, packaging, identifying and shipping the representative samples of materials to be tested to the Testing Laboratory.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Transport, handle and store pipe materials and precast reinforced concrete manhole components and the associated materials specified herein, in a manner recommended by the respective manufacturers to prevent damage and defects.

1.06 SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Keep trenches dewatered until pipe joints have been made and concrete cradle and encasement, if any, have cured.
 - 2. Under no circumstances lay pipe in water or on bedding containing frost.
 - 3. Do not lay pipe when weather conditions are unsuitable for pipe laying work, as determined by the Engineer.

PART 2 PRODUCTS

2.01 FORCE MAIN PIPE AND FITTINGS

- A. Elastomeric Gaskets: For pipe joint gasket material, provide elastomeric gaskets that have been tested as suitable for continuous contact with domestic sewage.
- B. Polyvinyl Chloride (PVC), 4 Through 8 Inch Diameter Pipe (As directed by the Township): Provide pipe which is permanently marked with manufacturer's trademark, size and AWWA conformance designation. Pipe design and material requirements shall conform to AWWA C900 requirements for DR 18, 150 psi pressure class.
 - 1. PVC Pipe Joints: Push-on or compression type, rubber gasket, conforming to ASTM D 3139 and F 477 requirements.
 - 2. Fittings: Gray iron or ductile iron conforming to ANSI A21.10 requirements, rated for 250 psi working pressure.
 - a. Fitting Joints: Rubber-gasket push-on or mechanical type conforming to ANSI A21.11 requirements.
 - b. Fitting Coating: Manufacturer's standard asphaltic coating, approximately one mil thick in accordance with AWWA C 151.
 - 3. Retainers for PVC Pipe: Manufactured from 60-42-10 ductile iron conforming to ASTM A 536 requirements, including the glands and tie bolts. The retainers shall have a sufficient number of tie bolts to restrain the working and test pressures established by the retainer manufacturer.
 - a. The glands shall have serrations on the inside diameter sufficient to hold against both the working and test pressures.
 - b. Acceptable Manufacturer:
 - 1) EBAA Iron Sales, Inc.
 - 2) Or equal.
 - 4. Restraints for PVC fittings: Manufactured from 60-42-10 ductile iron conforming to ASTM A 536 requirements, including the bell ring, restraint ring and tie bolts.
 - a. A split ring shall be utilized behind the bell of the fitting outlets. A serrated ring shall be used to grip the pipe and a sufficient number of bolts shall connect the bell ring and the serrated gripping ring. The combination shall restrain continuously against a working pressure rating of 150 psi.
 - b. Acceptable Manufacturer:

- 1) EBAA Iron Sales, Inc.
- 2) Or equal.

C. Polyethylene (PE) Pipe and Fittings (As directed by the Township. All pipe sizes are to internal diameter or use DIPS pipe): Provide pipe which is permanently marked with manufacturer's trademark, size and ASTM conformance designation. Pipe design shall conform to ASTM F 714 for SDR 17 performance requirements.

1. Pipe Construction: The polyethylene material shall have a PE 3408 designation and shall conform to ASTM D 1248 requirements for a Type III, Class C, Category 5, Grade P34 material. Pipe material shall also have a cell classification of 345434C as defined in ASTM D 3350, and have a hydrostatic design value basis of 1600 psi when tested in accordance with ASTM D 2837.
2. Fittings: Molded from polyethylene compound equal to the compound used in the PE pipe construction. Fabricated fittings shall conform to ASTM D 3261, SDR 17 requirements and shall be pressure rated to match the system piping in which they are installed.
3. Joining: Both pipe and fittings joined to one another by thermal butt fusion, saddle fusion, or socket fusion in accordance with procedures developed by the pipe manufacturer.
4. Flanged Joints: PE pipe and fittings joined to other materials by means of flanged connections composed of PE flange (fusion joined to pipe) and type 316 stainless steel back-up rings rated for the same pressure service as the pipe.

D. Ductile Iron Pipe (DIP): Conforming to ANSI A21.50 and ANSI A21.51 requirements.

1. Wall Thickness Class, Buried Pipe: As indicated on Drawings or as determined by the Engineer.
2. Wall Thickness Class, Exposed Pipe: Class 53 except as noted otherwise on Drawings.
3. Fittings: Gray iron or ductile iron conforming to ANSI A21.10 requirements, rated for 250 psi working pressure.
4. Rubber-Gasket Joints, Buried Pipe: Conforming to ANSI A21.11 requirements. For buried pipe installation, provide either push-on or mechanical joints except where other types of joints are indicated on the Drawings or required by the Specifications.
5. Restrained Joints: Conforming to requirements of ANSI A21.11 and designed for a working pressure equal to connected pipe rating. Provide joints for pipe and fittings similar to the following:
 - a. American Cast Iron Pipe Company; Lok-Fast or Lok-Set.
 - b. Clow Corporation; Super-Lock.
 - c. United States Pipe and Foundry Company; TRFLEX.
 - d. Or equal.
6. Flanged Joints, Exposed Pipe: Conforming to ANSI A21.15 requirements. Unless indicated otherwise on the Drawings, use flanged joints for pipe and fittings installed inside of structures.
 - a. Gaskets: 1/16 in. thick cloth insertion rubber full face type conforming to ANSI B16.21 requirements.
 - b. Bolts: Conforming to ANSI B18.2.1 requirements.
 - c. Nuts: Conforming to ANSI B18.2.2 requirements.

7. Retainer Glands: Designed for pipe joint retaining through the use of a follower gland and set screw anchoring devices which impart multiple wedging action against the pipe. The mechanical joint restraint device shall have a working pressure of at least 250 psi with a minimum safety factor of two to one. Material components as follows:
 - a. Gland: Manufactured of ductile iron conforming to ASTM A 536 requirements. Gland dimensions shall match ANSI A21.11 and A21.53.
 - b. Restraining Devices: Manufactured of ductile iron heat treated to a minimum hardness of 370 BHN. Restraining devices shall incorporate a set screw/twist off nut bolt to insure the proper actuating of the restraining device. The twist off nut shall be designed to come off at the torque limit desired to anchor the restraining device in place on the pipe.
 - c. Joint Deflection: Retainer Gland joint deflection shall be limited to a two degree maximum. Joint deflection shall be applied before the set screws are torqued.
 - d. Acceptable Manufacturers:
 - 1) EBAA Iron, Inc.; Megalug 1100 Series.
 - 2) Or equal.
8. Pipe and Fitting Lining: Manufacturer's standard cement-mortar lining in accordance with AWWA C 104, single thickness. Lining shall include an asphaltic seal coat to prevent moisture loss in cement-mortar curing sequence.
9. Pipe and Fitting Coating: Manufacturer's standard asphaltic coating, approximately one mil thick in accordance with AWWA C 151, applied to the outside of pipe and fittings.

2.02 PIPING SPECIALTIES

- A. Flanged Adapters: Fabricated from high strength steel (Style 128), or cast iron (Style 127), and designed for joining DIP plain-end pipe to flanged fittings, valves, and flanged end equipment.
 1. The compression-end of the adapter shall have the Dresser-Coupling type pack utilizing a Grade 27 wedge gasket for positive, watertight sealing. The flanged-end shall match the flange of the proposed fitting, valve or equipment connection.
 2. Acceptable Manufacturers:
 - a. Dresser Manufacturing Division of Dresser Industries, Inc.; Dresser Style 128 and 127.
 - b. Rockwell-International.
 - c. R. H. Baker & Co., Inc.
 - d. Or equal.
- B. PVC Waterstop: Use PVC waterstop in making a grouted connection of piping to existing manholes or structures, with Engineer approval. Waterstop construction as follows:
 1. Gasket type waterstop composed of virgin polyvinyl chloride (PVC) material which meets the performance requirements of U.S. Commercial Standard Specification CS 226-59.
 2. Acceptable Manufacturers:
 - a. FERNCO Inc., CMA Concrete Manhole Adapter, Distributed by the General

- Engineering Company.
 - b. Or equal.
- C. Sleeve Type Pipe Seal: Use this method of connection as the Engineer's preferred method of connection. Use sleeve type pipe seal in making a core-drilled connection of piping to existing manholes or structures. Pipe seal construction as follows:
 - 1. In general, the pipe seal shall conform to the requirements of ASTM C 923 and shall incorporate a positive compression fit of the gasket to both the manhole and the pipe.
 - 2. Acceptable Manufacturers:
 - a. Press-Seal Gasket Corp., Concrete Products Supply Co.; PSX Seal.
 - b. Trelleborg Pipe Seals Milford, Inc.; Kor-N-Seal 106-406 Series.
 - c. Or approved equal.
- D. Modular, Mechanical Type Pipe Seal: Use modular, mechanical type pipe seal in making a core-drilled connection of piping to existing manholes or structures. Pipe seal construction as follows:
 - 1. The seal shall consist of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening.
 - 2. The elastomeric element of the seal shall be sized and selected in accordance with the seal manufacturer's recommendations. Elastomeric element shall conform to ASTM D 2000 requirements for EPDM material.
 - 3. The hardware provided in the seal shall be as recommended by the seal manufacturer for buried service such as will exist at the project site.
 - 4. Acceptable Manufacturers:
 - a. Thunderline Corporation; Link-Seal.
 - b. Or equal.
- E. Wall Sleeves: Cast gray iron or ductile iron conforming to ANSI A21.10 requirements, rated for 250 psi working pressure, and provided with intermediate anchoring flange in center of sleeve.
 - 1. Joints: Joint requirements shall match that of the connected piping except where indicated otherwise on the Drawings.
 - 2. Acceptable Manufacturers:
 - a. McWane Incorporated
 - b. American Cast Iron Pipe Co.
 - c. U.S. Pipe and Foundry Co.
 - d. Or equal.
- F. Flexible Pipe Coupling: Coupling shall consist of a steel middle ring or sleeve, two steel or malleable iron flange or follower rings, two wedge shaped resilient gaskets and sufficient number of track-head bolts and nuts.
 - 1. Middle Ring or Sleeve: Steel construction conforming to ASTM A 283, (Grade A) requirements, fabricated in a true circular section and free of surface defect.
 - 2. Follower Rings or Flanges: Steel construction conforming to ASTM A 47 (Grade 32510) requirements, fabricated in a true circular section and free of surface defect, and tested and sized after welding by cold expanding a minimum of one percent.

3. Bolts and Nuts: Steel bolt conforming to ASTM A 183 requirements, double radius head or buttonhead track type with rolled threads, conforming to ANSI B1.1 requirements; and steel nuts conforming to ANSI B 18.2.2 requirements, American Standard Heavy Dimension Series.
 4. Gaskets: Resilient wedge-shaped of synthetic base compound designed for raw sewage and sludge service.
 5. Shop Paint: Middle and follower rings shop painted with primer compatible with specified field coat for piping where coupling is located.
 6. Acceptable Manufacturers:
 - a. Dresser Manufacturing Division of Dresser Industries, Inc.; Dresser Style 38 or 138.
 - b. Rockwell-International.
 - c. R. H. Baker & Co., Inc.
 - d. Or equal.
- G. Stainless Steel Supports: Fabricate supports for piping and equipment within structures using Type 304 stainless steel conforming to ASTM A 167. Individual pipe support and pipe strap designs are as indicated on the Drawings.
1. Anchors and Fasteners: Provide drilled-in type expansion anchors incorporating a one-piece stud (bolt) with integral expansion wedges, nut and washer as a UL Listed assembly and meeting physical requirements of Federal Specification FF-S-325, Group II, Type 4, Class 1. Stud of Type 303 or 304 stainless and nut and washer of Type 316 stainless.
 2. Standard Bolts, Nuts and Washers: Type 304 stainless steel conforming to ASTM A 320.
- H. Concrete: As specified in Section 03300 for Class A (3000 psi) Concrete.

2.03 SEWAGE VALVE

- A. Sewage Air Release Valve: Valve design shall automatically release air, gas or vapor under pressure during system operation. Valve design shall feature long body and float stem components so that the operating mechanism is kept free from contact with sewage during operation. Valve construction as follows:
1. Valve Body and Cover: Cast iron, conforming to ASTM A 48, Class 35 requirements.
 2. Inlet Size: 2-inches, NPT.
 3. Outlet Size: 1/2-inch, NPT.
 4. Maximum Working Pressure: 75 psi.
 5. Vent Orifice: 5/16-inch.
 6. Discharge Orifice Seat, Mechanism and Valve Stem: Stainless Steel.
 7. Orifice Button: Stainless steel and Buna-N, Nitrile Rubber conforming to ASTM SB 800 requirements.
 8. Mechanism Lever Pins and Float: High strength stainless steel, conforming to ASTM A 240 requirements.
 9. Backflushing and Cleaning Accessories: Factory assembled to the valve and consisting of a 2-inch shut-off valve at bottom inlet, a 1-inch blow-off valve near the bottom of the valve body, quick disconnect couplings and 2-inch shut-off

- valve at top of valve, and a section of rubber hose with quick disconnect coupling.
10. Acceptable Manufacturers:
 - a. Val-Matic Valve And Manufacturing Corp.; Model No. 48 Series.
 - B. Sewage Air and Vacuum Valve: Valve design shall automatically exhaust large quantities of air during the filling of a system and shall allow air to re-enter the system during draining or when a vacuum occurs. Valve design shall feature long body and float stem components so that the operating mechanism is kept free from contact with sewage during operation. Valve construction as follows:
 1. Valve Body and Cover: Cast iron, conforming to ASTM A 48, Class 35 requirements.
 2. Inlet Size: 2-inches.
 3. Discharge Orifice: 2-inches.
 4. Float Stem and Guide: Bronze, conforming to ASTM B 584 requirements.
 5. Floats: Stainless Steel, conforming to ASTM A 240 requirements.
 6. Orifice Seat: Buna-N, Nitrile Rubber, conforming to ASTM SB 800 requirements.
 7. Backflushing and Cleaning Accessories: Factory assembled to the valve and consisting of an inlet shut-off valve, a 1-inch blow-off valve near the bottom of the valve body, quick disconnect couplings and a 2-inch shut-off valve at the top of valve, and a section of rubber hose with quick disconnect coupling.
 8. Acceptable Manufacturers:
 - a. Val-Matic Valve And Manufacturing Corp.; Model No. 300 Series.
 - C. Sewage Combination Air Valves: Consisting of an air release valve and an air and vacuum valve factory piped into a compact assembly. The combination assembly shall automatically release air, gas or vapor under system operating pressure and shall also allow air to re-enter the system during draining or when a vacuum occurs. Combination valve designs shall feature long bodies and float stem components so that the operating mechanisms are kept free from contact with sewage during operation. Valve construction as follows:
 1. Valve Bodies and Covers: Cast iron, conforming to ASTM A 48, Class 35 requirements.
 2. Inlet Sizes: 2-inches.
 3. Air Release Outlet Size: 1/2-inch, NPT.
 4. Vacuum Discharge/Outlet Size: 2-inches.
 5. Air Release Valve Maximum Working Pressure: 75 psi.
 6. Air Release Valve Vent Orifice: 5/16-inch.
 7. Air Release Valve Discharge Orifice Seat, Mechanism and Valve Stem: Stainless steel.
 8. Air Release Valve Orifice Button: Stainless Steel and Buna-N, Nitrile Rubber conforming to ASTM SB 800 requirements.
 9. Air Release Valve Mechanism Lever Pins and Float: High strength stainless steel, conforming to ASTM A 240 requirements.
 10. Air and Vacuum Valve Float Stem and Guide: Bronze, conforming to ASTM B 584 requirements.
 11. Air and Vacuum Valve Floats: Stainless Steel, conforming to ASTM A 240 requirements.

12. Air and Vacuum Valve Orifice Seat: Buna-N, Nitrile Rubber, conforming to ASTM SB 800 requirements.
13. Backflushing and Cleaning Accessories: Factory assembled to the combination valves and consisting of two inlet shut-off valves, two blow-off valves, two clear water inlet valves, section of rubber hose and quick disconnect couplings.
14. Acceptable Manufacturers:
 - a. Val-Matic Valve And Manufacturing Corp.; Model No. 48 or 49/300 Series.

2.04 GATE VALVES

- A. Hose End Gate Valve: Class 125 bronze gate valve having screw-in bonnet, non-rising stem, tapered solid wedge, and rated 200 psi non-shock cold water, oil or gas. Valve body shall indicate ratings and manufacturer identification. Design of valve stuffing box of such that repacking under pressure is possible. Valve construction requirements as follows:
 1. Ends: Female standard pipe size to national standard hose.
 2. Handwheel: Aluminum alloy conforming to ASTM B 85 requirements, with zinc plated steel nut and aluminum identification plate (opening direction indicated).
 3. Valve Stem: Silicon bronze alloy conforming to ASTM B 371 requirements.
 4. Packing Nut/Packing Gland: Sintered bronze conforming to ASTM B 438 Grade I Type II requirements.
 5. Packing: TFE impregnated asbestos.
 6. Stuffing Box, Bonnet, Valve Body, Wedge and Hose Cap: Bronze conforming to ASTM B 62 requirements.
 7. Hose Cap Gasket: Rubber.
 8. Safety Chain: Brass.
 9. Acceptable Manufacturers:
 - a. NIBCO, Inc.; Cat. No. T-113-HC.
 - b. Crane Company.
 - c. Wm. Powell Company.
- B. Iron Body Gate Valve: Designed for working water pressure of 200 psi for valves 12-inch in diameter and smaller. Valve construction requirements as follows:
 1. General Requirements:
 - a. Markings factory cast on the bonnet or body of each valve indicating manufacturer's name or mark, year of valve casting, size of valve, directional flow arrow and designation of working water pressure.
 - b. Valves shall open to the left (counterclockwise). Valves operated by nut, handwheel, or otherwise as indicated on the Drawings. Operating nuts or wheels shall have cast thereon an arrow indicating the direction of opening.
 - c. Valve ends as indicated on the Drawings and unless indicated otherwise shall conform to the following:
 - 1) Flanged: Conforming to ANSI B16.1 requirements.
 - 2) Mechanical: Conforming to ANSI A21.11 requirements.
 - d. Valves of rising stem type except when installed underground; or otherwise indicated on Drawings.
 - e. Valve stuffing box of such design that valve can be packed under pressure when in fully open position.

2. Design Working Water Pressure: 200 psi for valves 12 inches diameter and smaller, and 150 psi (high pressure) for valves 14 inches diameters and larger.
 3. Design Working Water Pressure: 200 psi for valves 12 inches diameter and smaller, and 100 psi (medium pressure) for valves 14 inches diameters and larger.
 4. Valves 3-inches Through 12-inches in Diameter: Iron body, outside screw and yoke design, bronze mounted, with resilient-seated wedge conforming to requirements of AWWA C 509.
 - a. Resilient Seat: Composed of SBR or Urethane Rubber bonded to cast iron wedge.
 - b. Stem Seals: O-ring type.
 - d. Finish Coatings: Exterior asphalt varnish or epoxy coated and interior ferrous metal parts epoxy coated, according to AWWA C 550.
 5. Acceptable Manufacturers:
 - a. Clow Corporation.
 - b. American Darling Valve.
 - c. Kennedy Valve.
- C. Tapping Valve: Provide valve of same basic construction as Iron Body Gate Valve with exceptions as follows:
1. Oversized seat rings to accommodate tapping machine.
 2. Raised male face on flanged end for bolting to tapping sleeve.
 3. Mechanical or push-on joint with slotted holes for bolting to tapping machine.
 4. Tapping Sleeve: AWWA approved construction, of split sleeve design, having mechanical joint ends, and designed for 250 psi working pressure.
- D. Tapping Sleeve: Provide 18-inch size, AWWA approved construction, split type sleeve, designed for 250 psi working pressure.
1. Body: Carbon steel conforming to ASTM A 283, Grade C.
 2. Flanges: AWWA C207 Class D; ANSI 150 pound drilling.
 3. Gasket: Grade 60 Concave Wedge Gasket; gasket compounded to resist oil, natural gas, acids, alkalies, most (aliphatic) hydrocarbon fluids, water and many chemicals. Designed for operating temperatures up to 2123 degrees F.
 4. Bolts and Nuts: ANSI A21.11, Type 304 stainless steel.
 5. Finish: Manufacturer's standard fusion bonded epoxy, coated to 12 mills dry film thickness.
 6. Acceptable Manufacturers:
 - a. Rockwell International.
- E. Valve Boxes: Cast iron extension roadway type, three-piece construction, and of screw adjustment design.
1. Boxes shall have 4 1/4-inch minimum shaft diameter and cover marked SEWER.
 2. Boxes hot coated inside and out with a tar or asphalt compound.
 3. Box design shall be capable of receiving increment cast iron rings to raise the box in the future.

2.05 AIR RELEASE AND CLEANOUT CHAMBERS

- A. Precast Concrete Chambers: As specified in Section 02601.

1. Sump Frame and Grate: Light duty cast iron construction, conforming to ASTM A 48 requirements.

2.06 CONTRACTOR OPTIONS IN PRODUCTS

- A. Force Main Pipe and Fitting Options: The Contractor is allowed the option to provide PVC pipe, or PE pipe (for a certain size range), or DIP to construct the force mains. However, use only the one type of pipe, as selected, to construct the force mains for which the pipe material options are allowed.
 1. Through 3 inch diameter:
 - a. Polyvinyl Chloride Pipe (PVC).
 - b. Ductile Iron Pipe (DIP).
 2. 4 inch through 8 inch diameter:
 - a. Polyvinyl Chloride Pipe (PVC).
 - b. Polyethylene Pipe (PE).
 - c. Ductile Iron Pipe (DIP).
 3. Required Pipe Material Exception: Provide only ductile iron pipe and ductile iron or cast iron fittings within the air release and cleanout chambers.
- B. Thrust Restraint Option: The option is allowed to provide concrete thrust blocks or restrained joints at changes of directions. Use only the types of restraints as specifically manufactured for use with the pipe option selected.
- C. Pipe Connections to Existing Manholes or Structures Options: The option is allowed to construct one type of connection in the Project of the types listed herein, except where required otherwise on the Drawings.
 3. Cut-in opening utilizing PVC Waterstop and Grout, with Engineer Approval.
 1. Core-drilled opening utilizing Sleeve Type Pipe Seal.
 2. Core-drilled opening utilizing Modular, Mechanical Type Pipe Seal.
- D. Forcemain Locator Assembly: Locator assembly will be as specified on the standard detail drawing.
 1. Detection cable will be a 12 gauge AWG multi strand wire.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Field Inspection: Inspect each section of pipe and each pipe fitting before laying in conformance with the inspection requirements of the appropriate referenced standard.
- B. Rejected Products: Remove rejected Products from the Project site and replace with new Products.

3.02 PREPARATION

- A. General Requirements: Clean piping interior prior to laying pipe and following pipe laying, keep open ends of piping and pipe attachment openings capped or plugged until

actual connection or actual pipe testing.

1. Provide the protective means to prevent water and debris from washing into the pipe.
- B. Earthwork: Perform earthwork for force main installation as specified in Section 02221.
 1. Bedding materials and concrete work for pipe bedding as specified in Section 012221.
 2. Excavate trenches in rock at least 25-feet in advance of pipe laying. Protect pipe ends from rock removal operations.

3.03 FORCE MAIN CONSTRUCTION

- A. General Requirements: Use proper and suitable tools and appliances for the proper and safe handling, lowering into trench and laying of pipes.
 1. Lay pipe proceeding upgrade true to line and grades given. Lay bell and spigot pipe with bell end upgrade. No wedging or blocking permitted in laying pipe unless by written order of Engineer.
 2. Unless indicated otherwise, piping shall be installed with not less than four feet of cover.
 3. Exercise care to insure that each length abuts against the next in such manner that no shoulder or unevenness of any kind occurs along inside bottom half of pipe line.
 4. Before joints are made, bed each section of pipe full length of 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. Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded full length of its barrel.
 5. Walking or working on the installed force main, except as necessary in tamping and backfilling, not permitted until trench is backfilled one-foot deep over top of pipes.
 6. Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying.
 7. Take up and replace with new, such in-place pipe sections found to be defective. Replacement work at Contractor's expense.
 8. Concrete Thrust Blocks: Provide concrete thrust blocks for each fitting, and at those locations where horizontal and vertical deflections are made in the joints of the force mains. Use Class B concrete. Provide thrust blocks of the design indicated on the Detail Drawing.
- B. Pipe Laying and Joining: Perform pipe laying and joining in strict accordance with manufacturer's installation instructions, reference standards as included, and such additional requirements as specified herein.
 1. Arrange and pay for pipe manufacturer's representative to be present for first installation of pipe to instruct workmen on proper installation methods.
 2. Make joints absolutely watertight and immediately repair detected leaks and defects. Methods of repair subject to Engineer's approval.
 3. Laying/Joining Ductile Iron Pipe: Installation and joint assembly according to AWWA C 600, and as follows:

- a. Pipe Cutting: Where necessary to field cut pipe use approved pipe cutter, milling cutter or abrasive wheel saw.
- b. Push-on Joints: To make ductile cast iron pipe push-on joints, properly seat sealing gasket, evenly and sufficiently lubricate the spigot end of pipe, and fully enter joint until joint line is visible. Make deflection, if required, only after the joint has been assembled properly.
- c. Mechanical Joints: To make ductile iron pipe mechanical joint, position sealing gasket and gland for bolting and then enter the spigot into pipe bell end until joint line is visible. Tighten bolts evenly maintaining approximate distance between gland and face of flange at all points around the socket. Do not exceed pipe manufacturer's specifications for maximum torque applied to bolts.
- d. Flanged Joints: For DIP shall be faced true, fitted with gaskets, and drawn up square and tight to ensure full gasket flow and satisfactory seal.
- e. Joint Restraints: Install on buried DIP at changes in direction of pipe runs, and at terminal ends of pipe runs in accordance with the following table:

DUCTILE IRON PIPE RESTRAINED JOINT DIMENSIONS
(Restraint length in feet of straight pipe for each leg)

Fitting Type	6 Inch Dia. Pipe	8 Inch Dia. Pipe
Plug	25	25
Tee	25	25
Lateral	25	25
90 Deg.	25	25
45 Deg.	15	15
22 1/2 Deg.	15	15
11 1/4 Deg.	15	15

4. Laying/Joining Specified Types of Plastic Pipe: Perform installation and joint assembly according to ASTM D 2774 for Class I bedding material.
 - a. Push-on Joints. To make PVC pipe push-on joints, properly seat sealing gasket, evenly and sufficiently lubricate the spigot end of pipe, and fully enter joint until joint line is visible.
- C. Connections to Existing Manholes or Structures: Make pipe connections to existing manholes or structures by the previously selected option and in accordance with the appropriate requirements as follows:
 1. Core-Drilled Opening Utilizing Pipe Seal: Use this method of connection as the Authority's preferred method of connection.
 - a. Core-drill the required opening or openings using the proper equipment for the work. Make openings of sufficient size to accommodate the pipe and the Sleeve Type Pipe Seal or Mechanical Type Pipe Seal.
 2. Cut-In Opening Utilizing PVC Waterstop and Grout: Use this method of connection when core drilling is not feasible as determined by the Engineer.
 - a. Cut required opening or openings by such methods so as to prevent cracking and spalling concrete. Make openings of sufficient size to accommodate the pipe with PVC Waterstop installed and one inch of annular grout space.

Grout annular space using Non-Shrink Non-Metallic Grout as specified in Section 03600. Make connection watertight.

3. New Invert Channel: Regardless of the connection to existing manhole option selected, form a new invert channel in the existing manhole base to properly conduct the flow through the existing manhole. Do not permit ground water, surface water or debris to enter the existing facilities through the new connection.
4. Drop Connections: Make drop connections as indicated on the Drawings, where drop in invert is two feet or more or as required by the Engineer.

D. Setting Valves and Boxes: Unless otherwise directed by the Engineer, set valves and boxes truly vertical.

1. Set valve and boxes neatly to grade and in such a way that the box does not transfer shock or stress to the valve.
2. Exercise care to center the box over the wrench nut of the valve.

3.04 AIR RELEASE AND CLEANOUT CHAMBER CONSTRUCTION METHODS

A. As specified in Section 02601.

3.05 FIELD QUALITY CONTROL

A. General Requirements: Conduct tests specified herein so that the force main installed in the Project is tested to the Engineer's satisfaction. Conduct tests in the presence of and to the satisfaction of the Engineer.

1. Notification: The Contractor shall give the Engineer a minimum of 48 hours advance notification of the date of the testing specified herein.
2. The Contractor may elect to make a leakage test prior to backfilling the trenches, for his own purposes. However, the leakage tests of the force mains or sections thereof for acceptance, shall be conducted after the backfilling of the trenches has been completed.
3. When the length of the force main exceeds 1000 feet, test the force main in sections, the length of each section to be determined by the Engineer.

B. Testing Equipment: Provide tools, materials (including water), apparatus and instruments necessary for pipe line testing. Use air compressing apparatus equipped with a control panel with necessary piping, control valves and gauges to control air flow rate to the piping section under test, and also the air pressure within the test seal plugs.

1. To prevent accidental overloading of piping test section, provide air compressing apparatus with an approved pressure relief device set to relieve at ten psi.
2. Provide an extra pressure gauge of known accuracy to frequently check test equipment and apparatus.

C. Cleaning Prior to Tests: Before tests are conducted, flush piping with clean water until free of all forms of dirt and construction debris.

1. The water for the flush cleaning operation shall be from the Contractor's source.

D. Line Acceptance Test: After a force main or section thereof is constructed, backfilled, and successfully cleaned, perform a hydrostatic Line Acceptance Test as follows:

1. Seal force main at downstream end with a suitable pipe plug.
 2. Fill force main with clear water.
 3. Raise hydrostatic pressure to 100 psi. or one and one-half times the working pressure, whichever is greater; measured at the low point of the particular section of main being tested.
 4. A preliminary test period for the removal or absorption of air from the lines before measuring the leakage will be permitted.
 5. Maintain test pressure for a period of not less than four hours.
 6. Zero leakage is allowed.
- E. Repair and Retest: When force main or sections of force main fails to meet test requirements specified previously, determine source or sources of leakage and repair or replace defective material, and if a result of improper workmanship, correct such workmanship.
1. Conduct such additional tests required to demonstrate that force main meets specified test requirements.
- F. Township's Tests: The Township reserves the right to retest any piping throughout the duration of the Construction Period.
1. Make repairs as Work of this Section to piping found defective by such Township conducted tests.

END OF SECTION

SECTION 02725 – LOW PRESSURE SEWER

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The work specified in this Section consists of constructing the piped low pressure wastewater sewers and appurtenances thereto, and constructing the various structures within the pipeline.
- B. Related Sections:
 - 1. Trenching, Backfilling and Compacting: Section 02221.
 - 2. Manholes: Section 02601.
 - 3. Cast-In-Place Concrete: Section 03300.

1.02 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A21.10, Gray-Iron and Ductile-Iron Fittings, 2 through 48 inches, for Water and Other Liquids.
 - 2. ANSI A21.11, Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
 - 3. ANSI A21.15, Flanged Cast-Iron and Ductile-Iron pipe with Threaded Flanges.
 - 4. ANSI A21.50, Thickness Design of Ductile-Iron Pipe.
 - 5. ANSI A21.51, Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
 - 6. ANSI A21.53, Ductile-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
 - 7. ANSI B 1.1, Unified Inch Screw Threads.
 - 8. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
 - 9. ANSI B16.21, Nonmetallic Gaskets for Pipe Flanges.
 - 10. ANSI B18.2.1, Square and Hex Bolts and Screws, Including Askew head Bolts, Hex Cap Screws, and Lag Screws.
 - 11. ANSI B18.2.2, Square and Hex Nuts.
- B. American Society for Testing and Materials.
 - 1. ASTM A 36, Specification for Structural Steel.
 - 2. ASTM A 47, Specification for Ferritic Malleable Iron Castings.
 - 3. ASTM A 48, Specification for Gray Iron Castings.
 - 4. ASTM A 123, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 5. ASTM A 167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 - 6. ASTM A 183, Specification for Carbon Steel Track Bolts and Nuts.
 - 7. ASTM A 240, Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
 - 8. ASTM A 283, Specification for Low and Intermediate Tensile Strength Carbon

- Steel Plates.
9. ASTM A 307; Specification for Carbon Steel Externally Threaded Standard Fasteners.
 10. ASTM A 320, Specification for Alloy Steel Bolting Materials for Low-Temperature Service.
 11. ASTM A 536, Specification for Ductile Iron Castings.
 12. ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
 13. ASTM B 140 Specification for Copper-Zinc-Lead (Leaded Red Brass or Hardware Bronze) Rod, Bar, and Shapes.
 14. ASTM B 371, Specification for Copper-Zinc-Silicon Alloy Rod.
 15. ASTM B 584, Specification for Copper Alloy Sand Castings for General Applications.
 16. ASTM C 534, Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 17. ASTM D 1599, Standard Test Method for Short-Term Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.
 18. ASTM D 1784, Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 19. ASTM D 1785, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80 and 120.
 20. ASTM D 2000, Standard Classification System for Rubber Products in Automotive Applications.
 21. ASTM D 2241, Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR-Series).
 22. ASTM D 2466, Specification for Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 23. ASTM D 2564, Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
 24. ASTM D 2774, Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.
 25. ASTM D 3139, Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 26. ASTM E 84, Test Method for Surface Burning Characteristics of Building Materials.
 27. ASTM F 477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- C. American Water Works Association:
1. AWWA C 151, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
 2. AWWA C 600, Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances.
 3. AWWA C 800, Threads for Underground Service Line Fittings (with Appendix on Collected Standards for Service Line Materials).
- D. Federal Specifications:
1. Fed. Spec. FF-S-325, Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry) Group II (Shield, Expansion Bolt Anchor) Type 4

(Wedge Expansion Anchors) Class 1 (One-Piece Steel Expander with Cone Taper Integral with Stud).

1.03 SUBMITTALS

- A. Shop Drawings and Product Data: Submit completely dimensioned shop drawings, catalog cuts or other data as required to provide a complete descriptive information for the following:
1. Pipe and Fittings.
 2. Piping Specialties.
 3. Sewage Valve.
 4. Gate Valves.
 5. Precast Concrete Chambers
- B. Certificates: Submit certified records or reports of results of shop tests, with such records or reports containing a sworn statement that shop tests have been made as specified. Sworn certifications shall bear the seal of a Registered Professional Engineer.
1. Provide manufacturer's sworn certification that pipe will be manufactured in accordance with specified reference standards for each pipe type.

1.04 QUALITY ASSURANCE

- A. Design Criteria: In addition to the design requirements of the Pennsylvania Department of Environmental Protection (DEP), comply with the following:
1. Use only one type of class of pipe in any continuous sewer between structures.
 2. Use pipe and fittings designed to withstand imposed trench loadings and prevailing site conditions at the various locations.
- B. Source Quality Control:
1. Shop Tests: In accordance with Article 1.06 of the General Instructions, factory test pipe materials listed in the following. Each pipe manufacturer must have facilities to perform listed tests. The Engineer reserves the right to require the manufacturer to perform such additional number of tests as the Engineer may deem necessary to establish the quality of the material offered for use.

<u>MATERIAL</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Polyvinyl Chloride Pipe	ASTM D 2241	As specified in ASTM D 2241
Polyvinyl Chloride Pipe	ASTM D 1785	As specified in ASTM D 1785

2. Laboratory Tests: The Engineer reserves the right to require that laboratory tests also be conducted on materials that are shop tested. Furnish without compensation, labor, materials, and equipment necessary for collecting, packaging, and identifying representative samples of materials to be tested and the shipping of such samples to the Testing Laboratory.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Transport, handle, and store pipe materials and other products specified herein in a manner recommended by the respective manufacturers to prevent damage and defects.

1.06 SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Keep trenches dewatered until pipe joints have been made and concrete cradle and encasement, if any, have cured.
 - 2. Under no circumstances lay pipe in water or on bedding containing frost.
 - 3. Do not lay pipe when weather conditions are unsuitable, as determined by the Engineer, for pipe laying work.

PART 2 PRODUCTS

2.01 PIPE AND PIPE FITTINGS

- A. Elastomeric Gaskets: For pipe joint gasket material, provide elastomeric gaskets that have been tested as suitable for continuous contact with domestic sewage.
- B. Polyvinyl Chloride (PVC) SDR Pipe, 1 1/2 Through 3 Inch Diameter, Buried Pipe: Provide pipe which is permanently marked with manufacturer's trademark, size and ASTM conformance designation. Pipe design and material requirements shall conform to ASTM D 2241, SDR-21 for 200 psi pressure. PVC material shall conform to ASTM D 1784 requirements for Cell Classification 12454B.
 - 1. Pipe Joints: Push-on or compression type, rubber gasket, conforming to ASTM D 3139 and F 477 requirements; rubber gasket that have been tested as suitable for continuous contact with domestic sewage.
 - 2. Pipe Fittings: Manufactured in one piece of injection molded PVC compound meeting ASTM D 1784 requirements.
 - a. Fittings shall be Class 200 and conform to requirements of DR 21.
 - b. Fittings shall withstand a minimum of 630 psi quick burst pressure at 73 degrees F. when tested in accordance with ASTM D 1599 requirements.
 - c. Bells shall be gasketed joint conforming to ASTM D 3139 with gaskets conforming to ASTM F 477 requirements.
 - d. Acceptable Manufacturer: The Harrington Corporation or approved equal.
 - 3. Retainers for PVC Pipe: Manufactured from 60-42-10 ductile iron conforming to ASTM A 536 requirements, including the glands and tie bolts. The retainers shall have a sufficient number of tie bolts to restrain the working and test pressures established by the retainer manufacturer.
 - a. The glands shall have serrations on the inside diameter sufficient to hold against both the working and test pressures.
 - b. Acceptable Manufacturer: EBAA Iron Sales, Inc. or equal.
 - 4. Restraints for PVC fittings: Manufactured from 60-42-10 ductile iron conforming to ASTM A 536 requirements, including the bell ring, restraint ring and tie bolts.
 - a. A split ring shall be utilized behind the bell of the fitting outlets. A serrated ring shall be used to grip the pipe and a sufficient number of bolts shall connect the bell ring and the serrated gripping ring. The combination shall restrain continuously against a working pressure rating of 150 psi.

- b. Acceptable Manufacturer:
 - i. EBAA Iron Sales, Inc.
- C. HDPE DR-11 Pipe: Polyethylene pipe shall be manufactured in accordance with AWWA C901 for sizes ½” through 3”. Pipe will be DR-11. Pipe shall be PE 3608 high density polyethylene meeting cell 345464E for stripes per ASTM D 3350. Pipe shall also be listed by the Plastic Pipe Institute (PPI) TR-4. The strip color shall be “GREEN” for all pipe sizes.
 - 1. Polyethylene fittings shall be made from material meeting the same requirements as the pipe. Polyethylene fittings shall be molded or fabricated by the manufacturer of the pipe.
 - 2. Where applicable, fittings shall meet the requirements of AWWA C906.
 - 3. Molded fittings shall be manufactured in accordance with either ASTM D2683 (socket fused) or ASTM D3261 (butt fused) and shall be so marked. Fittings for service lateral connections will by a WYE 2x2x2 – inch in size.
- D. Flanged Adapters: Fabricated from high strength steel (Style 128), or cast iron (Style 127), and designed for joining DIP plain-end pipe to flanged fittings, valves, and flanged end equipment.
 - 1. The compression-end of the adapter shall have the Dresser-Coupling type pack utilizing a Grade 27 wedge gasket for positive, watertight sealing. The flanged-end shall match the flange of the proposed fitting, valve or equipment connection.
 - 2. Acceptable Manufacturers:
 - a. Dresser Manufacturing Division of Dresser Industries, Inc.; Dresser Style 128 and 127.
 - b. Rockwell-International.
 - c. R. H. Baker & Co., Inc.

2.02 PIPING SPECIALTIES

- A. Valve Boxes: Cast iron extension roadway type, three-piece construction, and of screw adjustment design.
 - 1. Boxes shall have 4 1/4-inch minimum shaft diameter and lock cover marked SEWER.
 - 2. Boxes hot coated inside and out with a tar or asphalt compound.
 - 3. Provide box compatible with valve for operating clearances.
- B. Flexible Insulation For Piping: Insulation manufactured by closed cell, 5 to 6 pounds cubic feet density foamed plastic with thermal conductivity of 0.26 BTUH per sq. ft. per degree per inch at 70 degrees F. mean temperature, water vapor transmission rating of less than 0.1 perms. per inch, and a self-extinguishing fire-rating; ASTM E 84. Insulation manufactured to meet requirements of ASTM C 534. Use insulation manufacturer's companion joint making/sealing adhesive to make permanent insulation joints.
 - 1. Flexible Insulation For Fittings: Insulate fittings and valve bodies with sleeves of same insulation thickness used on adjacent piping and having an inside diameter large enough to fit over the insulation on adjacent piping.
 - 2. Acceptable Manufacturers:

- a. Manville Products Corp.; Aerotube II, 1/2-inch thickness.
 - b. Owens-Corning Fiberglas.
 - c. Armstrong Industry Products Division.
- C. Curb Stop and Box: Designed to conform to AWWA Standard C800.
 - 1. All bronze construction, inverted key stop.
 - 2. Extension type arch pattern base of two-piece cast iron construction coated inside and out with tar base enamel and topped with cast iron lid secured by bronze bolt. Provide box compatible with T-wrench and stop. Provide cover marked SEWER.
- D. Flexible Pipe Coupling: Coupling shall consist of a steel middle ring or sleeve, two steel or malleable iron flange or follower rings, two wedge shaped resilient gaskets and sufficient number of track-head bolts and nuts.
 - 1. Middle Ring or Sleeve: Steel construction conforming to ASTM A 283, (Grade A) requirements, fabricated in a true circular section and free of surface defect.
 - 2. Follower Rings or Flanges: Steel construction conforming to ASTM A 47 (Grade 32510) requirements, fabricated in a true circular section and free of surface defect, and tested and sized after welding by cold expanding a minimum of one percent.
 - 3. Bolts and Nuts: Steel bolt conforming to ASTM A 183 requirements, double radius head or buttonhead track type with rolled threads, conforming to ANSI B1.1 requirements; and steel nuts conforming to ANSI B 18.2.2 requirements, American Standard Heavy Dimension Series.
 - 4. Gaskets: Resilient wedge-shaped of synthetic base compound designed for raw sewage and sludge service.
 - 5. Shop Paint: Middle and follower rings shop painted with primer compatible with specified field coat for piping where coupling is located.
 - 6. Acceptable Manufacturers:
 - a. Dresser Manufacturing Division of Dresser Industries, Inc.; Dresser Style 38 or 138.
 - b. Rockwell-International.
 - c. R. H. Baker & Co., Inc.
- E. Stainless Steel Pipe Supports: Fabricate pipe supports and pipe straps for exposed piping using Type 304 stainless steel conforming to ASTM A 167. Individual pipe support and pipe strap designs are as indicated on the Drawings.
 - 1. Anchors and Fasteners: Provide drilled-in type expansion anchors incorporating a one-piece stud (bolt) with integral expansion wedges, nut and washer as a UL Listed assembly and meeting physical requirements of Federal Specification FF-S-325, Group II, Type 4, Class 1. Stud of Type 303 or 304 stainless and nut and washer of Type 316 stainless.
 - 2. Standard Bolts, Nuts and Washers: Type 304 stainless steel conforming to ASTM A 320.
- F. Concrete: As specified in Section 03300 for Class B (3,000 psi.) Concrete.
- G. Modular, Mechanical Type Pipe Seal (LINK-SEAL): Modular, mechanical type pipe seal used for core-drilled connection of piping to existing manholes. Seal component

construction as follows:

1. The seal shall consist of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening.
2. The elastomeric element of the seal shall be sized and selected in accordance with the seal manufacturer's recommendations. Elastomeric element shall conform to ASTM D 2000 requirements for EPDM material.
3. The hardware provided in the seal shall be as recommended by the seal manufacturer for buried service such as will exist at the project site.
4. Acceptable Manufacturers:
 - a. Thunderline Corporation; Link-Seal.
 - b. Or equal.

2.03 SEWAGE VALVE

- A. Sewage Air Release Valve: Valve design shall automatically release air, gas or vapor under pressure during system operation. Valve design shall feature long body and float stem components so that the operating mechanism is kept free from contact with sewage during operation. Valve construction as follows:
 1. Valve Body and Cover: Cast iron, conforming to ASTM A 48, Class 35 requirements.
 2. Inlet Size: 2-inches, NPT.
 3. Outlet Size: 1/2-inch, NPT.
 4. Maximum Working Pressure: 75 psi.
 5. Vent Orifice: 5/16-inch.
 6. Discharge Orifice Seat, Mechanism and Valve Stem: Stainless Steel.
 7. Orifice Button: Stainless steel and Buna-N, Nitrile Rubber conforming to ASTM SB 800 requirements.
 8. Mechanism Lever Pins and Float: High strength stainless steel, conforming to ASTM A 240 requirements.
 9. Backflushing and Cleaning Accessories: Factory assembled to the valve and consisting of a 2-inch shut-off valve at bottom inlet, a 1-inch blow-off valve near the bottom of the valve body, quick disconnect couplings and 1/2-inch shut-off valve at top of valve, and a section of rubber hose with quick disconnect coupling.
 10. Acceptable Manufacturers:
 - a. Val-Matic Valve And Manufacturing Corp.; Model No. 48 Series.
 - b. Crispin-Multiplex Mfg. Co.; SL Series
- B. Sewage Air and Vacuum Valve: Valve design shall automatically exhaust large quantities of air during the filling of a system and shall allow air to re-enter the system during draining or when a vacuum occurs. Valve design shall feature long body and float stem components so that the operating mechanism is kept free from contact with sewage during operation. Valve construction as follows:
 1. Valve Body and Cover: Cast iron, conforming to ASTM A 48, Class 35 requirements.
 2. Inlet Size: 2-inches.
 3. Discharge Orifice: 2-inches.
 4. Float Stem and Guide: Bronze, conforming to ASTM B 584 requirements.
 5. Floats: Stainless Steel, conforming to ASTM A 240 requirements.

6. Orifice Seat: Buna-N, Nitrile Rubber, conforming to ASTM SB 800 requirements.
 7. Backflushing and Cleaning Accessories: Factory assembled to the valve and consisting of an inlet shut-off valve, a 1-inch blow-off valve near the bottom of the valve body, quick disconnect couplings and a 1/2-inch shut-off valve at the top of valve, and a section of rubber hose with quick disconnect coupling.
 8. Acceptable Manufacturers:
 - a. Val-Matic Valve And Manufacturing Corp.; Model No. 300 Series.
 - b. Crispin-Multiplex Mfg. Co.; SL Series
- C. Sewage Combination Air Valves: Consisting of an air release valve and an air and vacuum valve factory piped into a compact assembly. The combination assembly shall automatically release air, gas or vapor under system operating pressure and shall also allow air to re-enter the system during draining or when a vacuum occurs. Combination valve designs shall feature long bodies and float stem components so that the operating mechanisms are kept free from contact with sewage during operation. Valve construction as follows:
1. Valve Bodies and Covers: Cast iron, conforming to ASTM A 48, Class 35 requirements.
 2. Inlet Sizes: 2-inches.
 3. Air Release Outlet Size: 1/2-inch, NPT.
 4. Vacuum Discharge/Outlet Size: 2-inches.
 5. Air Release Valve Maximum Working Pressure: 75 psi.
 6. Air Release Valve Vent Orifice: 5/16-inch.
 7. Air Release Valve Discharge Orifice Seat, Mechanism and Valve Stem: Stainless steel.
 8. Air Release Valve Orifice Button: Stainless Steel and Buna-N, Nitrile Rubber conforming to ASTM SB 800 requirements.
 9. Air Release Valve Mechanism Lever Pins and Float: High strength stainless steel, conforming to ASTM A 240 requirements.
 10. Air and Vacuum Valve Float Stem and Guide: Bronze, conforming to ASTM B 584 requirements.
 11. Air and Vacuum Valve Floats: Stainless Steel, conforming to ASTM A 240 requirements.
 12. Air and Vacuum Valve Orifice Seat: Buna-N, Nitrile Rubber, conforming to ASTM SB 800 requirements.
 13. Backflushing and Cleaning Accessories: Factory assembled to the combination valves and consisting of two inlet shut-off valves, two blow-off valves, two clear water inlet valves, section of rubber hose and quick disconnect couplings.
 14. Acceptable Manufacturers:
 - a. Val-Matic Valve And Manufacturing Corp.; Model No. 48 or 49/300 Series.
 - b. Crispin-Multiplex Mfg. Co.; US Series
- D. Valve Support work: Provide steel support as indicated on the Standard Details.
1. Miscellaneous Metals: Steel conforming to requirements of ASTM A 36 and galvanize finished according to ASTM A 123.
 2. Drilled-In Expansion Anchors and Fasteners: UL Listed stainless steel anchor and fastener incorporating a one-piece stud (bolt) with integral expansion wedges, nut

- and washer, and meeting physical requirements of Federal Specification FF-S-325, Group II, Type 4, Class 1. Stud of Type 303 or 304 stainless and nut and washer of Type 316 stainless.
3. Standard Bolts, Nuts and Washers: Type 304 stainless steel conforming to ASTM A 320.

2.04 VALVES

- A. General Requirements: Provide valves of the same type by same manufacturer; suitable for the intended service. Markings shall be cast on the bonnet or body of the valve indicating manufacturer's name or mark, the year the valve casting was made, the size of the valve, directional flow arrow and designation of working water pressure.
 1. Valve pressure-temperature ratings of valve shall be not less than the design criteria applicable to the system components.
 2. Valves shall open to the left (counterclockwise). Valve shall be operated by handwheel or operating nut as indicated on the Drawings. Operating wheel shall have cast thereon an arrow indicating the direction of opening.
 3. Provide extension stems with bronze bushed stem guides where required.
 4. Valve ends as indicated on the Drawings and unless indicated otherwise shall conform to the following:
 - a. Flanged: Conforming to ANSI B16.1.
 - b. Screw End: Threaded in accordance with ANSI B2.1.
- B. Gate Valves: Provide valves designed for working water pressure of 200 psi., and having rising stem operation except when installed underground, or where indicated otherwise on Drawings. Valves shall contain stuffing box of such design that allow repacking under pressure when valve is in fully open position.
 1. Valves smaller Than 3-inches In Diameter: Provide valves of solid bronze construction with tapered split wedge disc.
 - b. Physical properties of brass pressure containing parts shall conform to ASTM B 62.
 - c. Stems fabricated of Alloy A (rolled silicon brass) conforming to ASTM B 371, or Copper Alloy No. 876 (silicon bronze + silicon brass) conforming to ASTM B 584, or other material equally resistant to dezincification.
 2. Hose End Type: Bronze construction, tapered solid wedge disc, nonrising stem, female inlet and outlet having American Standard Taper Pipe thread. (Provide quick disconnect couplings in polypropylene material as manufactured by Plastic Piping Systems.)
 - a. Acceptable Manufacturers:
 - 1) Crane Company; No. 451 with cap and chain.
 - 2) Wm. Powell Company.
- C. Plug Valves (Straightway Type): Provide valves designed for a minimum working water pressure of 175 psi for valves through 12 in.
 1. Provide non-lubricated eccentric type plug valve with valve bodies of cast iron conforming to ASTM A 126 Grade B, or valve bodies of semi-steel with coated plug suitable for wastewater and corrosion resistant seats.
 2. Provide valves with port areas sized at least 80 percent of full pipe area.
 3. Provide T-wrench for operation.

4. Acceptable Manufacturers:
 - a. DeZurik; Series 100 Eccentric Valves.
 - b. Henry Pratt Company.
 - c. Homestead Industries, Inc.
 - d. Dresser Industries, Inc.
- D. Bronze Ball Valves: Valve body of solid bronze material conforming to ASTM B 584, and having a straight-through flow passage.
 1. Seats and O-rings of Buna-N.
 2. Valves of quarter-turn operation with a T-handle or round handle suitable for use in confined spaces, and which will allow sufficient clearance whether valve is in open or closed position.
 3. Threaded end valves available in sized 1/4 inch through 2 inch shall be rated 200 psi.
 4. Ball and Stem: Brass chrome finish conforming to ASTM B 140.
 5. Acceptable Manufacturers:
 - a. Crane Co.
- E. PVC Ball Check Valve: Provide ball check valve designed for a minimum water working pressure of 150 pounds per square inch and factory tested to double that pressure prior to shipment.
 1. Construction: Double union type with the valve body shaped to provide excess area through the valve to assure full delivery of the pipe line size capacity.
 2. Materials: Polyvinyl chloride PVC 12454-B conforming to ASTM D 1784 with sealing O-rings of Viton.
 3. Acceptable Manufacturers:
 - a. NIBCO Inc.; True-Union Ball Check.

2.05 PRECAST CONCRETE CHAMBERS

- A. General Requirements: Terminal cleanout chambers, in-line cleanout chambers, junction cleanout chambers, and air release chambers shall be of materials and construction conforming to precast concrete manhole requirements specified in Section 02601, with the following additional requirements:
 1. Manhole covers (lids) do not require cover hold-down bolts on air release chambers.
 2. Sump Frame and Grate: Cast iron conforming to ASTM A 48.
- B. Piping In Chambers: Provide ductile iron pipe and ductile iron or cast iron fittings within the chambers except where other type of pipe is indicated on the drawing detail.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Field Inspection: Inspect each section of pipe and each pipe fitting before laying in conformance with the inspection requirements of the appropriate referenced standard.

- B. Rejected Products: Remove rejected Products from the Project site and replace with new Products.

3.02 PREPARATION

- A. General Requirements: Clean piping interior prior to laying pipe, and following pipe laying, keep open ends of piping and pipe attachment openings capped or plugged until actual connection or actual pipe testing.
 - 1. Provide the protective means to prevent water and debris from washing into the pipe.
- B. Earthwork: Perform earthwork for sewer installation as specified in Section 02221.
 - 1. Bedding materials and concrete work for pipe bedding as specified in Section 02221.
 - 2. Excavate trenches in rock at least 25-feet in advance of pipe laying. Protect pipe ends from blasting, if blasting is allowed in the Project.

3.03 PRESSURE WASTEWATER SEWER CONSTRUCTION METHODS

- A. General Requirements: Use proper and suitable tools and appliances for the proper and safe handling, lowering into trench and laying of pipes.
 - 1. Lay pipe proceeding upgrade true to line and grades given. Lay bell and spigot pipe with bell end upgrade. No wedging or blocking permitted in laying pipe unless by written order of Engineer.
 - 2. Unless indicated otherwise, install piping with not less than four feet of cover.
 - 3. Exercise care to insure that each length abuts against the next in such manner that no shoulder or unevenness of any kind occurs along inside bottom half of pipe line.
 - 4. Before joints are made, bed each section of pipe full length of 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. Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded full length of its barrel.
 - 5. Walking or working on the installed pipe line, except as necessary in tamping and backfilling, not permitted until trench is backfilled one-foot deep over top of pipes.
 - 6. Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying.
 - 7. Take up and replace with new, such in-place pipe sections found to be defective.
- B. Pipe Laying and Joining: Perform pipe laying and joining in strict accordance with manufacturer's installation instructions, reference standards as included, and such additional requirements as specified herein.
 - 1. Arrange and pay for pipe manufacturer's representative to be present for first installation of pipe to instruct workmen on proper installation methods.
 - 2. Make joints absolutely watertight and immediately repair detected leaks and defects. Methods of repair subject to Engineer's approval.
 - 3. Threaded Joints: Cut pipe ends square, deburr and ream to size of original bore.

- Cut threads to American Standard tapered pipe threads, free of oil and cuttings. Use an approved joint tape or joint paste to aid in joint lubrication and sealing. After fabrication, paint exposed threads with red lead paint.
4. Laying/Joining Specified Types of Plastic Pipe: Perform installation and joint assembly according to ASTM D 2774 for Class I bedding material.
 - a. Push-on Joints. To make PVC pipe push-on joints, properly seat sealing gasket, evenly and sufficiently lubricate the spigot end of pipe, and fully enter joint until joint line is visible.
 - b. Solvent-Weld Joints: Use chemical solvent welding components to join PVC pipe. Use the type of solvents specified in manufacturer's printed recommendations.
 5. Concrete Thrust Blocks: Provide concrete thrust blocks for each fitting, and at those locations where horizontal and vertical deflections are made in the joints of the force mains. Use Class B concrete. Provide thrust blocks of the design indicated on the Detail Drawing.
 - a. Joint Restraints: Install on buried DIP at changes in direction of pipe runs, and at terminal ends of pipe runs in accordance with the following table:

DUCTILE IRON PIPE RESTRAINED JOINT DIMENSIONS
(Restraint length in feet of straight pipe for each leg)

Fitting Type	6 Inch Dia. Pipe	8 Inch Dia. Pipe
Plug	25	25
Tee	25	25
Lateral	25	25
90 Deg.	25	25
45 Deg.	15	15
22 1/2 Deg.	15	15
11 1/4 Deg.	15	15

- C. Pipe Connections to Existing Manholes: Make pipe connections to existing manholes in accordance with the appropriate requirements as follows:
 1. Core-drill the required opening or openings using the proper equipment for the work. Make openings of sufficient size to accommodate the pipe and the Pipe Seal (LINK-SEAL). Install the Pipe Seal in accordance with the manufacturer's installation instructions. Do not permit ground water, surface water or debris to enter the existing facilities through the new connection.
 2. Run the exposed pipe (Drop Connection) within the manhole using SCH-40 PVC Pipe with Solvent Weld Socket Type joints. Run piping within the manhole as indicated on the Drawings.
 3. Anchor the exposed pipe in place within the manhole as indicated on the Drawings using Exposed Pipe Support Work. Embed the Drilled-In Expansion Anchors to four and one-half bolt diameters.

3.04 PRECAST CONCRETE CHAMBER INSTALLATIONS

- A. As specified in Section 02601 for precast manholes and as shown on the Drawings.

- B. Insulation Installation: Install flexible insulation on piping within chambers. Install insulation on clean, dry pipe surfaces. Perform cleaning required for removal of construction debris and dirt from the piping.
1. Installation: Install flexible insulation on piping according to manufacturer's instructions, using specific adhesive to seal both longitudinal and butt joints. Insulate in-line appurtenances to the same thickness as adjoining insulation. Install insulation in 1/2-inch thickness.
 2. Weatherizing Installation: Weatherize flexible insulation using those protective and moisture impervious materials as recommended by the insulation manufacturer.

3.05 FIELD QUALITY CONTROL

- A. General Requirements: Conduct tests specified herein so that each pressure wastewater sewer installed in the Project is tested to the Engineer's satisfaction.
1. The Contractor may elect to make a leakage test prior to backfilling the trenches, for his own purposes. However, the leakage tests of the pressure wastewater sewers, or sections thereof, for acceptance shall be conducted after the backfilling of the trenches has been completed.
 2. Provide tools, materials (including water), apparatus and instruments necessary for pressure wastewater sewer testing.
 3. When the length of the pressure wastewater sewer exceeds 1000 feet, test the sewer in sections, the length of each section to be determined by the Engineer.
 4. Conduct tests of every kind in the presence of and to the satisfaction of the Engineer.
- B. Cleaning Prior to Tests: Before tests are conducted, flush piping with clean water until free of all forms of dirt and construction debris.
1. The water for the flush cleaning operation shall be from the Contractor's source.
- C. Line Acceptance Test: After the pressure wastewater sewer or section thereof is constructed, backfilled, and successfully cleaned, perform a hydrostatic Line Acceptance Test as follows:
1. Seal pressure wastewater sewer at downstream end with a suitable pipe plug.
 2. Fill pressure wastewater sewer with clear water.
 3. Raise hydrostatic pressure to one and one-half times the operating pressure; measured at the low point of the particular section of sewer being tested.
 4. A preliminary test period will be permitted for the removal or absorption of air from the sewer before measuring the leakage.
 5. Maintain test pressure for a period of not less than four hours.
 6. Allowable leakage will be zero.
 7. Pressure testing shall not be required for continuous sections of HDPE DR-11 pipe, unless joints for fittings, valves, etc. exist.
- D. Repair and Retest: When the pressure wastewater sewer, or sections thereof, fails to meet test requirements specified previously, determine source or sources of leakage and repair or replace defective material, and if a result of improper workmanship, correct such.

1. Conduct such additional tests required to demonstrate that pressure wastewater sewers meet specified test requirements.
- E. The Owner reserves the right to retest piping throughout the duration of the Construction Period.
1. Make repairs as Work of this Section to piping found defective by such Owner conducted tests.

END OF SECTION

SECTION 03100 - CONCRETE FORMWORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The work specified in this Section consists of constructing the formwork for the formed vertical and horizontal concrete placements.

1.02 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 347; Formwork for Concrete Fifth Edition.
 - 2. ACI 350R; Environmental Engineering Concrete Structures.
- B. American Plywood Association: APA Grade-Trademarks.
- C. U. S. Department of Commerce Product Standards:
 - 1. PS-1-74 For Construction and Industrial Plywood.
 - 2. PS-20-70 The American Softwood Lumber Standard.
- D. Western Wood Products Association: WWPA Catalog 'A' Product Use Manual.
- E. Southern Pine Inspection Bureau (SPIB): Standard Grading Rules for Southern Pine.

1.03 QUALITY ASSURANCE

- A. Formwork Design: Provide formwork designed to maintain the tolerances indicated and to include factors pertinent to safety of personnel during construction.
 - 1. Design formwork in accordance with American Concrete Institute's Recommended Practice for Concrete Formwork ACI 347, and in accordance with the following:
 - a. Design forms and falsework to include assumed values of live load, dead load, weight of moving equipment operated on formwork, temporary construction material, foundation pressures, stresses, lateral stability, and such other factors pertinent to safety of structure during construction.
 - b. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent construction.
- B. Allowable Tolerances: Set and maintain concrete forms within tolerance limits stated in American Concrete Institute's Recommended Practice for Concrete Formwork ACI 347.

1.04 PROJECT CONDITIONS

- A. Protection: Protect formwork materials before, during and after erection to ensure acceptable finished concrete work. Also protect in-place materials and other operations of work in connection with concrete pours.
 - 1. In event of damage to erected forms, make necessary repairs or replacements prior

to concrete pours. Perform such corrective work at no increase in Contract Price.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Form Lumber Materials: Provide lumber free of material defects that would deform the finished Concrete Product.
 - 1. Form framing, sheathing, struts, braces and shoring shall conform to WWPA Catalog A or SPIB Grading Rules.
 - 2. Rough Structural and Dimension Lumber: Provide lumber of allowable species, surfaced four sides as applicable, and grade stamped with the appropriate WWPA or SPIB stamp indicating product compliance with PS-20-70.
- B. Plywood Form Sheathing and Panels: Provide plywood of not less than 5/8-inch thickness, Exterior Type B-B Plywood Class I and II EXT-APA conforming to U.S. Product Standard PS-1-74.
 - 1. Provide Class II only on surfaces not exposed to view.
- C. Steel Forms: Metal Forms of a pre-engineered standard design, but conforming to the concrete sections indicated on the Drawings, may be used instead of wood forms.
- D. Form Ties: Provide factory fabricated, adjustable-length, removable or snap-off metal form ties conforming to ACI 347 and ACI 350R.
 - 1. Provide snap-off metal ties with ends that break at least 1-1/2-inches from the face of the wall.
 - 2. Removable ties that leave holes larger than 7/8-inches are not permitted.
 - 3. Form ties fabricated on the project site and wire ties or flat bands are not acceptable.
 - 4. Wood spacers are not permitted within the pour.
- E. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

PART 3 EXECUTION

3.01 PREPARATION

- A. Final Preparation: Prior to placement of concrete, perform final cleaning of the formwork and verify the accuracy of alignment of the formwork.
- B. Form Coating Application: Apply form coatings in accordance with manufacturer's specifications and the following:
 - 1. Do not allow excess form coating material to accumulate in the forms.
 - 2. Do not allow form coatings to come in contact with construction joints or reinforcing steel.

3.02 CONSTRUCTION

- A. General Requirements: Construct forms in accordance with ACI 347 to required dimensions, plumb, straight and mortar tight, and paste tight where appearance is important.
 - 1. Securely brace and shore forms to prevent displacement, bowing and pillowing, and to safely support imposed concrete load.
 - 2. Provide offsets, sinkages, keyways, recesses, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and such other features as required. Use selected materials to obtain above requirements.
 - 3. Fabricate forms for easy removal without hammering or prying against concrete surfaces.
 - 4. Form intersecting planes to provide true, clean-cut corners, with edge grain of plywood not exposed to concrete.
 - 5. Build into forms, or otherwise secure in forms, items such as inserts, anchors, miscellaneous metal items, and such other embedded items as indicated on Drawings.
 - 6. Wet forms sufficiently to prevent joints in wood forms from opening prior to concrete pour.
- B. Openings: Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete.
 - 1. Securely brace temporary openings and set tightly to forms to prevent the loss of concrete mortar. Locate temporary openings on forms in as inconspicuous location as possible consistent with the requirements of the work.
 - 2. Provide openings in concrete formwork of the correct size and in the proper location to accommodate other items and operations of construction work passing through forms. Accurately place and securely support items to be built into forms.
- C. Earth Forms: Where soil conditions will permit excavation to accurate sizes without bracing, and soil subsidence can be prevented during the concrete pour, earth forms may be used.
 - 1. Before concrete is poured, lightly wet earth forms but not to a muddy condition.
- D. Re-Use of Forms: Forms for re-use shall meet new form requirements with respect to affect on poured concrete appearance and structural stability.
 - 1. Re-use of forms shall in no way delay or change the concrete pour schedule as compared to the schedule obtainable if all forms were new (in the case of wood forms) or if the total required forms were available (in the case of metal forms).

3.03 FORM REMOVAL

- A. General Requirements: Upon removal of forms, notify the Engineer in order that a review of the newly stripped surfaces may be made before patching and finishing is performed. Additional requirements as follows:
 - 1. Remove forms in accordance with ACI 347, remove forms without damage to concrete, and remove forms in a manner to insure complete safety to the cast-in-

- place structure.
 - 2. Cutting form ties back from the face of the concrete is not permitted.
- B. Form Shoring Removal: In no case shall supporting forms or shoring be removed until the members have acquired sufficient strength to support safely their weight and the anticipated construction loads without distortion or excessive deflection.
- 1. The Engineer's consent to remove forms shall not relieve the Contractor of the responsibility for the safety of the work.
- C. Temperature Limitations: When the atmospheric temperature at the site has been continuously above 50 degrees F. from the time of the pour, the forms shall be removed at the earliest practical time within the limits set forth in this paragraph and wet curing shall continue to proceed without delay.
- 1. Forms for walls and other vertical faces may be carefully removed 24 hours after the last portion of concrete in the section involved has been placed provided the concrete has sufficiently hardened to preclude damage resulting from form removal and provided these members are not subjected to loads for a period of 14 days.
 - 2. Horizontal forms shall remain in place for a minimum of 14 days or until the concrete, as determined by job cured cylinders, has attained a compressive strength of 3,000 psi. When a water reducing retarder is used in the concrete mix, the normal time periods for removing forms may have to be increased.
 - 3. When the atmospheric temperature at the site drops below 50 degrees F., all forms shall be left in place for at least 5 days regardless of the temperature within the protective covering or enclosure.

END OF SECTION

SECTION 03200 - CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The work specified in this Section consists of fabricating and placing the various types of concrete reinforcement indicated or noted on the Drawings for the concrete placements.
- B. Related Sections:
 - 1. Concrete Formwork: Section 03100

1.02 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 315; Details and Detailing of Concrete Reinforcement.
 - 2. ACI 318; Building Code Requirements for Reinforced Concrete.
- B. American Society for Testing and Materials.
 - 1. ASTM A 82; Specification for Cold-Drawn Steel Wire for Concrete Reinforcement.
 - 2. ASTM A 185; Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
 - 3. ASTM A 307; Specification for Carbon Steel Externally Threaded Standard Fasteners.
 - 4. ASTM A 320; Specification for Alloy Steel Bolting Materials for Low-Temperature Service.
 - 5. ASTM A 615; Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, including Supplementary Requirement.
- C. Concrete Reinforcing Steel Institute: CRSI, Manual of Standard Practice for Reinforcing Concrete Construction.

1.03 SUBMITTALS

- A. Shop Drawings and Product Data: Prepare shop drawings of concrete reinforcement in accordance with American Concrete Institute's Standard ACI 315.
 - 1. Indicate bending diagrams, splicing and lap of rods, and shapes, dimensions and details of bar reinforcing and accessories.
- B. Test Reports: Submit two copies of reports showing the results of tests. Such tests conducted in accordance with the American Society for Testing and Materials Specifications.
 - 1. Test Requirements may be waived, based upon certified copies of mill test reports.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Storage of Materials: Store reinforcing materials in a manner to prevent excessive rusting and fouling with dirt, grease and other bond-breaking coatings.
 - 1. Identify bundles of reinforcing steel with stamped metal tags wired to steel.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Reinforcing Steel:
 - 1. Reinforcement Bars: Conforming to ASTM A 615, Grade 60, Deformed steel reinforcing bars, which shall satisfy the exceptions in ACI Building Code, AASHTO and Federal Specifications.
 - 2. Wire: Conforming to ASTM A 82.
 - 3. Welded Wire Fabric: Conforming to ASTM A 185.
 - 4. Metal Accessories: Conforming to CRSI Manual of Standard Practice for Reinforcing Concrete Construction.
- B. Anchors:
 - 1. Steel Anchor Bolts: Shapes as required; conforming to ASTM A 307.
 - 2. Stainless Steel Anchor Bolts: Shapes as required; conforming to ASTM A 320 Grade B8, AISI Type 304.

2.02 FABRICATION

- A. General Requirements: Perform bending of steel reinforcement by the cold bending method. Perform bar shape fabricating in a manner that will not injure the material or lessen the member strength.
 - 1. Do not use bars with kinks or bends not indicated on Drawings.
 - 2. Use a designed bending machine, either hand or power-operated.
 - 3. Do not field bend bars partially embedded in concrete unless approved by the Engineer.
- B. Field Bending: Perform field bending of steel reinforcement using workmen skilled in the practice of field bending, and observing the following requirements.
 - 1. Perform field bending of steel reinforcement as specified above under General.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Notification: Notify Engineer 48 hours before placing concrete so he can inspect placement of metal reinforcement.
- B. Field Inspection: Verify that items to be embedded in concrete are secured in place and block-outs in formwork are secured in place as required.
 - 1. Formwork constructed as work of Section 03100.

3.02 INSTALLATION

- A. **Placing Reinforcement:** Place metal reinforcement accurately and securely brace against displacement through the use of reinforcing accessories in accordance with ACI 318.
 - 1. Terminate reinforcement two inches from face of expansion joints.
 - 2. Continue reinforcement across or through construction joints.
 - 3. When obstructions interfere with the placement of reinforcing, pass such obstructions by placing reinforcing around and not bending the reinforcing to clear the obstructions.
 - 4. Install welded wire fabric as indicated, lapping joints six inches and wiring securely. Extend welded wire fabric to within two inches of sides and ends of slabs.
 - 5. Do not lay metal reinforcement on formwork. Raise reinforcement as concrete is placed.
 - 6. Support reinforcing using metal accessories; products other than metal accessories not permitted.
- B. **Splicing Reinforcement:** Splice metal reinforcement as indicated and in accordance with ACI 318.
 - 1. Welding of crossing bars (tack welding) is not permitted without approval of Engineer.
 - 2. Secure metal reinforcement at intersections with not less than No. 16-gauge annealed wire or appropriate size clips.
- C. **Anchor Bolts Setting:** Set at locations indicated on Drawings and secure in place to prevent movement during concrete pours.
- D. **Cleaning Reinforcement:** Clean or otherwise protect metal reinforcement so that at the time concrete is placed, reinforcement is free from rust, scale or other coatings that will destroy or reduce bond.
- E. **Reinforcement Protection:** Provide protection for reinforcement during concrete pours in accordance with ACI 318, unless indicated otherwise on the Drawings.
 - 1. On exterior exposed work, no ties or spacers will be permitted to remain within 3/4 inches of the finished surfaces.
 - 2. Protection: Protect in-place reinforcing from excessive construction traffic and other work.

END OF SECTION

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The work specified in this Section consists of constructing the unformed concrete placements as well as the formed vertical and horizontal concrete placements.
- B. Related Sections:
 - 1. Concrete Formwork: Section 03100.
 - 2. Concrete Reinforcement: Section 03200.
- C. Work Specified Under Other Sections: Items to be embedded in concrete are as specified in the various other Sections of the Specifications. The responsibility for coordinating concrete pours with embedded items rests solely with the Contractor.

1.02 REFERENCES

- A. American Association of State Highway and Transportation Officials, AASHTO M 182 Burlap cloth made from Jute or Kenaf.
- B. American Concrete Institute:
 - 1. ACI 211.1; Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
 - 2. ACI 301; Specifications for Structural Concrete for Buildings.
 - 3. ACI 304; Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
 - 4. ACI 305R; Hot Weather Concreting.
 - 5. ACI 306R; Cold Weather Concreting.
 - 6. ACI 308; Standard Practice for Curing Concrete.
 - 7. ACI 318; Building Code Requirements for Reinforced Concrete.
- C. American Society for Testing and Materials.
 - 1. ASTM C 31; Methods of Making and Curing Concrete Test Specimens in the Field.
 - 2. ASTM C 33; Specification for Concrete Aggregates.
 - 3. ASTM C 39; Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 4. ASTM C 42; Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
 - 5. ASTM C 94; Specification for Ready-Mixed Concrete.
 - 6. ASTM C 143; Test Method for Slump of Portland Cement Concrete.
 - 7. ASTM C 150; Specification for Portland Cement.
 - 8. ASTM C 156; Test Method for Water Retention By Concrete Curing Materials.
 - 9. ASTM C 171; Specification for Sheet Materials for Curing Concrete.
 - 10. ASTM C 172; Methods of Sampling Freshly Mixed Concrete.

11. ASTM C 173; Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
12. ASTM C 192; Method of Making and Curing Concrete Test Specimens in the Laboratory.
13. ASTM C 231; Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
14. ASTM C 260; Specification for Air-Entraining Admixtures for Concrete.
15. ASTM C 309; Specification for Liquid Membrane - Forming Compounds for Curing Concrete.
16. ASTM C 494; Specification for Chemical Admixtures for Concrete.
17. ASTM C 881; Specification for Epoxy-Resin-Base Bonding System for Concrete.
18. ASTM C 882; Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete.
19. ASTM D 6; Loss on Heating of Oil and Ashpaltic Compounds, Test Method for.
20. ASTM D 297; Standard Methods for Rubber Products-Chemical Analysis.
21. ASTM D 570; Test Method for Water Absorption of Plastics.
22. ASTM D 638; Test Method for Tensile Properties of Plastics.
23. ASTM D 695; Test Method for Compressive Properties of Rigid Plastics.
24. ASTM D 732; Test Method for Shear Strength of Plastics by Punch Tool.
25. ASTM D 790; Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
26. ASTM D 1751; Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
27. ASTM D 1752; Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

D. U. S. Army Corps of Engineers Specifications:

1. U. S. Corps of Engineers CRD-C 572 Specification for Waterstop.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's descriptive product data and current specifications covering the named manufacture's products specified herein. Include installation instructions.
- B. Samples: Submit samples of materials being used when requested by the Engineer including names, sources and descriptions.
- C. Test Reports: Submit concrete test reports specified hereinafter under Field Quality Control of PART 3 of this Specifications Section.

- D. Design Mix: Prior to production of concrete, submit for approval the mix designs proposed for this Project.
 - 1. ACI Deviation Analysis: Include with the mix designs a standard deviation analysis in accordance with ACI 301 Section 3.9.1, or trial mixture test data as proposed in ACI 301 Section 3.9.3.3.
 - 2. Material Compliance: Use materials in such proposed design mixes as specified hereinafter.
 - 3. Adjustments: Make such adjustments in the proposed design mix as directed by the Engineer.
- E. Certificates: Furnish the Engineer and local authorities requiring same, certificates originated by the batch mixing plant certifying ready mixed concrete, as manufactured and delivered, to be in conformance with ASTM C 94.
- F. Delivery Tickets: A delivery ticket shall accompany each load of concrete from the batch plant.
 - 1. Tickets shall be signed by the Contractor's representative, noted as to time and place of pour and kept in a record at the site. Make such records available for inspection upon request by the Engineer.
 - 2. Information presented on the ticket shall include the tabulation covered by ASTM C 94, 16.1.1 through 16.2.8, as well as any additional information the local codes may require.

1.04 QUALITY ASSURANCE

- A. Testing Agency: Provide the services of an agency regularly performing work conforming to The American Society for Testing and Materials ASTM E 329, Recommended Practice for Inspection and Testing Agencies for Concrete and Steel in Construction.
- B. Source Quality Control:
 - 1. Laboratory Tests: In accordance with Article 1.06 of the General Instructions, materials stated herein require advance examination or testing according to methods referenced, or as required by the Engineer.
 - 2. Compression Test Cylinders: For laboratory trial batches, make in accordance with American Concrete Institute ACI 301. Test to consist of three compression test cylinders for each class of concrete with one broken at seven days and two broken at 28 days; ASTM C 192 and ASTM C 39.

1.05 PROJECT CONDITIONS

- A. ACI Compliance: Cast-in-place concrete work shall conform to ACI 301 except as modified by these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

CAST-IN-PLACE CONCRETE

- A. Cements: Only one brand and manufacturer of approved cement shall be used for exposed concrete. Cement Type Requirements and usage are as follows:
 - 1. Concrete Work Exposed to Wastewater (Sewage and Sewage Gases) Contact: Type II, Moderate Sulfate Resistance Portland Cement conforming to ASTM C 150.
 - 2. Concrete Work for All Other Uses: Type I, Normal Portland Cement conforming to ASTM C 150.
- B. Normal weight Concrete Aggregates: Processed aggregate meeting requirements of ASTM C 33 and subject to the following limitations:
 - 1. Coarse Aggregate Size: Maximum size of coarse aggregate shall not exceed the following requirements but in no case larger than 1 2-inches.
 - a. One-fifth narrowest dimension between sides of forms within which concrete is to be cast.
 - b. Three-fourths of the minimum clear spacing between reinforcing bars or between reinforcing bars and forms.
 - c. One-third the slab thickness for unreinforced slabs.
- C. Water: Clear and free from deleterious amounts of acids, alkalis, and organic substances.

2.02 CONCRETE QUALITY

- A. Classes of Concrete/Compressive Strengths: Provide only Class A concrete in the project except for those cases where indicated otherwise on the Drawings.
 - 1. Classes of Concrete:
 - a. Class A: 4000 psi minimum compressive strength at 28 days; 564 pounds per cubic yard minimum cement content.
 - b. Class B: 3000 psi minimum compressive strength at 28 days; 517 pounds per cubic yard minimum cement content.
 - 2. Piping Encasement: Where encasement of piping is required provide Class B concrete.
 - 3. Conduit Encasement: Where encasement of conduit runs is required provide Class B concrete.
- B. Proportions of Concrete Ingredients: Establish proportions, including water-cement ratio, on the basis of either laboratory trial batches or field experience, with the materials being as specified herein.
 - 1. Laboratory Trial Batches: According to ACI 301, Section 3.9 and ACI 318.
 - 2. Proportions by Field Experience Method: According to ACI 301, Section 3.9 and ACI 318.
 - 3. Selection of Proportions for Normal weight Concrete: According to ACI 211.1.
 - 4. Water-Cement Ratio: Class A Concrete only shall have a maximum water cement ratio of 0.50.
- C. Slump: Proportion and produce concrete to have a slump, not to exceed four inches if consolidated by vibration. Slump, not to exceed five inches if consolidated by rodding,

spading or other manual methods.

2.03 ADMIXTURES

- A. Concrete Admixtures: Provide admixtures produced and serviced by established, reputable manufacturers and use such admixtures in compliance with the individual product manufacturer's recommendations and printed instructions.
1. Calcium Chloride: Not permitted as an admixture.
- B. Air Entraining Admixture: Conforming to ASTM C 260. Provide air-entrained concrete for each concrete pour except where indicated otherwise on the Drawings or specified otherwise herein. Total air content required as follows:
1.

<u>Maximum-Size Coarse Aggregate, inches</u>	<u>Air Content % by Volume</u>
1-1/2	5 plus/minus 1
3/4 or 1	6 plus/minus 1
3/8 or 2	7-1/2 plus/minus 1
 2. Do not provide air-entrained concrete where a hardener is indicated on the Drawings or specified herein.
- C. Water-Reducing Admixture: Conforming to ASTM C 494 Type A and a product that is free of chloride.
1. Unless high temperatures occur or placing conditions dictate a change, use concrete containing a water-reducing admixture.
- D. Water-Reducing and Retarding Admixture: Conforming to ASTM C 494 Type D and a product that is free of chloride.
1. When high temperatures occur or placing conditions dictate, a change from the water-reducing admixture (Type A) to a water-reducing and retarding admixture (Type D) may be required.
- E. Water-Reducing and Accelerating Admixture: Conforming to ASTM C 494 Type E and a product that is free of chloride.
1. When low temperatures occur or placing conditions dictate, a change from the water-reducing admixture (Type A) to a water-reducing and accelerating admixture (Type E) may be required.

2.04 CONCRETE APPURTENANCES

- A. Curing Materials, Sheet Form: Use curing materials that will not stain or affect concrete finish or lessen the concrete strength and comply with the following requirements:
1. Burlap: Materials conforming to AASHTO M 182.
 2. Sheet Materials: Material conforming to ASTM C 171.
- B. Liquid Curing Compounds: Material conforming to ASTM C 309, Type 1, free of wax or other adhesive bond breaking ingredients.
1. Note: Where a finish material is to be applied over concrete, provide certification by the curing compound manufacturer certifying the curing compound as non-

- detrimental to the bond of the finish material.
2. Acceptable Manufacturers:
 - a. Master Builders; Master Kure.
 - b. Euclid Chemical Company; Kurez Formula E-100.
 - c. L & M Construction Chemicals, Inc.; L & M Cure.
 - d. Or equal.
- C. Liquid Curing and Sealing Compounds: Material conforming to ASTM C 309, Type 1, free of wax and composed of chlorinated rubber base material with a minimum of 27 percent solids contents.
1. Note: Where no other finish material is to be applied over interior concrete, provide an application of Liquid Curing and Sealing Compound in accordance with material manufacturer's instructions to achieve a dust-proof floor finish.
 2. Acceptable Manufacturers:
 - a. Master Builders; Masterseal.
 - b. Euclid Chemical Company; Super Floor Coat.
 - c. L & M Construction Chemicals, Inc.; L & M Surfaseal.
 - d. Or equal.
- D. Epoxy Bonding Compound: Provide a high-modulus, low-viscosity, moisture insensitive epoxy adhesive having the following properties of the mixed epoxy resin:
1. Compressive Properties at 28 days, conforming to ASTM D 695:
 - a. Compressive Strength: 8,500 psi. min.
 - b. Modulus of Elasticity: 375,000 psi. min.
 2. Tensile Properties at 14 days, conforming to ASTM D 638:
 - a. Tensile Strength: 4,000 psi. min.
 - b. Elongation at Break: one to three percent.
 - c. Modulus of Elasticity: 275,000 psi. min.
 3. Flexural Properties at 14 days, conforming to ASTM D 790:
 - a. Flexural Strength (Modulus of Rupture): 6,300 psi. min.
 - b. Tangent Modulus of Elasticity in Bending: 400,000 psi. min.
 4. Shear Strength at 14 days, conforming to ASTM D 732: 5000 psi. min.
 5. Total Water Absorption at 7 days, conforming to ASTM D 570: One percent maximum (two hour boil).
 6. Bond Strength, conforming to ASTM C 882:
 - a. Plastic concrete to hardened concrete at 14 days (moist cure): 1,700 psi. min.
 - b. Plastic concrete to steel at 14 days (moist cure): 1700 psi. min.
 7. Mixed epoxy resin adhesive shall conform to ASTM C 881, Type II, Grade 2, Class B and C.
 8. Mix Ratio: 100 percent solids, two-component; mixed one part by volume component A to one part by volume component B.
 9. Acceptable Manufacturers:
 - a. Sika Corporation; Sikadur 32 Hi-Mod.
 - b. Euclid Chemical Company.
 - c. L & M Construction Chemicals, Inc.
 - d. Or equal.

- E. Preformed Expansion Joint Fillers:
 - 1. Nonextruding and Resilient Bituminous Types (Exterior Use): Conforming to ASTM D 1751.
 - 2. Sponge Rubber or Cork Type (Interior Use): Conforming to ASTM D 1752.
- F. Embedded (Vinyl) Waterstop: Ribbed type manufactured from virgin polyvinyl chloride plastic compound conforming to U. S. Corps of Engineers CRD-C 572.
 - 1. 6-inch Waterstop: 6 x 3/8-inch, such as Vinylex Corporation; Cat. No. R6-38.
 - 2. Acceptable Manufacturers:
 - a. Vinylex Corporation (Catalog Nos. as specified above).
 - b. W. R. Grace & Company.
 - c. W. R. Meadows, Inc.
 - d. Or equal.
- G. Surface (Expanding-Type) Waterstop: A specially formulated joint sealant which swells on contact with water. Provide waterstop packaged in continuous length coils. Material composition as follows:
 - 1. Chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties.
 - 2. Waterstop shall have a coating formulated to inhibit initial expansion due to moisture presence in the fresh concrete.
 - 3. Waterstop configuration shall be of dual extrusion design and 10 mm by 20 mm dimensions.
 - 4. Waterstop shall be secured to hardened concrete with the waterstop manufacturer's standard adhesive binder.
 - 5. Acceptable Manufacturers:
 - a. Greenstreak, Inc.; Hydrotite VCJ.
 - b. Or equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Field Inspection: Inspect work to receive cast-in-place concrete for deficiencies which would prevent proper execution of the finished work. Do not proceed with concrete placement until such deficiencies are corrected.

3.02 PREPARATION

- A. Production of Ready-Mixed Concrete: Batched, mixed and transported in accordance with ASTM C 94.
 - 1. Plant equipment and facilities shall conform to the Check List for Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association.
- B. Formwork Construction: As specified in Section 03100.
 - 1. Formwork Preparation: Prepare formwork in advance and remove snow, ice, water and debris from within forms.

- a. Wet subgrades in accordance with ACI to eliminate water loss from concrete.
 - b. Pre-position expansion joint material, anchors and embedded items.
 2. Embedded Waterstop Installation: Install in construction joints, expansion joints and where required for watertightness.
 - a. Hold end joints to a minimum.
 - b. Make watertightness of joints the same as continuous waterstop material and to permanently develop not less than 50 percent of the mechanical strength of the parent section and to permanently retain their flexibility.
 - c. Adequately support waterstops to prevent displacement and deformity of the waterstops during concrete pours.
 - d. In substructures and other structures required to be watertight, install waterstops if concreting is discontinued for a sufficient length of time, which in the opinion of the Engineer, may result in seepage cracks in concrete.
 3. Other Embedded Items: Place sleeves, inserts, anchors and embedded items required for adjoining work prior to concrete pours. Place embedded items accurately, and support them against displacement. Embedded items shall conform to the following requirements:
 - a. Maximum outside dimension of embedded item shall not be greater than one-third the overall thickness of the member in which it is embedded.
 - b. Minimum spacing between embedded items shall not be less than three widths on center nor less than three inches clear between the items.
 - c. Embedded items shall not impair the strength of the member.
 - d. Provide two inches minimum clearance from the embedded item to the face of the slab.
 4. Surface Waterstop Installation: Install surface applied waterstop at such locations where indicated on the Drawings, and otherwise only as directed by the Engineer.
 - a. Install the waterstop in strict accordance with the manufacturer's installation instructions and with respect to the environmental requirements specified therein and substrate preparation.
- C. Reinforcement Work: As specified in Section 03200.
1. Pre-position reinforcement in advance of concrete pours.
- D. Preparation for Bonding To New (Hardened) Concrete: Bond fresh concrete with hardened previously poured new concrete in accordance with the following:
1. Thoroughly clean hardened concrete of foreign matter and laitance and saturate with water. Initial concrete pour shall have a rough surface.
 2. Cover the hardened concrete with a heavy coating of grout to approximately 2-inch thickness. Use grout of same material composition and proportions of concrete being poured except coarse aggregate omitted. Grout shall have a slump of 6-inches minimum.
 3. Place new concrete on grout before it has attained its initial set.
 4. Other bonding methods must be approved by Engineer prior to their use.
- E. Preparation for Bonding New Concrete To Existing Concrete: Roughen existing concrete in the area of bonding to produce exposed aggregate and an absolutely uncontaminated concrete surface.

1. Apply Epoxy Bonding Compound over existing prepared concrete in accordance with manufacturers instructions.

3.03 PLACING CONCRETE

- A. General Requirements: Perform concrete placement work in accordance with ACI 304 and such additional requirements as specified herein.
 1. Discharge of the concrete shall be completed within 1-1/2 hours or before the mixing drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates.
- B. Conveying/Placing: Handle concrete from mixer to final deposit rapidly by methods which will prevent segregation or loss of ingredients to maintain required quality of concrete. Carry on placing at such a rate that concrete which is being integrated with fresh concrete is still plastic.
 1. Do not convey concrete through aluminum or aluminum alloy.
 2. Do not place concrete by pumps or other similar devices without prior written approval of Engineer.
 3. Do not allow concrete to drop vertically more than four feet.
 4. Deposit concrete in approximately horizontal layers of 12 to 18 inches.
 5. Do not allow concrete to flow laterally more than three feet.
 6. Do not deposit concrete on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within sections.
 7. Do not use concrete which has partially hardened or has been contaminated by foreign materials.
 8. Do not place concrete in forms containing standing water, or on frozen surfaces, or around embedded items which have a surface temperature below freezing.
 9. Make placement within sections continuously to produce monolithic unit.
 10. Do not begin placing of concrete in beams or slabs until concrete previously placed in walls or columns has attained initial set.
 11. Do not bend reinforcement out of position when placing concrete.
- C. Consolidation: Consolidate concrete by vibration, spading, rodding or other manual methods. Work concrete around reinforcement, embedded items and into corners: eliminate all air or stone pockets and other causes of honeycombing, pitting or planes of weakness.
 1. Use vibration equipment of internal type and not the type attached to forms and reinforcement.
 2. Use vibrators capable of transmitting vibration to concrete in frequencies sufficient to provide satisfactory consolidation.
 3. Do not leave vibrators in one spot long enough to cause segregation. Remove concrete segregated by vibrator operation.
 4. Do not use vibrators to spread concrete.
 5. Have sufficient reserve vibration equipment to guard against shutdown of work occasioned by failure of equipment in operation.
- D. Cold Weather Concreting: In general, perform cold weather concrete work in

accordance with ACI 306R and the following additional requirements.

1. Temperature of concrete delivered at the job-site shall conform to the following temperature limitations:

Minimum Concrete Temperature, Degrees F

Air Temperature, Degrees F	For Sections with Least Dimension <u>Less Than 12 in.</u>	For Sections with Least Dimension <u>12 in. or Greater</u>
30 to 45	60	50
0 to 30	65	55

2. Provide equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather.
 3. Maintain concrete at temperatures listed in Table 1.4.1 of ACI 306R as follows, provided the concrete has developed a compressive strength of 500 psi. for pours in the following locations:
 - a. Slab-on-grade: Two days.
 - b. Walls or Vertical pours: Three days.
 4. If the strength is not achieved, the minimum temperature shall be maintained an additional 24 hours or until the 500 psi strength is reached.
 5. Make additional concrete cylinders to verify strength achievement of 500 psi; however, it will not be necessary to take them in every pour provided concrete temperatures are maintained fairly uniform. Once two sets of cylinders have been broken and a strength of 500 psi is achieved, additional cylinders will not be required except for random testing as determined by the Engineer.
 6. Remove temperature protection after 500 psi is achieved, but in a manner so thermal shock does not occur to the exposed concrete. The removal criteria shall be as stated in ACI 306R.
 7. Leave housing, covering, or other protection used in curing, intact at least 24 hours after artificial heating is discontinued.
 8. If water or aggregate is heated above 100 degrees F, combine water with aggregate in the mixer before cement is added. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 100 degrees F.
- E. Hot Weather Concreting: In general, perform hot weather concrete work in accordance with ACI 305R and the following additional requirements.
1. Temperature of concrete delivered at the job-site shall not exceed 90 degrees F.
 2. Cool ingredients before mixing to prevent temperature in excess of 90 degrees F.
 3. Make provisions for windbreaks, shading, fog spraying, sprinkling or wet cover when necessary.
- F. Underwater Placement of Concrete: When permitted by Engineer, foundation concrete may be placed in still water and according to the following:
1. Concrete placed in water shall contain twenty-five percent of cement over and above the amount specified for the particular class of concrete used. No additional compensation will be allowed for this added cement.
 2. Do not deposit concrete in water which has a temperature below 40 degrees F.
 3. Place the concrete underwater continuously through a tremie pipe. Diameter of

the tremie pipe shall be approximately eight times the maximum size of the largest coarse aggregate. Use seal in pipe to start concrete placement, and keep filled with concrete continuously with the end of the pipe embedded in the placed concrete at all times. If seal is lost, withdraw pipe and reseal and start charging operations again.

4. Protect placed concrete from water motion for at least four days and longer if required.

G. Construction Joints: Provide wall and slab construction joints as necessary but in compliance with the following:

1. Locate construction joints so as to least impair the strength of the structure and near the middle of the span of slabs or beams.
2. Space construction joints in slabs not greater than 30-feet in each direction, although some adjustments, as approved by the Engineer, may be permitted due to certain structural elements considerations.
3. If a cast-in-place concrete beam intersects another beam at a proposed construction joint, offset the joint in the beam a distance equal to twice the width of the beam and provide adequate shear reinforcement as determined by the Engineer.
4. Provide waterstops in construction joints where such joints are exposed to liquids, or in contact with earth, or subject to weather exposure.
5. Place walls and slabs in alternate sections allowing at least five days elapsed time before concrete is placed against an adjacent vertical joint.
6. When concreting is to be discontinued for more than forty-five (45) minutes and if the construction plane is to be horizontal, install keyways and embed reinforcing bar rods in the concrete before initial hardening. Use keyways and reinforcing bar rods in vertical concrete construction only when indicated or directed by the Engineer.

H. Expansion Joints and Contraction Joints: Install where indicated on the Drawings. Do not extend reinforcing or other embedded metal items through expansion and contraction joints; except where indicated otherwise on Drawings.

3.04 FINISHING

A. Form Tie Repairs: Following form removal repair holes vacated by removable components of form ties in accordance with the following.

1. Hammer-pack holes with stiff mortar of same mix and ingredients as employed in surrounding concrete. Prepare mortar not more than 30 minutes prior to use.
2. Render mortar patch work inconspicuous. Maintain mortar patches damp and cure as specified herein for Curing and Protection.

B. Finishes: Finish exposed concrete surfaces true and even, free from open or rough areas, depressions or projections. Bring concrete up in vertical pours to the required elevation, strike-off with a straight edge and float-finish.

1. Spade Finish: Obtained by forcing a flat spade or similar device, down adjacent to the form and pulling the top of the spade away from the form to bring mortar to the surface next to the forms. After forms are removed satisfactorily, correct

- concrete surface irregularities.
2. **Floated Finish:** After concrete has been placed, consolidated, struck off and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation. During or after first floating, check planeness of surface with a ten foot straightedge applied at not less than two different angles. Cut down high spots and fill low spots during this procedure to produce a surface with true planes within 1/4-inch in ten feet as determined by a ten foot straightedge placed anywhere on the slab in any direction. Following straightedge checking, refloat slab immediately to a uniform sandy texture.
 3. **Smooth Rubbed Finish:** Obtained by rubbing a Spade Finished vertical surface not later than one day after form removal. Wet surface and rub with carborundum brick or other abrasive until uniform color and texture are produced. Do not use cement grout other than the cement paste drawn from the concrete itself by the rubbing process.
 4. **Steel Trowel Finish:** Obtained by power troweling and hand troweling a Floated Finish. First troweling after power floating shall produce a smooth surface which is relatively free of defects but which may still show some trowel marks. Perform additional trowelings by hand after the surface has hardened sufficiently. Perform final troweling when a ringing sound is produced as the trowel is moved over the surface. Thoroughly consolidate surface by hand trowel operations. Produce finished surface essentially free of trowel marks, uniform in texture and appearance, with true planes within 1/4-inch in ten feet, as determined by a ten foot straightedge placed anywhere on the slab in any direction.
 5. **Broom or Belt Finish:** Immediately after concrete has received a Floated Finish, give surface a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

C. Application For Finishes:

1. **Spade Finish:**
 - a. Surfaces to be backfilled with earth.
 - b. Surfaces to be concealed by surface applied finish materials, excluding painting.
 - c. Surfaces to be rubbed.
2. **Floated Finish:**
 - a. Bottoms of chambers, manholes, and other tank type structures.
 - b. Surfaces to receive Steel Trowel Finish.
 - c. Surfaces to receive Broom or Belt Finish.
3. **Smooth Rubbed Finish, Exterior Applications:**
 - a. Exposed vertical surfaces of concrete structures, of whatever nature, down to one foot below finished grade elevation of earth.
 - b. Exposed vertical surfaces of troughs, channels and such other passages for the flow of liquids.
4. **Smooth Rubbed Finish, Interior Applications:**
 - a. Exposed vertical surfaces of concrete structures, including overhead sloped or horizontal surfaces.
 - b. Inside vertical surfaces of chambers, manholes, and tank type structures, including wet wells, down to one foot below the average water level.

- c. Inside vertical surfaces of troughs, channels and such other passages for the flow of liquids.
- 5. Steel Trowel Finish:
 - a. Interior floor surfaces intended for pedestrian and vehicle traffic, and floor surfaces receiving decorative coverings.
 - b. Interior bottom surfaces of troughs, channels and such other passages for the flow of liquids.
- 6. Broom or Belt Finish: Exterior concrete walks, steps and platforms.

3.05 CURING AND PROTECTION

- A. General Requirements: Immediately after placement, and finishing, protect concrete from premature drying, excessive hot or cold temperatures and mechanical injury. Perform curing by either water curing, sheet form curing or sealing methods in accordance with ACI 308. Cure concrete continuously for a minimum of seven days at ambient temperatures above 40 degrees F.
- B. Hot Weather Curing: See Hot Weather Concreting this Section.
- C. Cold Weather Curing: See Cold Weather Concreting this Section.
- D. Water Curing Methods: Perform only water curing methods on concrete surfaces receiving surface applied grouts and other cementitious overlays.
- E. Liquid Curing Compound Application: Apply the liquid membrane forming compound at such rates to restrict the loss of water to not more than 0.055 g/sq. cm of surface in 72 hours when tested in accordance with ASTM C 156.
- F. Liquid Curing and Sealing Compound Application: Final troweling must be completed.
 - 1. Apply compound when concrete surface is damp but not wet and can no longer be marred by the walking workmen.
 - 2. Apply compound at the application rate and by methods consistent with compound manufacturer's application instructions.

3.06 FIELD QUALITY CONTROL

- A. Testing and Inspection: Make periodic inspections and tests of materials and operations as work is in progress. Failure to detect defective work will not prevent rejection when defect is discovered, nor will it obligate the Engineer for final acceptance.
 - 1. Obtain composite concrete samples in accordance with ASTM C 172.
 - 2. Mold and cure three test specimens for each strength test in accordance with ASTM C 31.
 - 3. Test specimens in accordance with ASTM C 39. Test one specimen at 7 days for information and two at 28 days for acceptance.
 - 4. Make one strength test for each 50 cu. yd. of concrete, unless waived by the Engineer, but not less than one test for each structure.
 - 5. Make slump tests for each strength test and whenever consistency of concrete appears to vary in accordance with ASTM C 143.

6. Make air content test for each strength test in accordance with ASTM C 231 or ASTM C 173 except if aggregate with high absorptions are used, use the latter test method.
- B. Evaluation and Acceptance: The strength level of the concrete will be considered satisfactory if 90 percent of the strength test results and the averages of all sets of three consecutive strength test results equal or exceed specified strength and no individual test result is below specified strength by more than 500 psi.
1. If the strength of cylinders falls below specified compressive strengths, the Engineer shall have the right to order a change in the mix proportions for the remaining concrete being poured.
 2. If required by the Engineer, obtain and test core specimens from hardened concrete in accordance with ASTM C 42.

END OF SECTION

SECTION 03600 - GROUT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The work specified in this Section consists of providing the individual grout placements stated in other Sections of the Specifications and where indicated on drawings, or required in the work.
- B. Related Sections:
 - 1. Cast-In-Place Concrete: Section 03300.

1.02 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM C 109; Test Method for Compressive Strength of Hydraulic Cement Mortars (Using two inch or 50-mm Cube Specimens).
 - 2. ASTM C 191; Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
 - 3. ASTM C 596; Test Method for Drying Shrinkage of Mortar Containing Portland Cement.
 - 4. ASTM C 827; Test Method for Early Volume Change of Cementitious Mixtures.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's descriptive product data and current specifications covering named manufactured products specified in this Section. Include placing instructions. Submit product data for the following:
 - 1. Non-Shrink Non-Metallic Grout.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Furnish the grout manufacturer's current independent laboratory test results indicating the grout as non-shrink from time of placement as conforming to the Following:
 - 1. Indicating no expansion after final set, according to ASTM C 827.
 - 2. Indicating 4,000 psi strength developed with a trowelable mix within 24 hours, according to ASTM C 109.
 - 3. Indicating placement time based on initial set of not less than 60 minutes, according to ASTM C 191.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Handling: Provide protective covering over materials to prevent moisture damage and contamination of grout materials during delivery and handling.
- B. Storage: Store grout materials in undamaged condition with seals and labels intact as

packaged by the manufacturer.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements: Protect against high and low temperatures and unfavorable environmental conditions in accordance with American Concrete Institute standards for placement of concrete.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Non-Shrink Non-Metallic Grout: Provide a factory premixed material containing no corrosive irons, aluminums, chemicals or gypsums and complying with the following limitations:
 - 1. Grouts containing water reducers, accelerators, or fluidifiers shall have no drying shrinkage greater than the equivalent sand cement and water mix when tested according to ASTM C 596.
 - 2. Grout shall exhibit no shrinkage before initial set and show no expansion after set when tested according to ASTM C 827.
 - 3. Initial set of grout shall occur in not less than 60 minutes according to ASTM C 191 Test.
 - 4. Use Type I (Normal) cement for grout applications not in contact with sewage.
 - 5. Use Type II (Sulfate Resistant) cement for grout applications in contact with sewage.
 - 6. Acceptable Manufacturers:
 - a. U.S. Grout Corporation; FIVE STAR.
 - b. Or equal.
- B. Water: Clear and free from deleterious amounts of acids, alkalis, and organic substances.

2.02 GROUT QUALITY

- A. Non-Shrink Grout: Use ready-mix type requiring only the addition of water. Do not add other materials. Water requirement proportions shall conform to manufacturer's specifications for the desired mix consistency.

PART 3 EXECUTION

3.01 PREPARATION

- A. Preparation of Surface: Clean surfaces to be grouted to be free of oil, grease, laitance, dirt and other contaminants. Remove loose material. Remove rust, paint, and oil from metal components in contact with grout.
 - 1. Non-Shrink Grout: Perform additional surface preparation in accordance with manufacturer's instructions.

- B. Formwork: Use forming procedures that allow proper and complete placement of grout.
 - 1. Pre-treat wood forms with forming oils so that they do not absorb moisture.
 - 2. Anchor Support elements of formwork so no movement is possible. Remove supports only after grout has hardened.
- C. Grout Mixing: Use power operated mechanical mixer of sufficient capacity to carry out batch mixing without interruption.
 - 1. Mix Non-Shrink Grout in accordance with manufacturer's instructions.

3.02 INSTALLATION

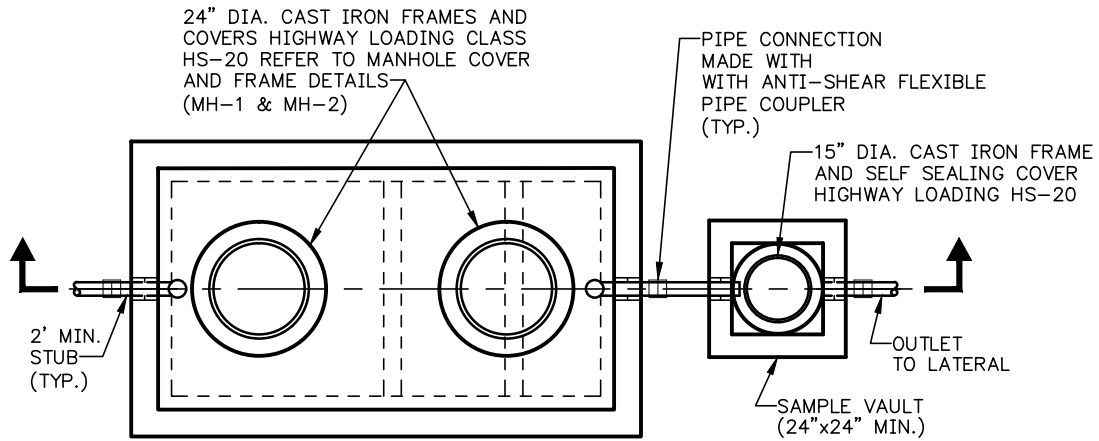
- A. Non-Shrink Non-Metallic Grout: Perform grout placement in accordance with the recommendations of ACI and the manufacturer's published specifications for mixing and placing. Place Non-Shrink Non-Metallic Grout only where indicated on Drawings.

END OF SECTION

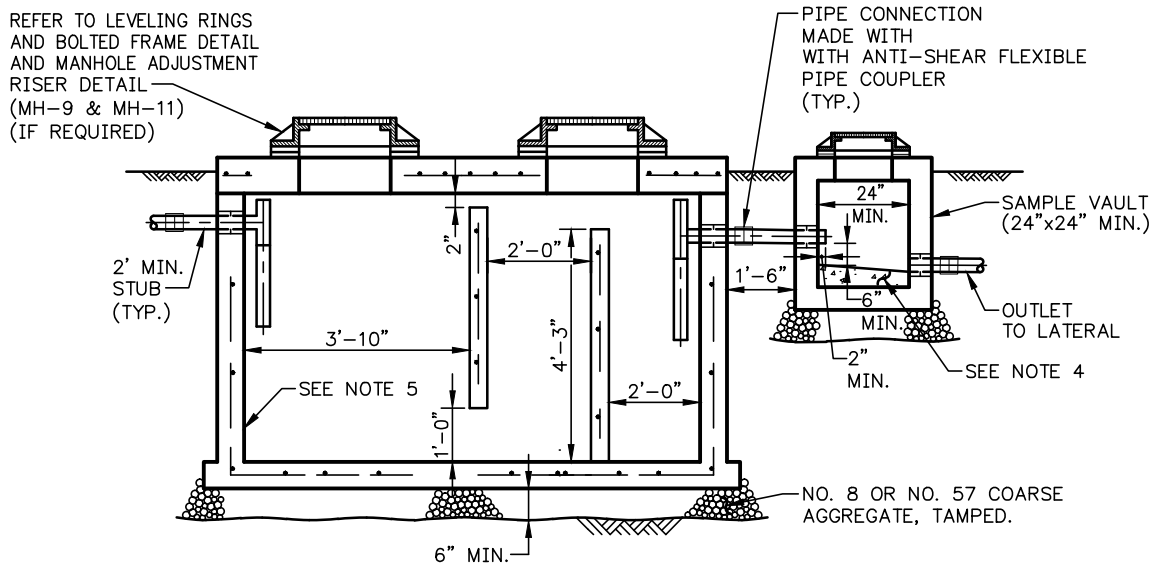
UPPER ALLEN TOWNSHIP



STANDARD DETAIL DRAWINGS FOR SANITARY SEWERS



PLAN



SECTION

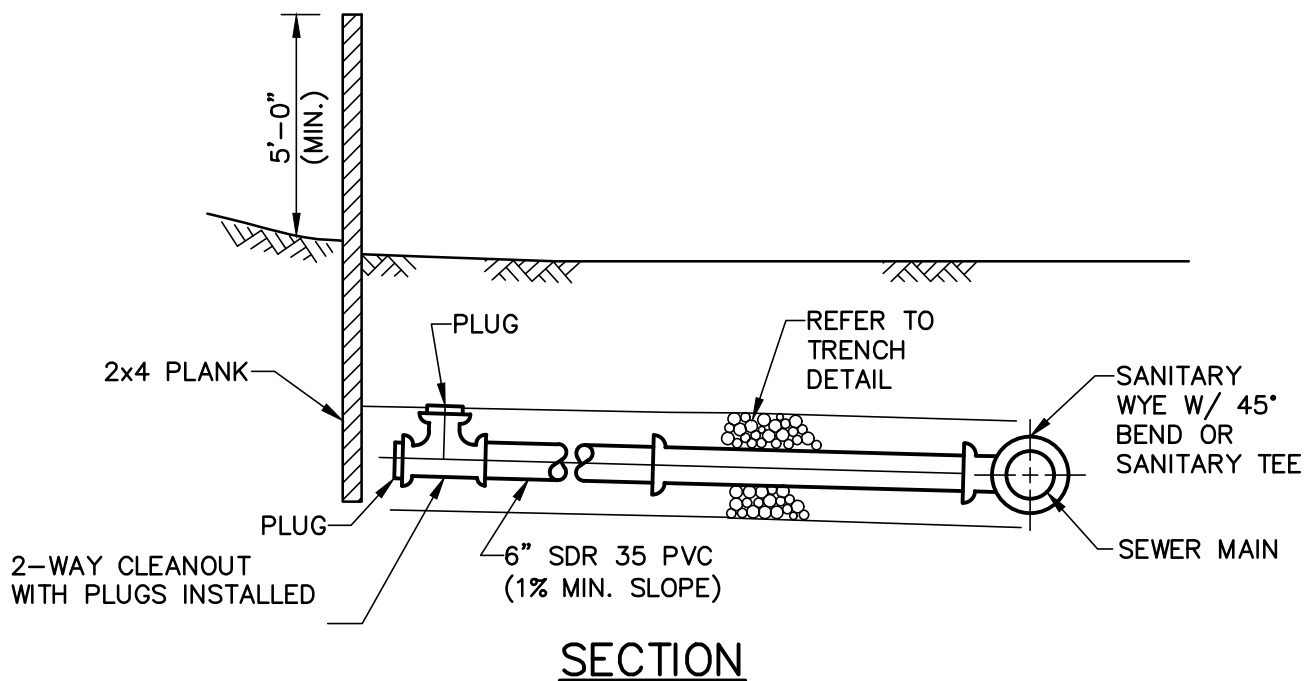
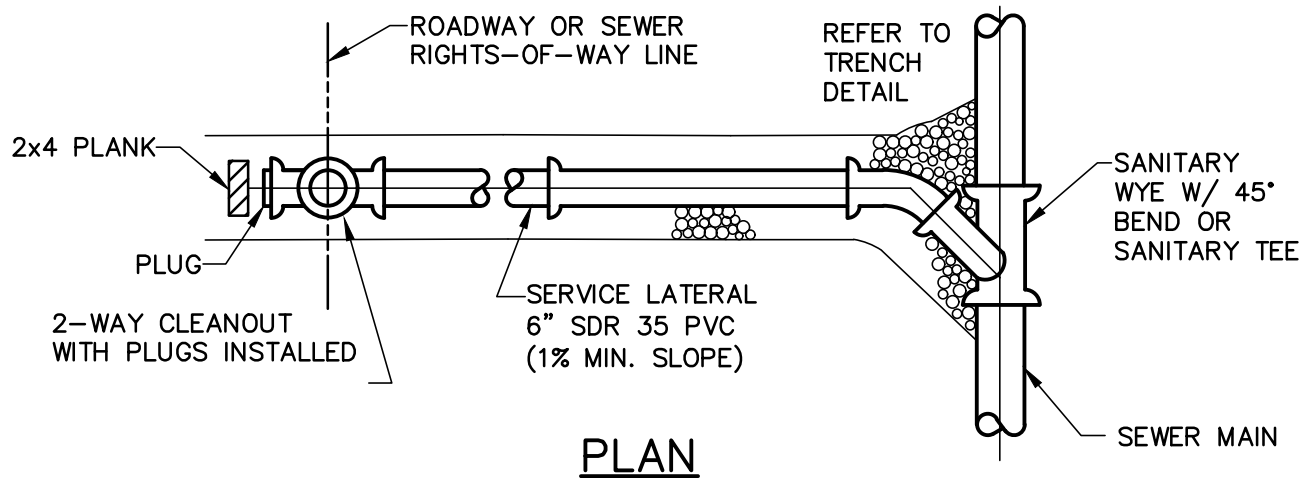
NOTES:

1. MINIMUM SIZE OF GREASE INTERCEPTOR PERMITTED IS 1,000 GALLONS.
2. GREASE INTERCEPTOR SIZE AND DESIGN SHALL COMPLY WITH SECTION 200-3.13, PARA. E, OF THE TOWNSHIP CODE.
3. ACCEPTABLE MANUFACTURERS: MONARCH PRODUCTS OR APPROVED EQUAL.
4. CONCRETE FOR SLOPE TO BE 3500 psi MIX DESIGN MEETING SECTION 2601 PART 3 PARAGRAPH E OF THE STANDARD SPECIFICATIONS.
5. COAT ALL INTERIOR CONCRETE SURFACES WITH 100% SOLIDS EPOXY RESIN SYSTEM.

FILE NAME: GR-1-GREASE-INT.DWG

STANDARD DETAILS
**TYPICAL GREASE INTERCEPTOR
 AND SAMPLING VAULT**
 UPPER ALLEN TOWNSHIP

DATE	REVISIONS
11/08	DWG. CREATED
11/14	GENERAL REVISIONS
SCALE NO SCALE	DWG. NO. GR-1



NOTES:

1. 2-WAY CLEANOUT NOT TO BE LOCATED IN SIDEWALK OR BENEATH OTHER CURB LINE UTILITIES.
2. THERE SHALL BE A 10 FOOT HORIZONTAL SEPARATION BETWEEN THE WATER SERVICE AND THE SERVICE LATERAL/BUILDING SEWER.
3. 2-WAY CLEANOUT TO BE LOCATED ON TOWNSHIP R/W LINE AND LOCATION TO BE SITE SPECIFIC WITH RESPECT TO CURB AND SIDEWALK.
4. WHERE 2-WAY CLEANOUT IS NOT REQUIRED, SERVICE CONNECTION SHALL BE EXTENDED TO THE RIGHTS-OF-WAY LINE AND PLUGGED.
5. DETECTION TAPE REQUIRED IN PIPE TRENCH AT A DEPTH OF NO MORE THAN 12-INCHES BELOW FINAL SURFACE GRADE OR PAVEMENT SUBGRADE.
6. 2-WAY CLEANOUTS MAY ALSO BE USED FOR TESTING AND OBSERVATION.

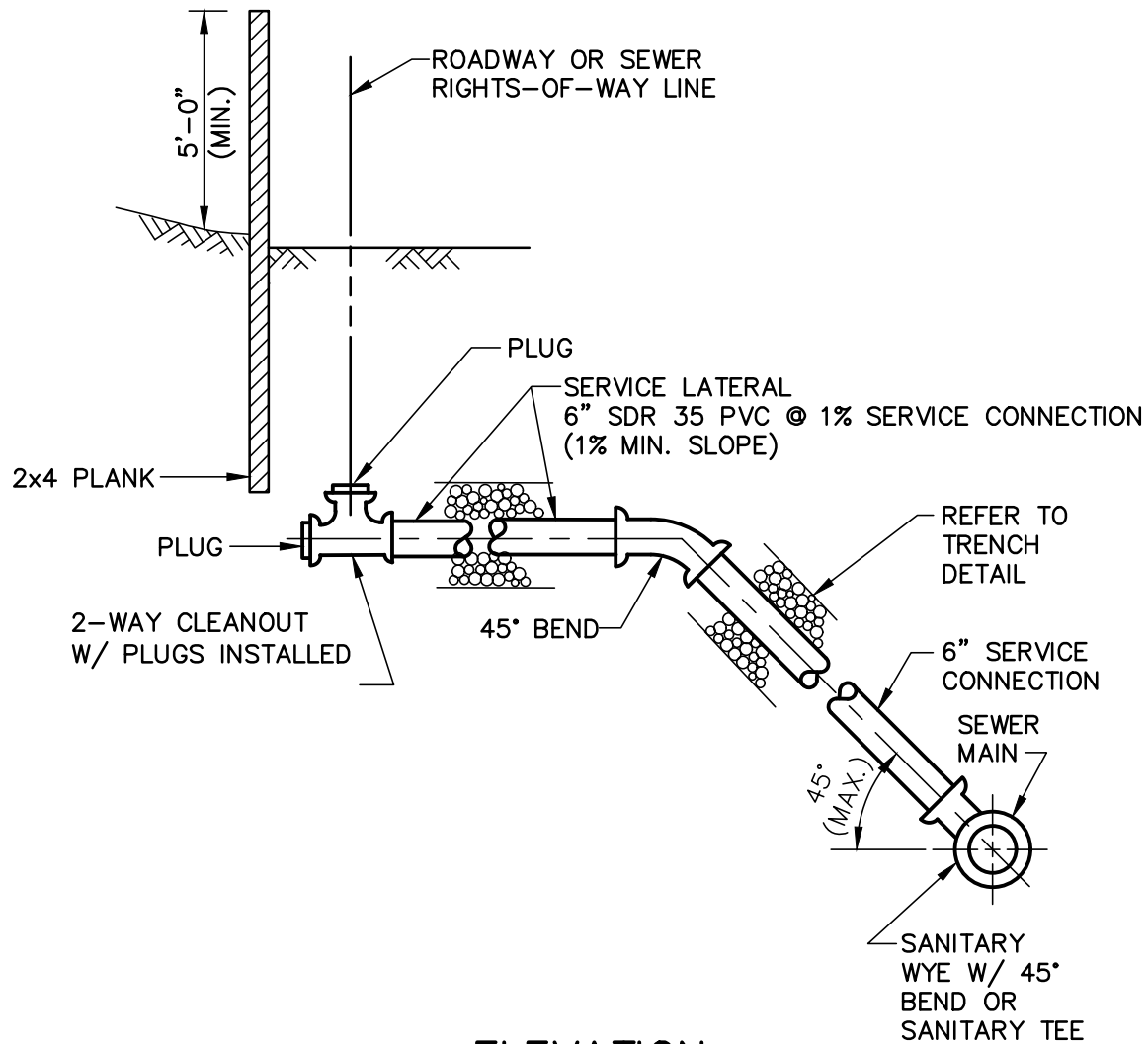
FILE NAME: LAT-1-SHALLOW.DWG

STANDARD DETAILS

SERVICE LATERAL – SHALLOW SEWER

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
1/17	DWG./NOTE REVISIONS
SCALE NO SCALE	DWG. NO. LAT-1



ELEVATION

NOTES:

1. 2-WAY CLEANOUT NOT TO BE LOCATED IN SIDEWALK OR BENEATH OTHER CURB LINE UTILITIES.
2. THERE SHALL BE A 10 FOOT HORIZONTAL SEPARATION BETWEEN THE WATER SERVICE AND THE SERVICE LATERAL/BUILDING SEWER.
3. 2-WAY CLEANOUT TO BE LOCATED ON TOWNSHIP R/W AND LOCATION TO BE SITE SPECIFIC WITH RESPECT TO CURB AND SIDEWALK.
4. WHERE 2-WAY CLEANOUT IS NOT REQUIRED, SERVICE CONNECTION SHALL BE EXTENDED TO THE RIGHTS-OF-WAY LINE AND PLUGGED.
5. DETECTION TAPE REQUIRED IN PIPE TRENCH AT A DEPTH OF NO MORE THAN 12-INCHES BELOW FINAL SURFACE GRADE OR PAVEMENT SUBGRADE.
6. 2-WAY CLEANOUTS MAY ALSO BE USED FOR TESTING AND OBSERVATION.

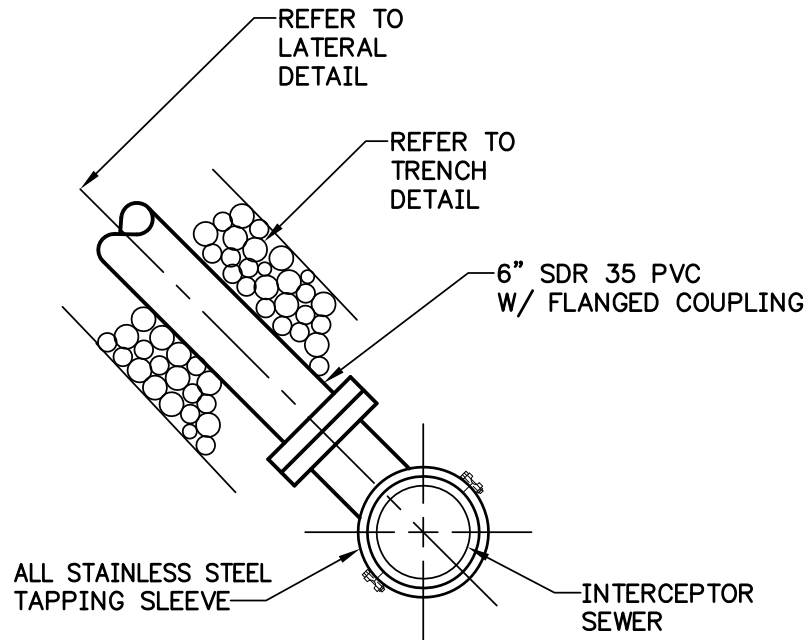
FILE NAME: LAT-2-DEEP.DWG

STANDARD DETAILS

SERVICE LATERAL – DEEP SEWER

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
1/17	DWG./NOTE REVISIONS
SCALE NO SCALE	DWG. NO. LAT-2



ELEVATION

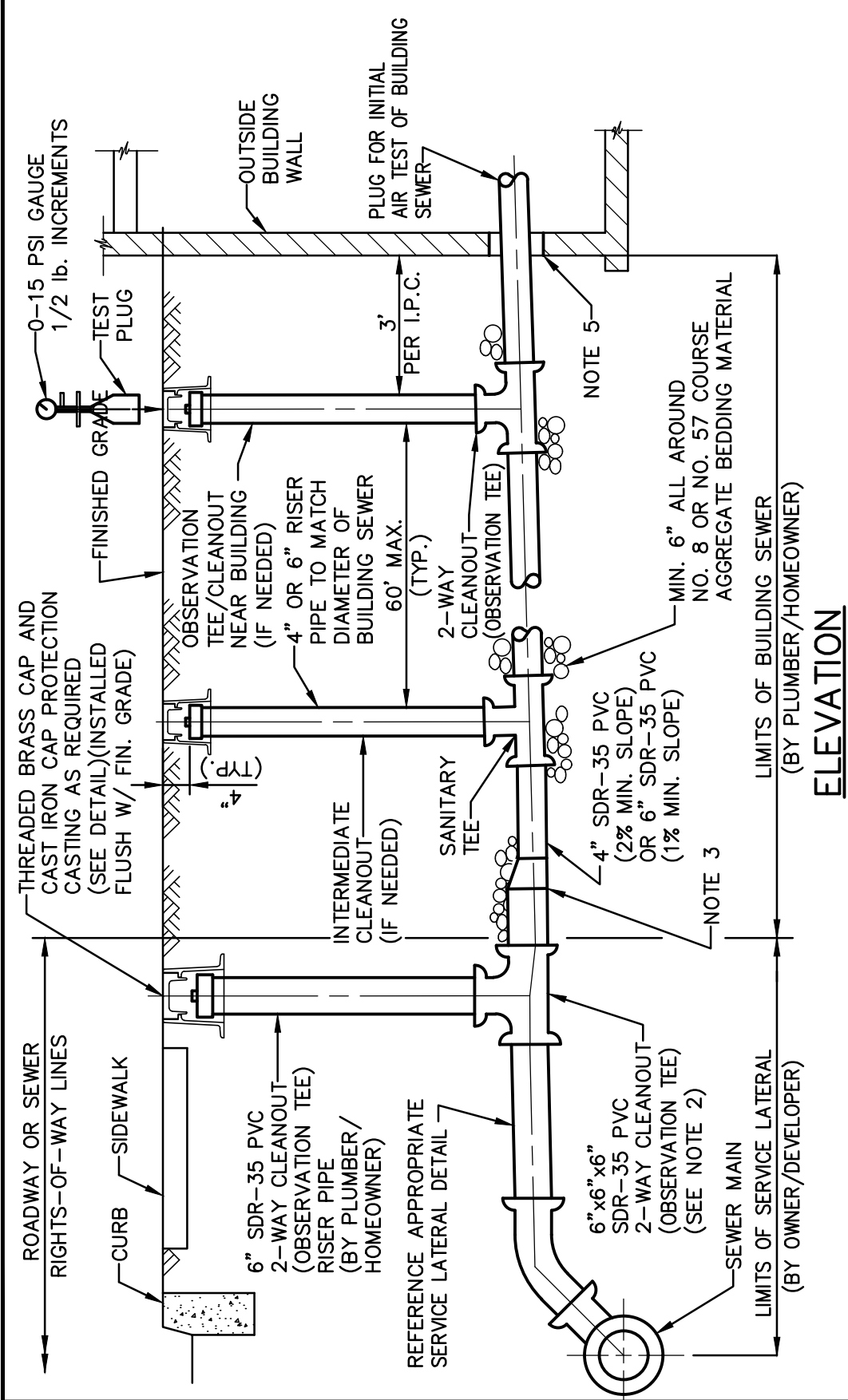
NOTE:

1. ALL STAINLESS STEEL TAPPING SLEEVE SHALL BE JCM INDUSTRIES 432 OR APPROVED EQUAL.

FILE NAME: LAT-3-SEWER-TAP.DWG

STANDARD DETAILS
SERVICE LATERAL – 12" OR LARGER
INTERCEPTOR SEWER TAP
 UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. LAT-3



NOTES:

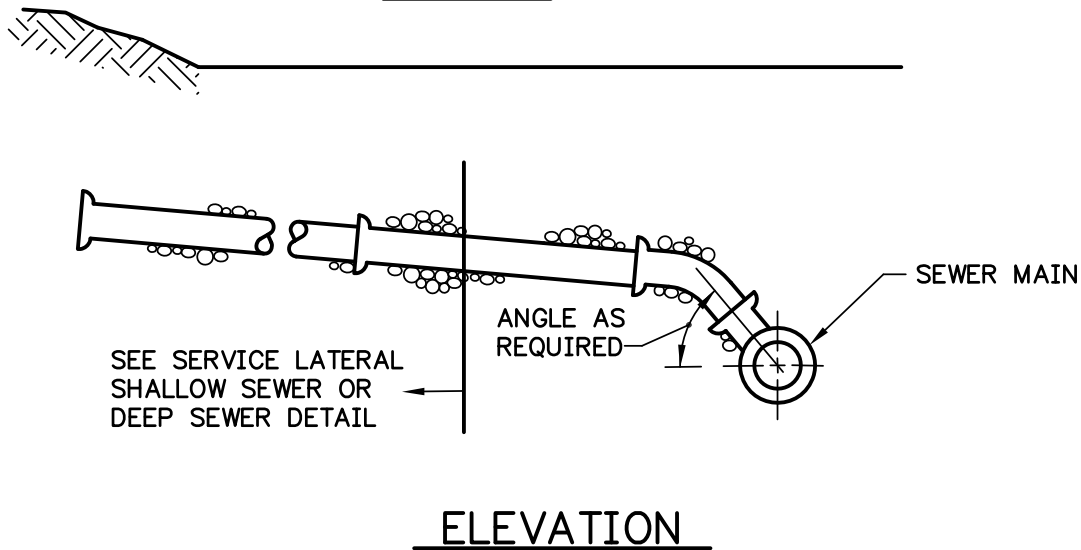
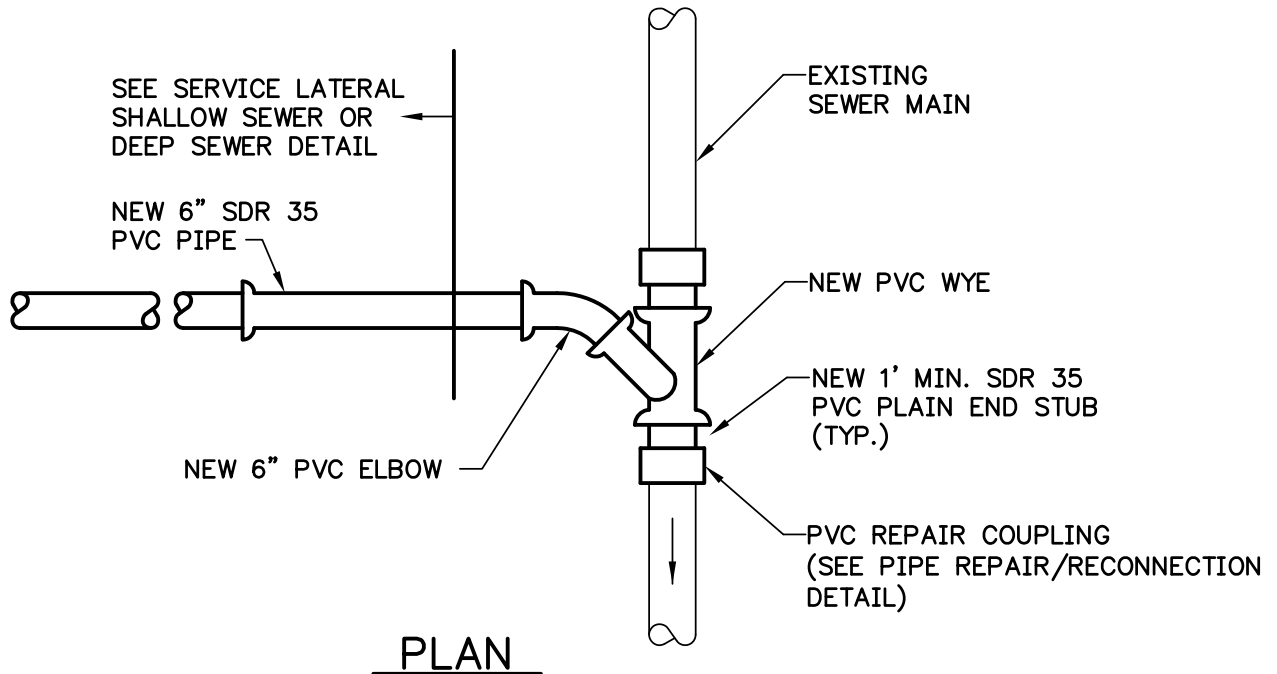
1. PIPE SIZES AND MATERIALS TO BE IN ACCORDANCE WITH TOWNSHIP REQUIREMENTS.
2. 2-WAY CLEANOUT (OBSERVATION TEE) TO BE LOCATED AT TOWNSHIP R/W LINE AND LOCATION TO BE SITE SPECIFIC WITH RESPECT TO CURB AND SIDEWALK.
3. FOR 4" BUILDING SEWER USE ECCENTRIC 4"x6" ADAPTER FITTING AT TRANSITION TO 2-WAY CLEANOUT (4"x6" FLEXIBLE COUPLING NOT ALLOWED).
4. CLEANOUT/TEST TEE SPACING IS 60' MAXIMUM, UNLESS OTHERWISE APPROVED IN WRITING BY TOWNSHIP.
5. WALL SLEEVE TO BE 2" GREATER THAN DIAMETER OF BUILDING SEWER PIPE AND SEALED WATER TIGHT.
6. ANY PIPE LESS THAN 3 FEET OF COVER SHALL BE APPROVED IN WRITING BY TOWNSHIP.
7. THERE SHALL BE A 10 FOOT HORIZONTAL SEPARATION BETWEEN WATER SERVICE AND SERVICE LATERAL/BUILDING SEWER, OR WATER SERVICE SHALL BE ENCASED IN A WATERTIGHT PVC CONDUIT SEALED AT BOTH ENDS WITH APPROPRIATE FERNCO ADAPTER.
8. INSTALL TEST PLUGS AS REQUIRED FOR ACCEPTANCE AIR TESTING.
9. TRAFFIC RATED PROTECTION CASTING REQUIRED IN PAVED AREAS ONLY.
10. DETECTION TAPE REQUIRED IN PIPE TRENCH AT A DEPTH OF 12-INCHES BELOW FINAL SURFACE GRADE OR PAVEMENT SUBGRADE.

FILE NAME: LAT-4-BLDG-SEWER.DWG

STANDARD DETAILS **BUILDING SEWER DETAIL**

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
1/17	NOTE REVISIONS
SCALE NO SCALE	DWG. NO. LAT-4



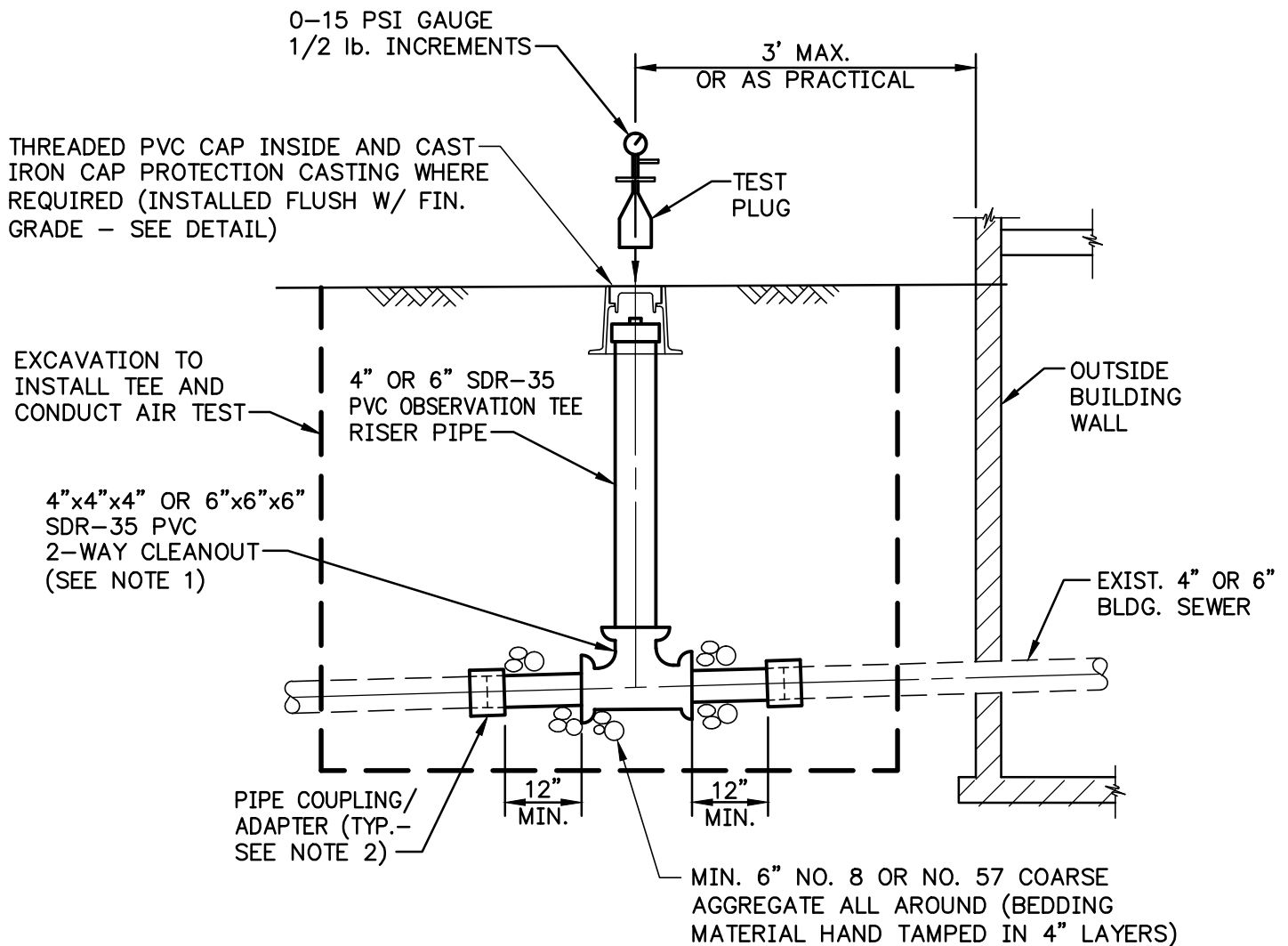
NOTES:

1. EXISTING MAIN SEWER TO BE SAW CUT.
2. IN CERTAIN CIRCUMSTANCES USE OF A TAPPING SADDLE MAY BE PERMITTED OR REQUIRED, INCLUDING CONNECTIONS TO LARGER DIAMETER INTERCEPTORS SEWERS, WITH TOWNSHIP APPROVAL (SEE DETAIL).

FILE NAME: LAT-5-SERVICE.DWG

STANDARD DETAILS
**SERVICE LATERAL CONNECTION
 TO EXISTING SEWER MAIN**
 UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. LAT-5



ELEVATION

NOTES:

1. 2-WAY CLEANOUT SHALL BE THE SAME SIZE AS BUILDING SEWER.
2. REFER TO PIPE REPAIR/RECONNECTION DETAIL FOR PROPER FITTINGS/COUPLINGS/ADAPTERS.
3. FITTINGS/COUPLINGS/ADAPTERS FOR CONNECTIONS TO EXISTING SEWERS MUST BE IN ACCORDANCE WITH TOWNSHIP SPECIFICATIONS AND ARE SUBJECT TO TOWNSHIP REVIEW AND APPROVAL.

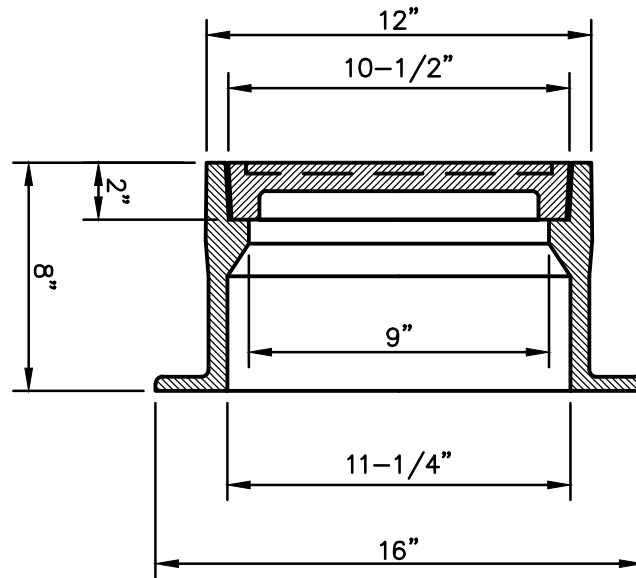
FILE NAME: LAT-6-WAY-CO-BLDG.DWG

STANDARD DETAILS 2-WAY CLEANOUT (NEAR BLDG.)

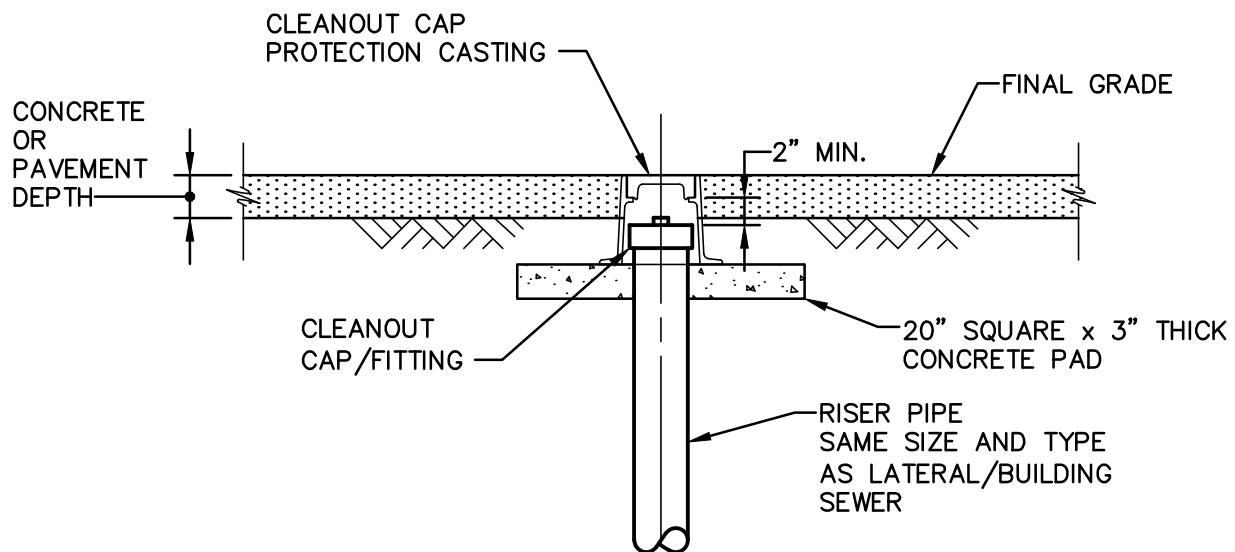
(AS NECESSARY FOR AIR TESTING LATERAL
WHEN THERE IS NO CLEANOUT IN BUILDING)

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
SCALE NO SCALE	DWG. NO. LAT-6



CAP



ELEVATION

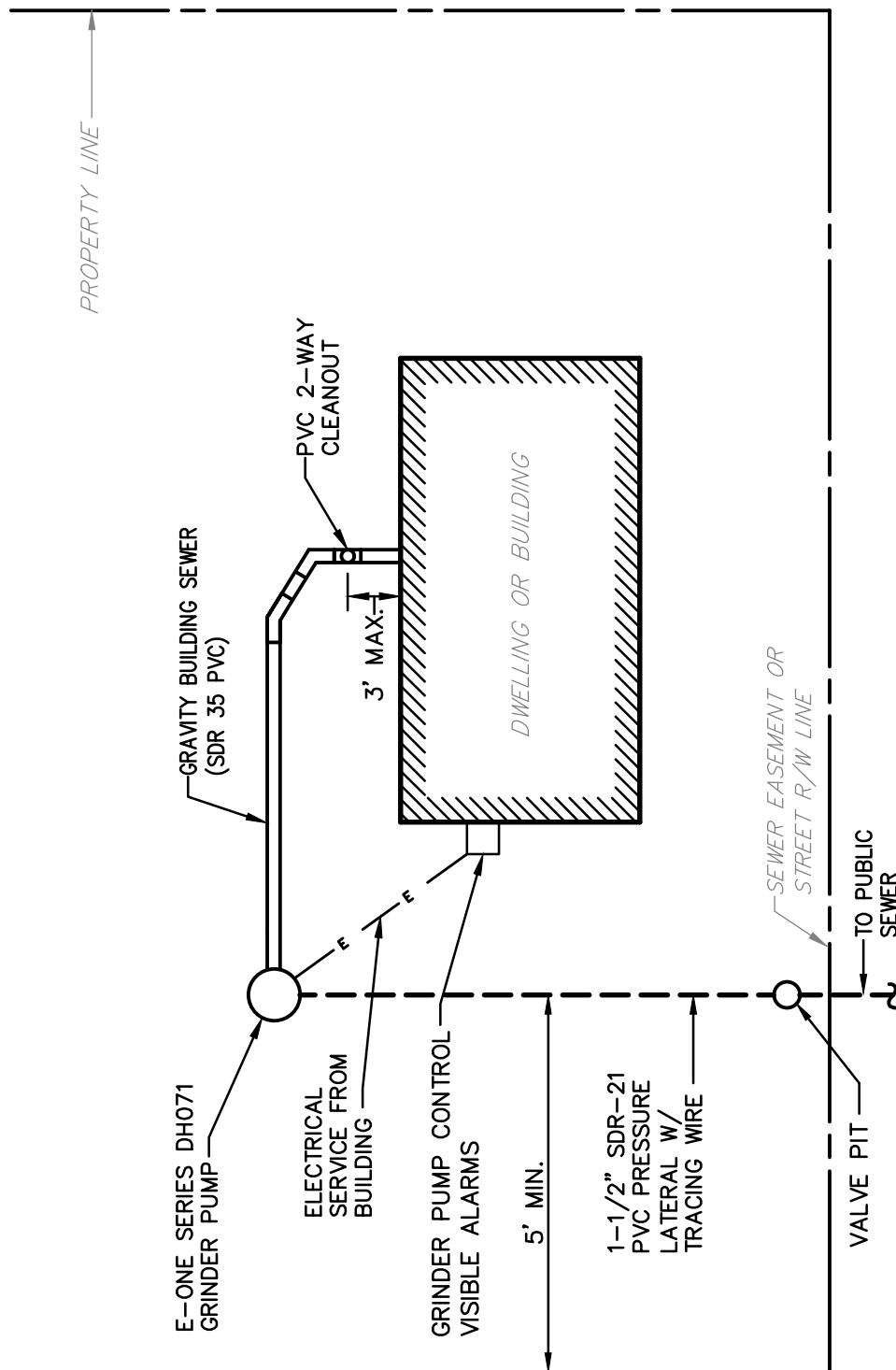
NOTES:

1. CASTING FRAME AND COVER SHALL BE HEAVY DUTY WITH "S" MARKING ON COVER.
(EAST JORDAN IRON WORKS CATALOG No. 1565, OR APPROVED EQUAL.)

FILE NAME: LAT-8-CO-CAP.DWG

STANDARD DETAILS
**CAP PROTECTION CASTING FOR
 CLEANOUT COVER IN VEHICULAR TRAFFIC AREAS**
 UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
1/17	NOTE/TITLE REVISIONS
SCALE NO SCALE	DWG. NO. LAT-8



NOTES:

1. ACTUAL PUMP STATION AND LATERAL LOCATIONS MAY VARY. CONTRACTOR TO COORDINATE INSTALLATION LOCATIONS WITH OWNER/TOWNSHIP.
2. CLEANOUT REQUIRED IN LOW PRESSURE SERVICE LATERAL EVERY 100', CONSISTING OF 1-1/2" TEE, SDR21 VERTICAL PIPE AND THREADED CAP (NOT REQUIRED WITH CONTINUOUS DR 11 HDPE PRESSURE PIPE).
3. CONTINUOUS PE3408/3608 DR 11 (160 PSI) HDPE PRESSURE PIPE (IRON PIPE SIZE) MAY BE USED IN PLACE OF SDR 21 PVC PRESSURE PIPE.
4. 24-HR. STABILIZATION PERIOD REQUIRED BEFORE INSTALLING FITTINGS ON BACKFILLED PIPING TO ALLOW FOR EXPANSION/CONTRACTION (1"/100'/10 DEGREE TEMP. CHANGE).
5. VALVE PIT NOT REQUIRED WHEN CONNECTING TO GRAVITY SEWER MAIN, OR WHEN CONNECTING TO A LOW PRESSURE SEWER SYSTEM TWO-WAY IN-LINE CLEANOUT/VALVE PIT WITH SERVICE LINE CHECK VALVE.

STANDARD DETAILS

TYPICAL GRINDER PUMP INSTALLATION DETAIL – PLAN

UPPER ALLEN TOWNSHIP

FILE NAME: LP-2-GRNDPMPINST-PLAN.DWG

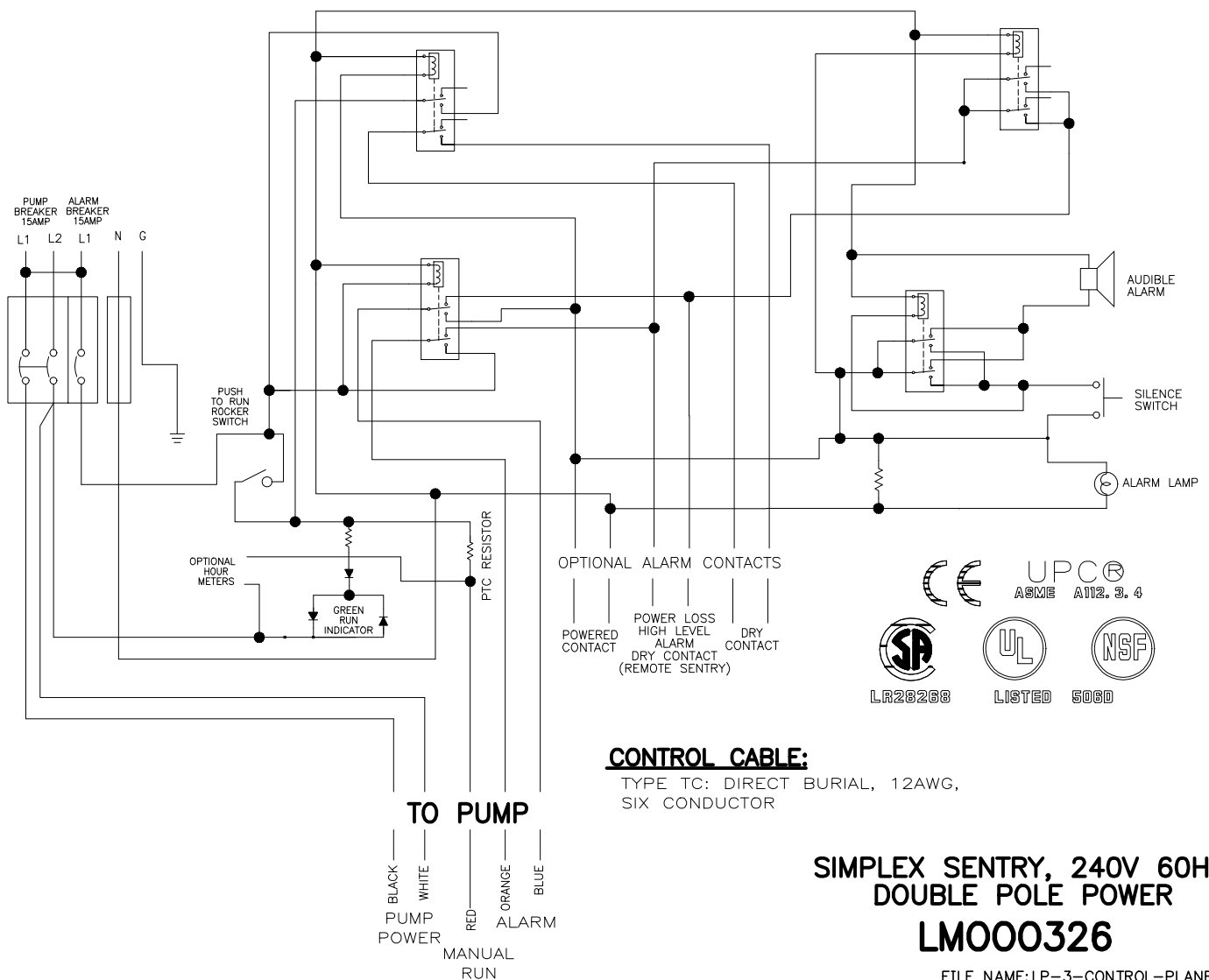
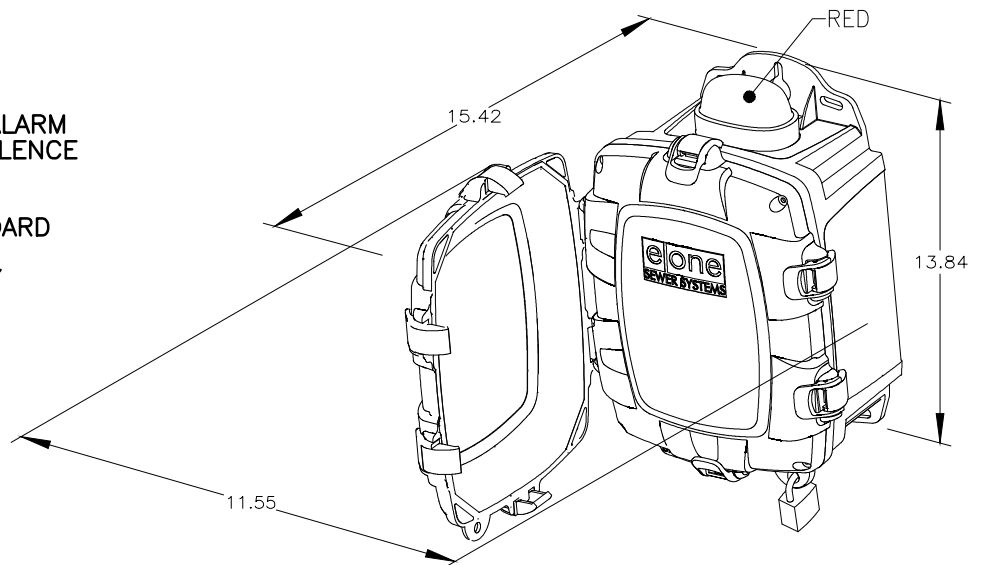
DATE	REVISIONS
3/08	DWG. CREATED
12/09	NOTE REVISIONS
2/17	NOTE REVISIONS
SCALE NO SCALE	DWG. NO. LP-2

SIMPLEX SENTRY:

REDUNDANT RUN (HIGH LEVEL)
EXTERNAL VISUAL & AUDIBLE ALARM
EXTERNAL LATCHING MANUAL SILENCE
MANUAL RUN
PUMP RUN INDICATOR
CONFORMAL COATED CIRCUIT BOARD
PADLOCK
NEMA 4X ENCLOSURE ASSEMBLY
CORROSION PROOF THERMOPLASTIC
POLYESTER APPROVED BY UL FOR
ELECTRICAL CONTROL ENCLOSURE

OPTIONS:

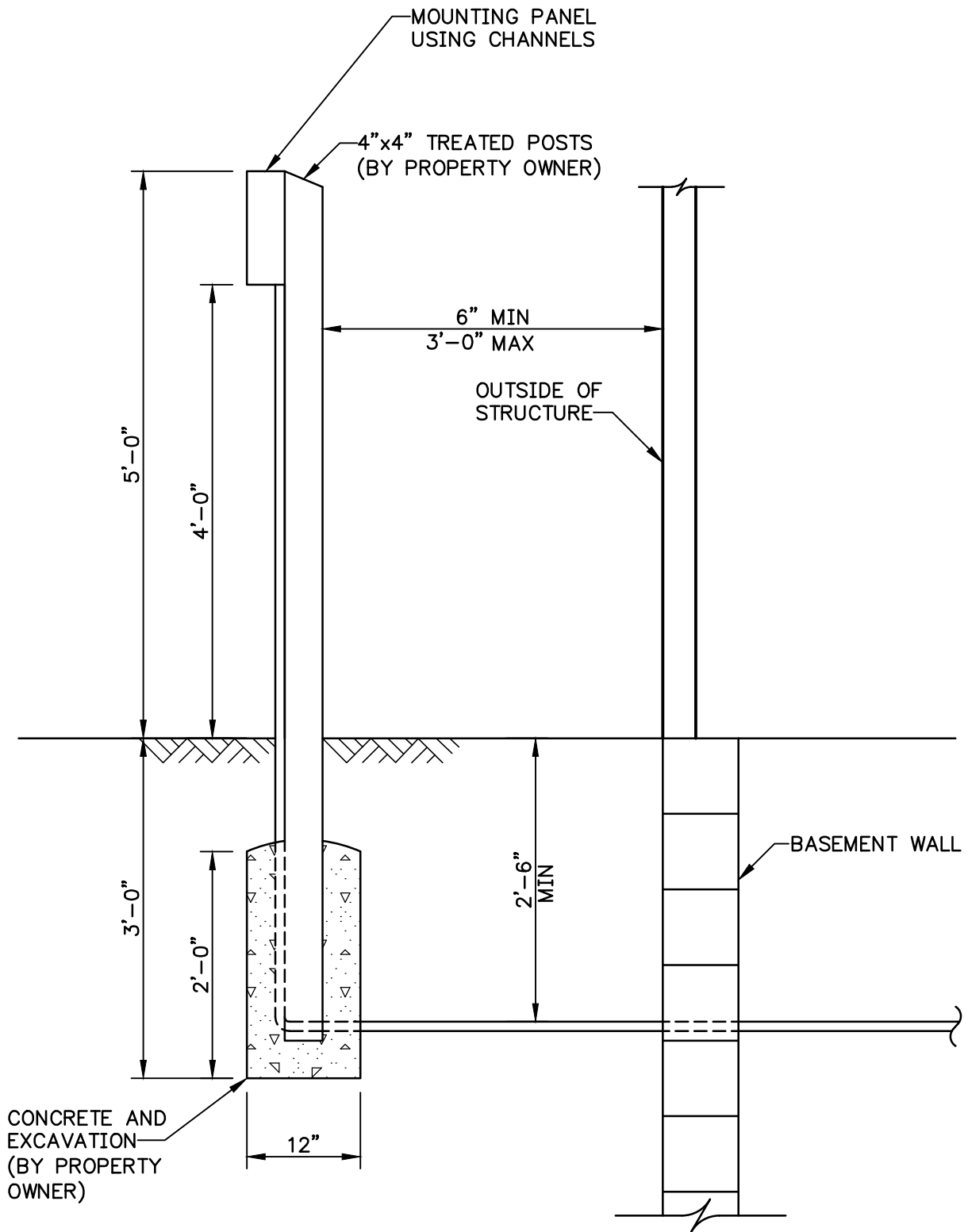
- ☐ ALARM CONTACTS
☐ HOUR METER



STANDARD DETAILS
**E-ONE CONTROL
PANEL DETAIL**
UPPER ALLEN TOWNSHIP

FILE NAME: LP-3-CONTROL-PANEL.dwg

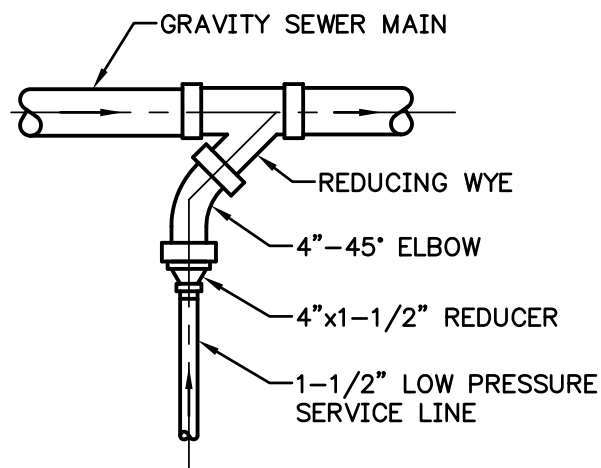
DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. LP-3



FILE NAME: LP-4-PANEL-MOUNT.dwg

STANDARD DETAILS
CONTROL PANEL
OPTIONAL MOUNTING POST
 UPPER ALLEN TOWNSHIP

DATE	REVISIONS	
3/08	DWG. CREATED	
SCALE NO SCALE		DWG. NO. LP-4

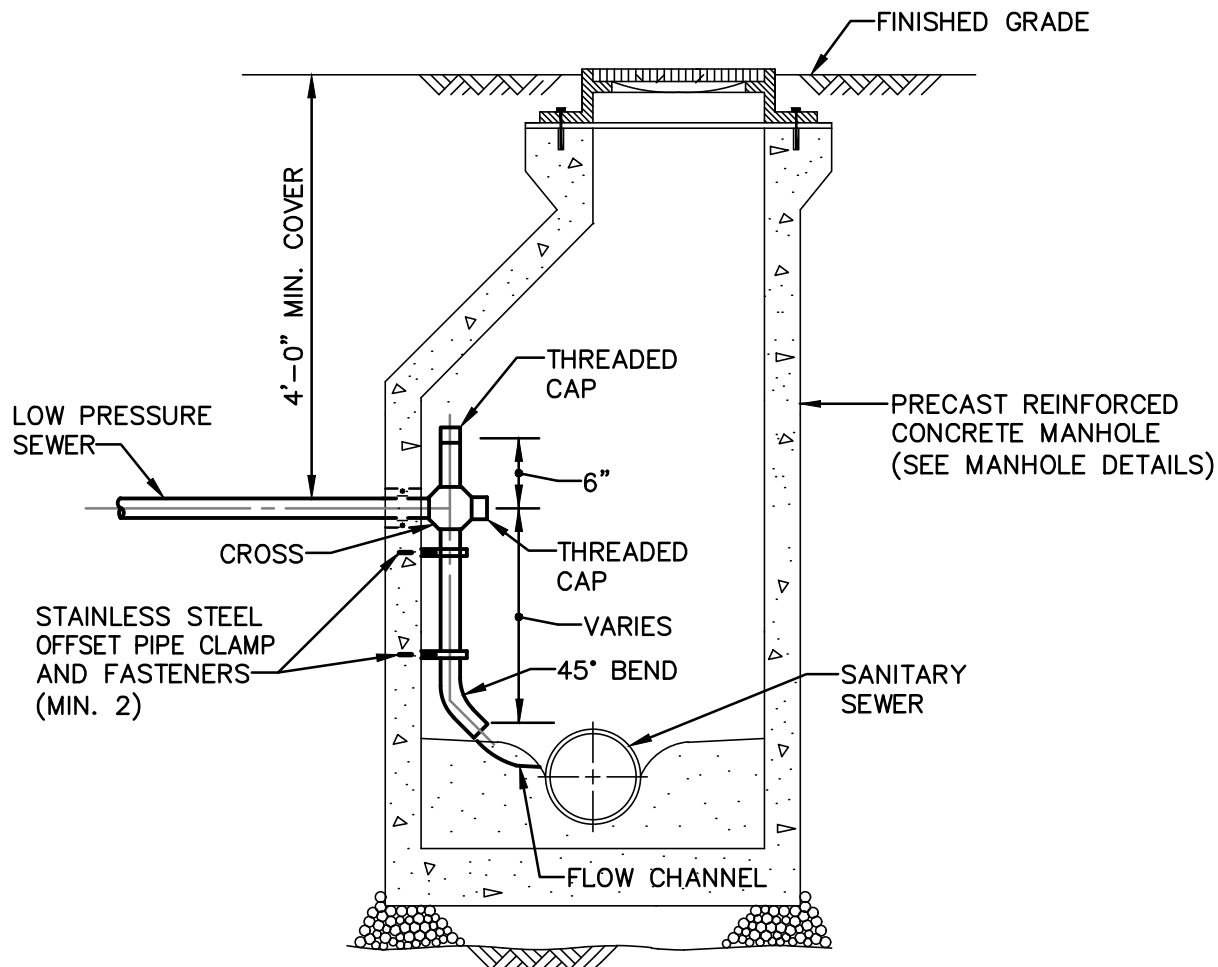


PLAN

FILE NAME: LP-5-LOW-PRES-CONN.dwg

STANDARD DETAILS
**LOW PRESSURE SERVICE LINE
 CONNECTION AT GRAVITY MAIN**
 UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. LP-5



NOTES:

1. MANHOLE WALL PENETRATION TO BE CORE DRILLED AND SEALED WITH APPROPRIATE SIZED TRELLEBORG KOR-N-SEAL PIPE-TO-MANHOLE BOOT CONNECTOR.

FILE NAME: LP-6-LOW-PRES-DISCHG.dwg

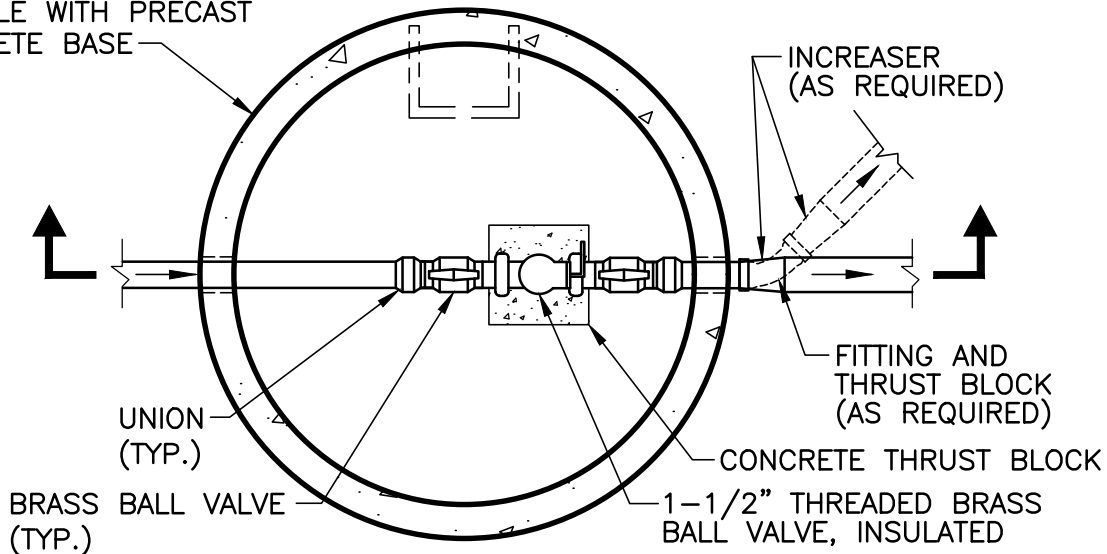
STANDARD DETAILS

LOW PRESSURE SEWER DISCHARGE TO MANHOLE

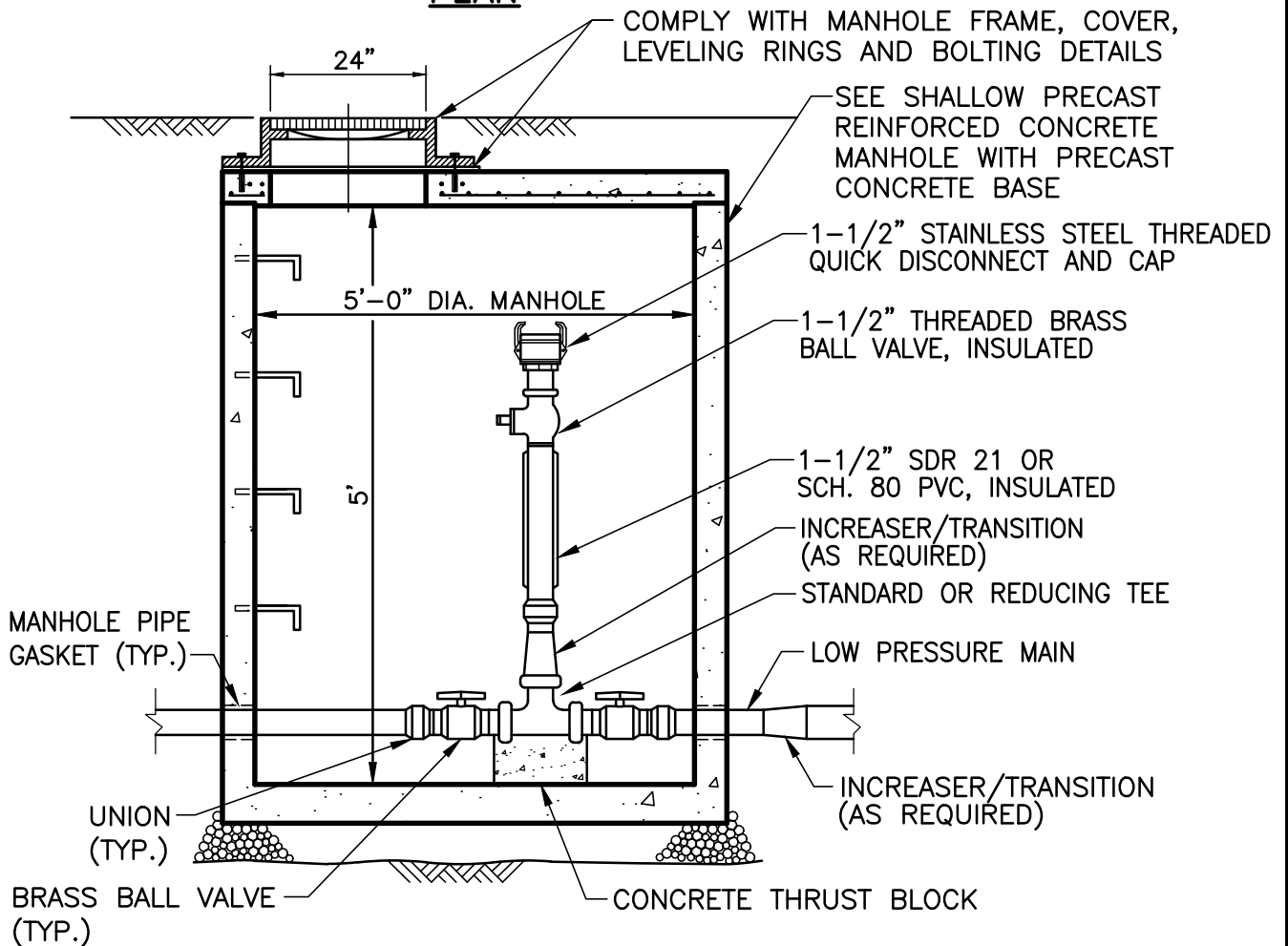
UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
1/17	NOTE REVISION
SCALE NO SCALE	DWG. NO. LP-6

SEE SHALLOW PRECAST
REINFORCED CONCRETE
MANHOLE WITH PRECAST
CONCRETE BASE



PLAN



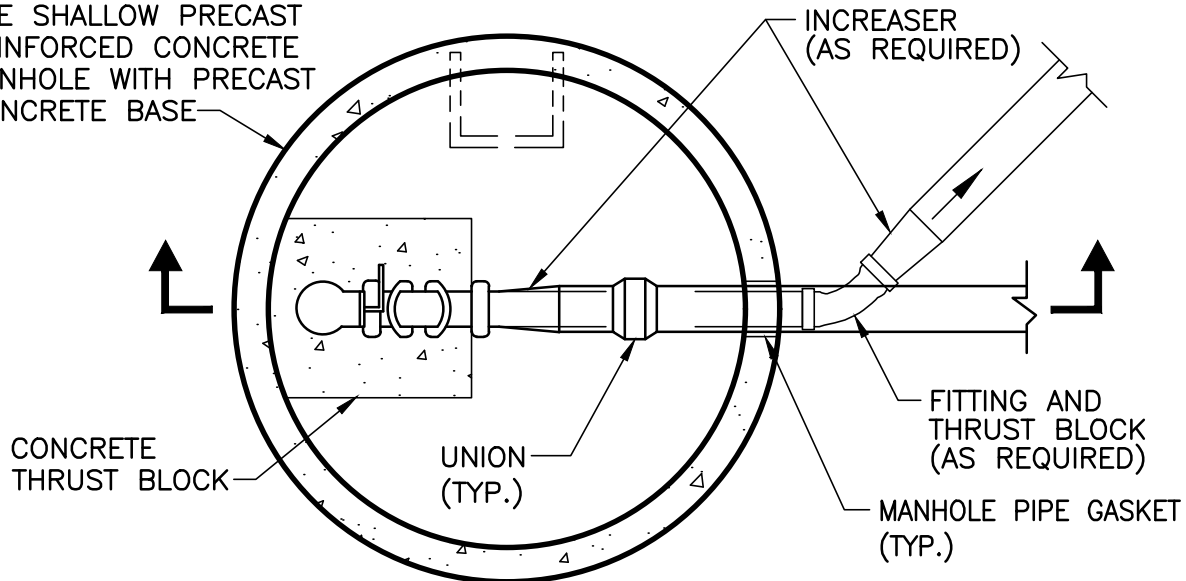
SECTIONAL ELEVATION

FILE NAME: LP-7-IN-LINE-CO-VALVE.DWG

STANDARD DETAILS
**IN-LINE CLEANOUT/VALVE PIT
FOR LOW PRESSURE SEWER MAIN**
UPPER ALLEN TOWNSHIP

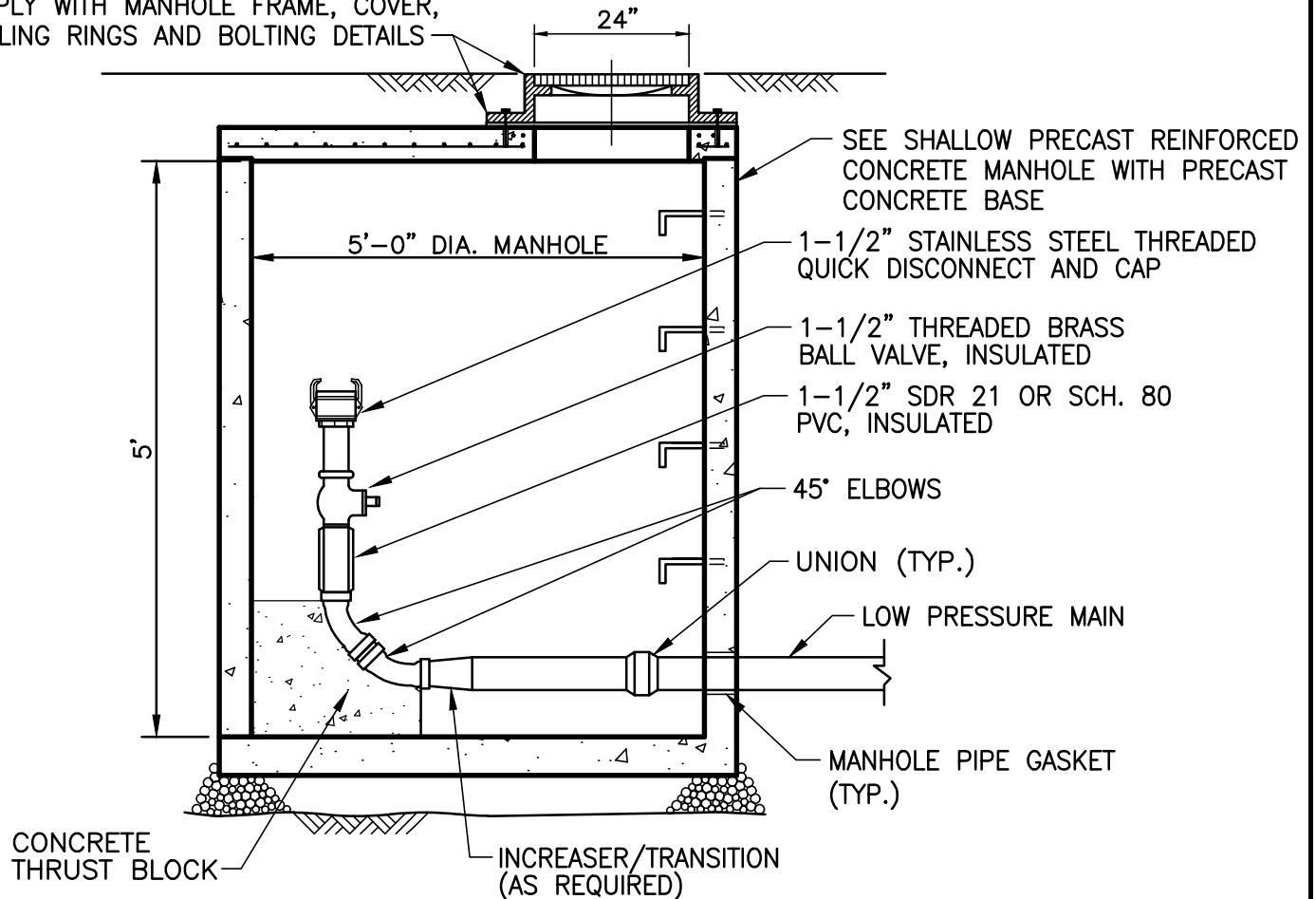
DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
1/17	DWG. REVISIONS
SCALE NO SCALE	DWG. NO. LP-7

SEE SHALLOW PRECAST
REINFORCED CONCRETE
MANHOLE WITH PRECAST
CONCRETE BASE



PLAN

COMPLY WITH MANHOLE FRAME, COVER,
LEVELING RINGS AND BOLTING DETAILS



SECTIONAL ELEVATION

FILE NAME: LP-8-IN-LINE-TERM-CO.dwg

STANDARD DETAILS
**IN-LINE TERMINAL CLEANOUT
FOR LOW PRESSURE MAIN**
UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
1/17	DWG. REVISIONS
SCALE NO SCALE	DWG. NO. LP-8

2" X 2" X 1/4" ALUMINUM
OR S.S. ANGLE SUPPORT
WITH END BRACKETS AND
S.S. EXPANSION
ANCHOR BOLTS (TYP.)

S.S. U-BOLT AND
FASTENERS

MANHOLE PIPE GASKET
(TYP.)

AIR AND VACUUM RELEASE
VALVE (SEE SECTION VIEW)

PLAN

COMPLY WITH MANHOLE FRAME, COVER,
LEVELING RINGS AND BOLTING DETAILS

SEE SHALLOW PRECAST
REINFORCED CONCRETE
MANHOLE WITH PRECAST
CONCRETE BASE

2" PR-200 OR
SCH. 80 PVC TEE

MANHOLE PIPE GASKET
(TYP.)

LOW PRESSURE
SEWER MAIN

COMB. VACUUM/AIR RELEASE
VALVE AND CHAMBER—
CRISPIN 'X' SERIES-316 S.S.

5'-0" DIA. MANHOLE

2" BRASS BALL VALVE (TYP.)

PR-200 OR SCH. 80 PVC
TEE (SIZE AS REQ.'D)

SCH. 80 PVC UNION (TYP.)

CONCRETE THRUST BLOCK

SECTION

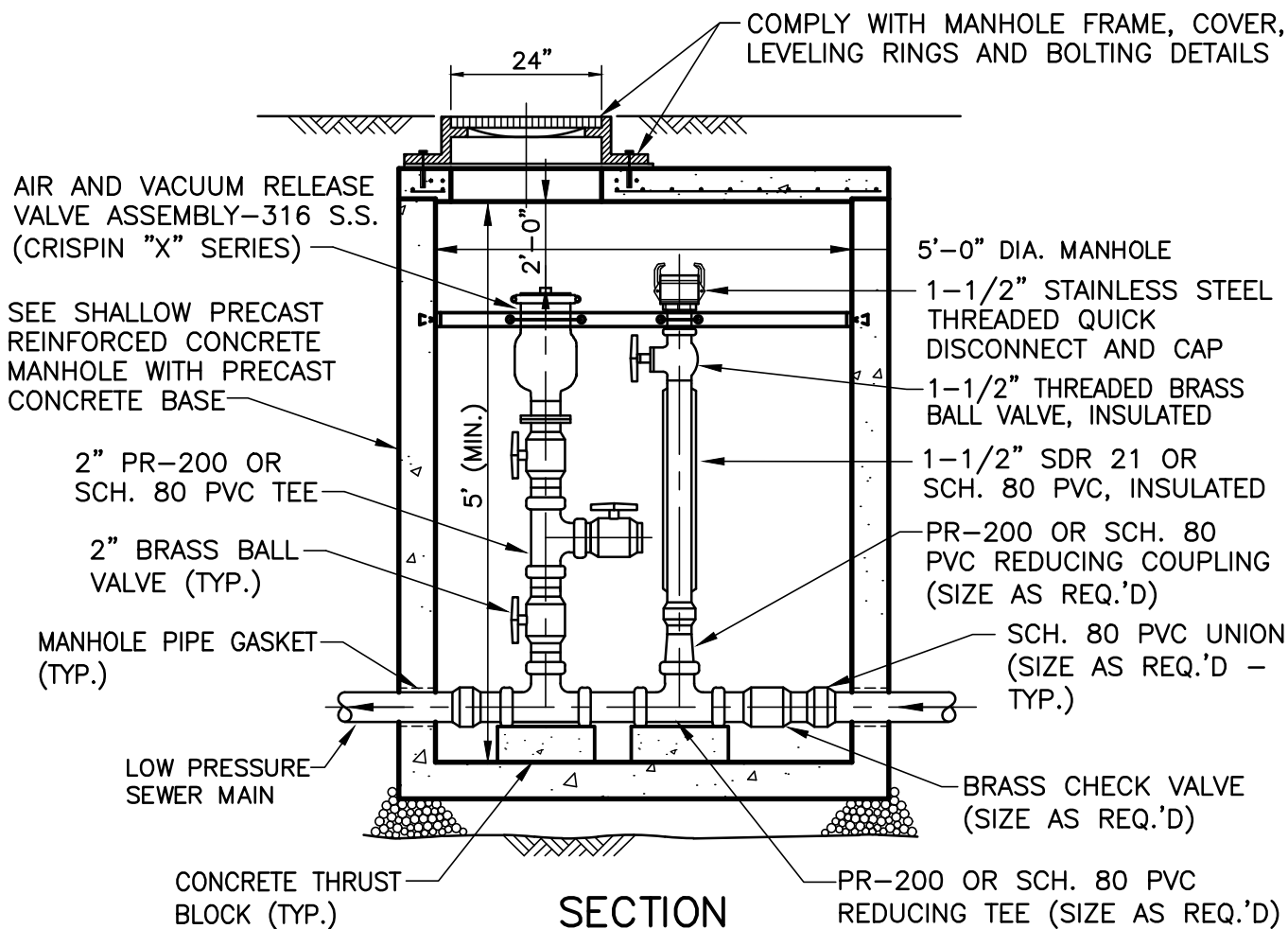
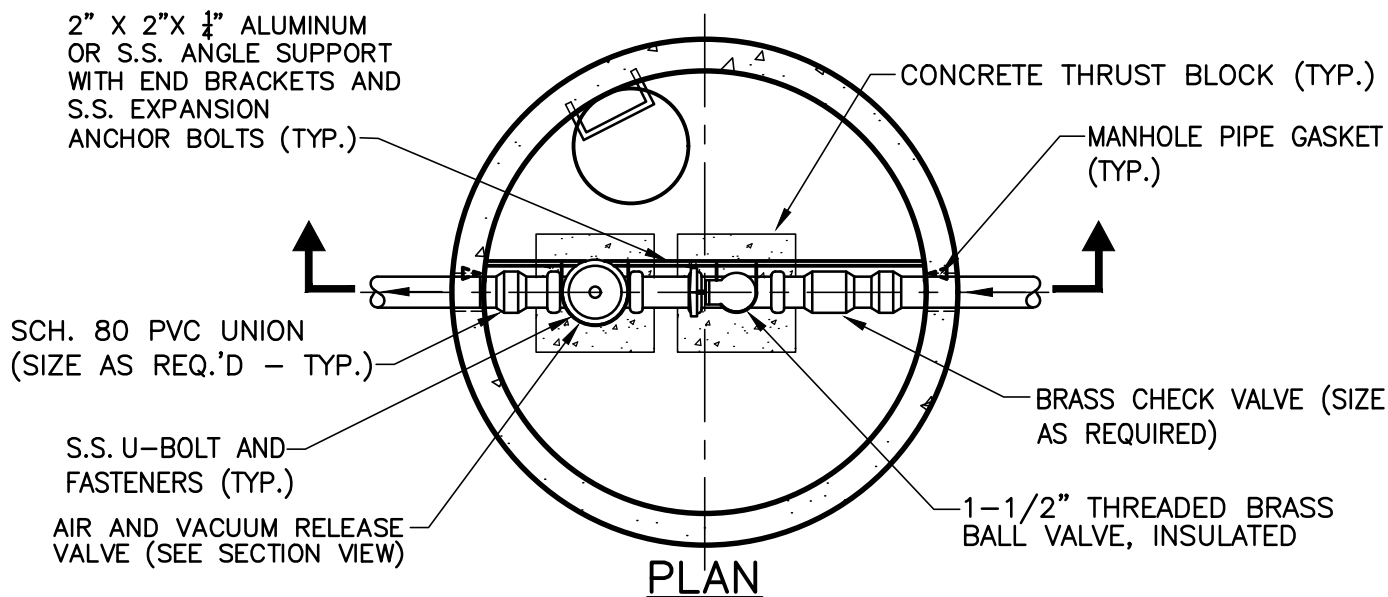
FILE NAME: LP-9B-AIR-VAC. RELEASE & CHAMBER.dwg

STANDARD DETAILS

**COMB. VACUUM/AIR RELEASE VALVE AND
CHAMBER FOR LOW PRESSURE SEWER MAIN**

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
2/17	DWG. CREATED
4/18	LABELING MODIFIED
SCALE NO SCALE	DWG. NO. LP-9B



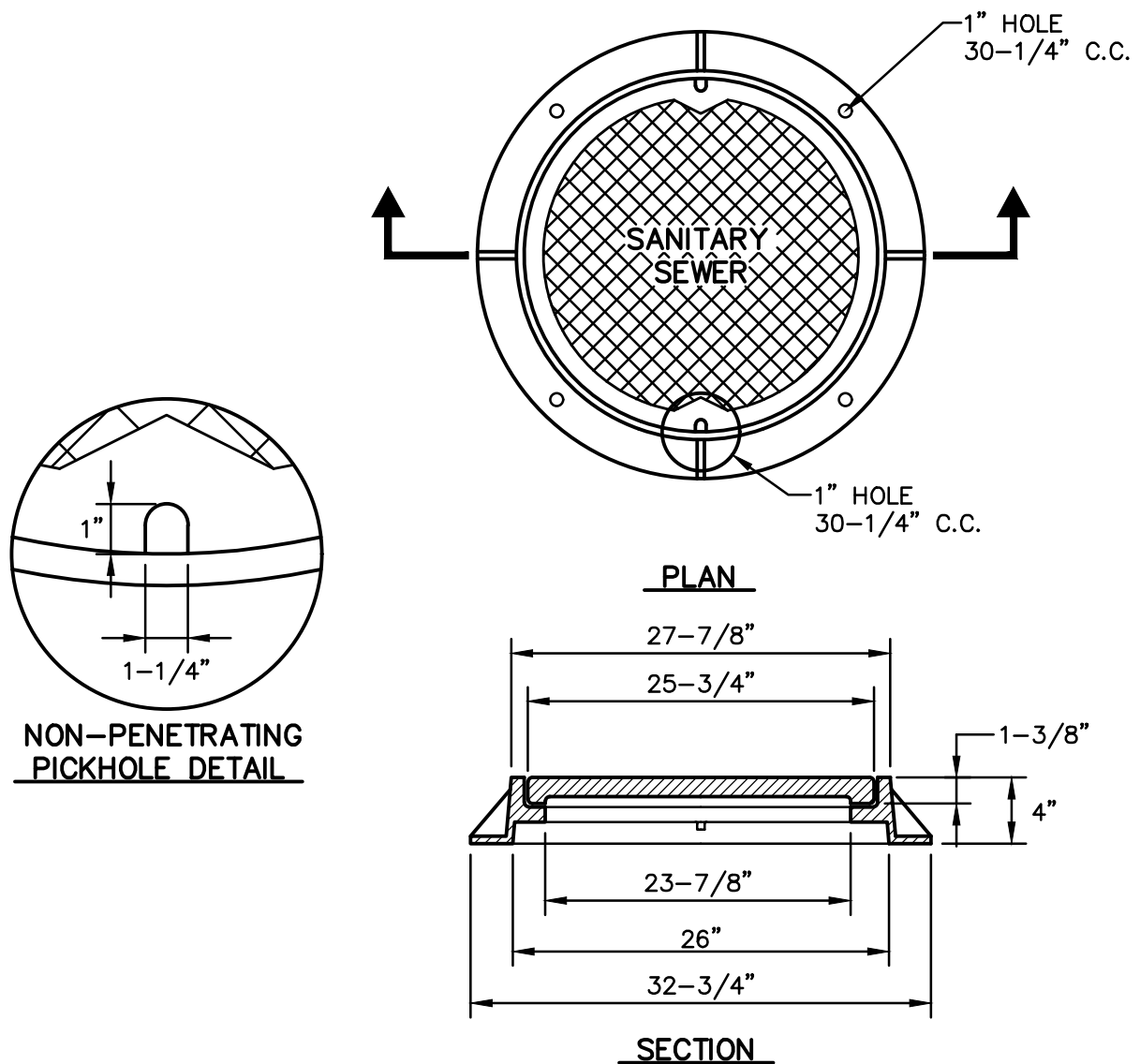
FILE NAME: LP-9C-COMB. AIR-VAC. REL.-CO-CBK. VALVE PIT.dwg

STANDARD DETAILS

COMB. VACUUM/AIR RELEASE, CLEANOUT AND CHECK VALVE FOR LOW PRESSURE SEWER

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
2/17	DWG. CREATED
SCALE NO SCALE	DWG. NO. LP-9C



NOTES:

1. MATERIAL SHALL BE GRAY CAST IRON CONFORMING TO ASTM A48 (LATEST REVISION)
2. UNITS TO BE DESIGNED HEAVY DUTY FOR AASHTO HS20-44 WHEEL LOADS IN VEHICULAR TRAFFIC AREAS.
3. EACH FRAME AND COVER SHALL HAVE MACHINED HORIZONTAL BEARING SURFACES.
4. PROPERLY SIZED/DESIGNED POLYETHYLENE COVERS MAY BE SUBSTITUTED FOR CAST IRON COVERS IN NON-VEHICULAR TRAFFIC AREAS.
5. ALL COVERS MUST BE GASKETED AND WATERTIGHT.

FILE NAME: LP-10-VLV-PIT-COV.dwg

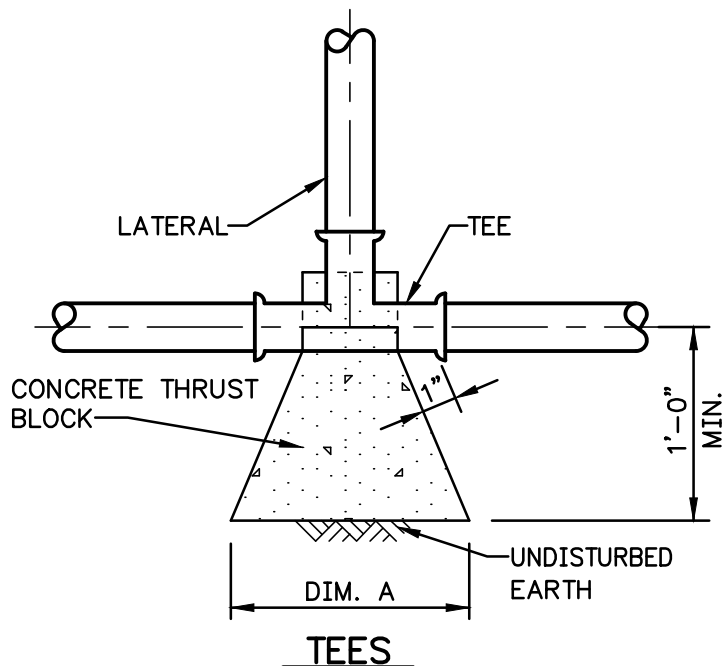
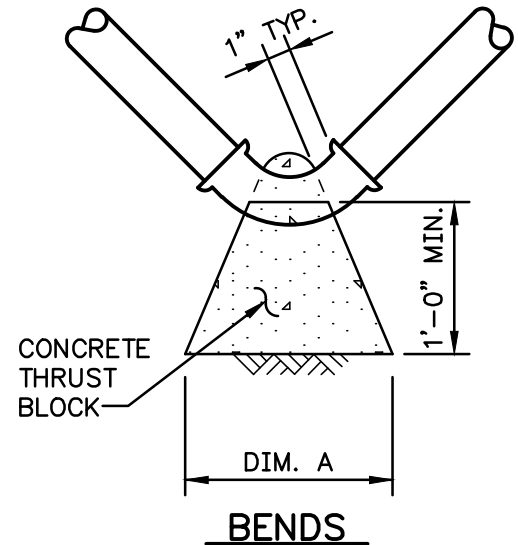
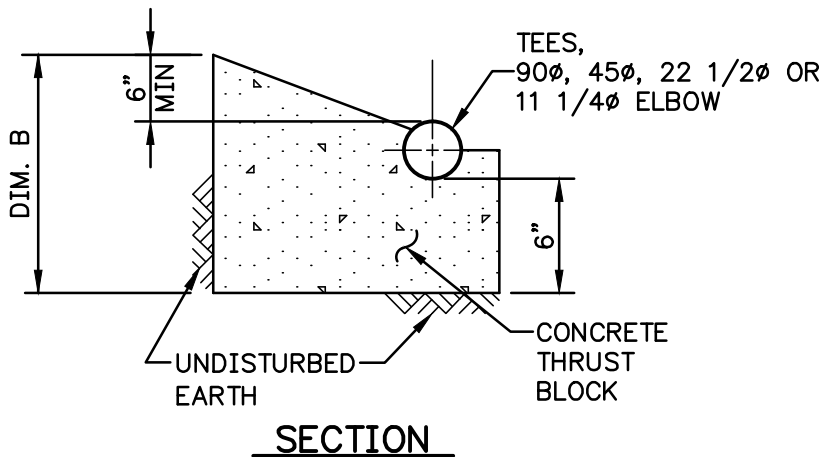
STANDARD DETAILS PRESSURE LATERAL VALVE PIT COVER DETAIL

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
1/17	NOTE REVISIONS
SCALE NO SCALE	DWG. NO. LP-10

ELBOW DIMENSION SCHEDULE

DIM.	3"-90°	3"-45°	3"-22 1/2°	3"-11 1/4°	2 1/2"-90°	2 1/2"-45°	2 1/2"-22 1/2°	2"-90°	2"-45°	1 1/2"-90°	1 1/2"-45°
A	20"	18"	16"	12"	18"	16"	14"	16"	14"	14"	12"
B	15"	15"	15"	14"	15"	15"	15"	14"	14"	14"	14"

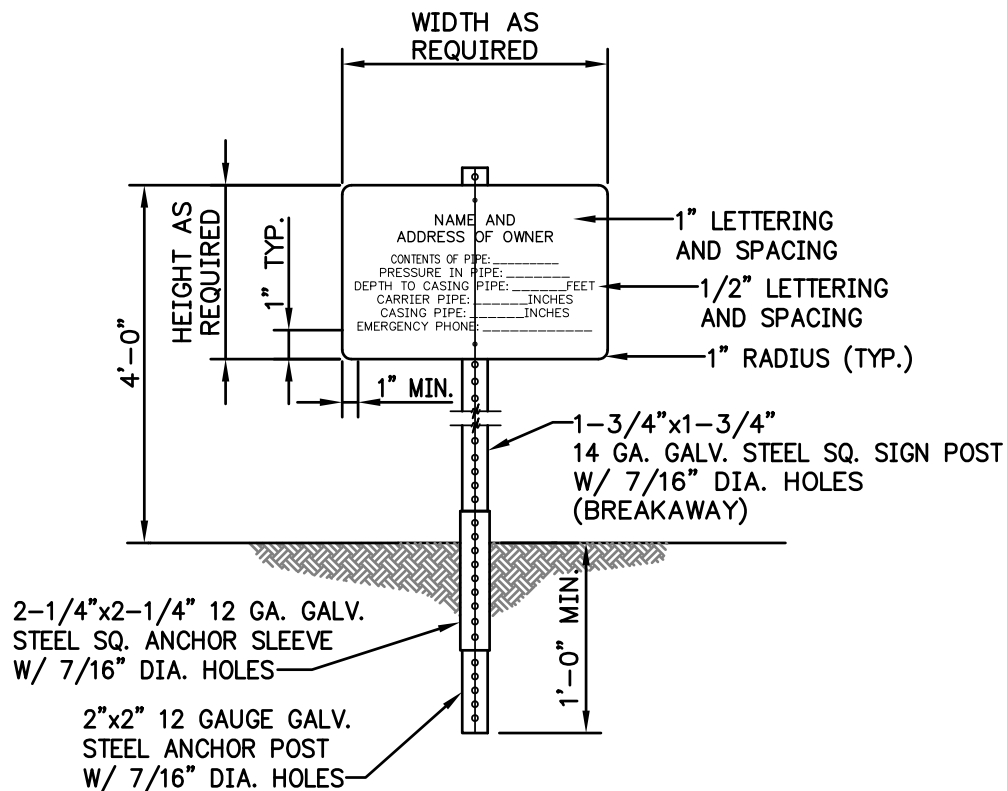


TEE DIMENSION SCHEDULE LATERAL SIZE				
DIM.	1-1/2"	2"	2-1/2"	3"
A	14"	16"	18"	20"
B	14"	14"	15"	15"

STANDARD DETAILS
**CONCRETE THRUST BLOCK DETAILS
 FOR LOW PRESSURE SEWER MAIN**
 UPPER ALLEN TOWNSHIP

FILE NAME: LP-11-THRUST-BLOCKS.dwg

DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. LP-11



ELEVATION

NOTES:

1. ALL SPECIFIC INFORMATION REQUIRED AT EACH APPLICABLE LOCATION WILL BE FURNISHED BY THE ENGINEER.
2. SEE PROJECT MANUAL FOR FABRICATION AND INSTALLATION REQUIREMENTS.
3. SIGNS WITHIN TOWNSHIP STREET OR STATE HIGHWAY RIGHTS-OF-WAY SHALL CONFORM TO THE AGENCY HAVING JURISDICTION.

FILE NAME: LP-12-CROSSING-SIGN.dwg

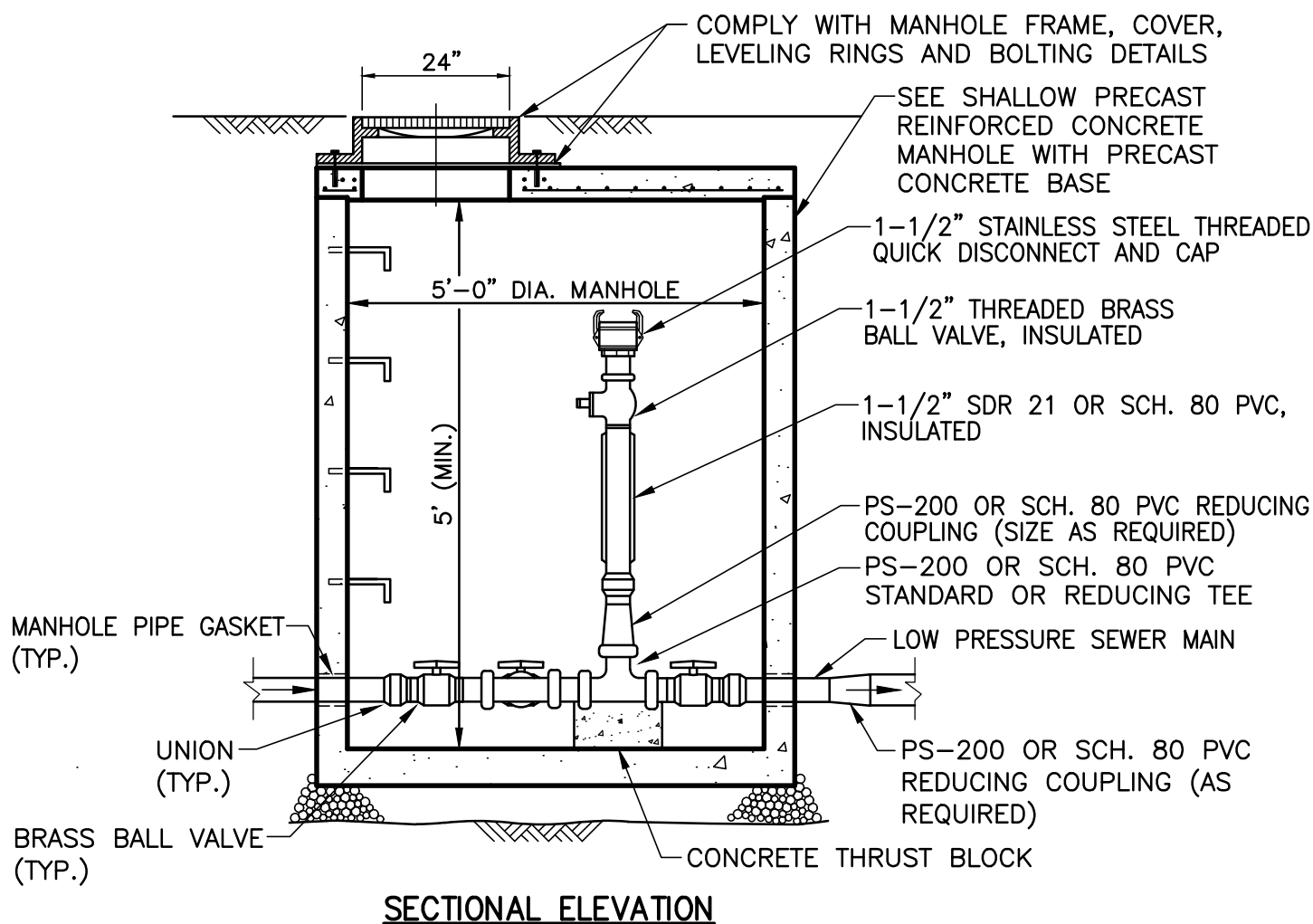
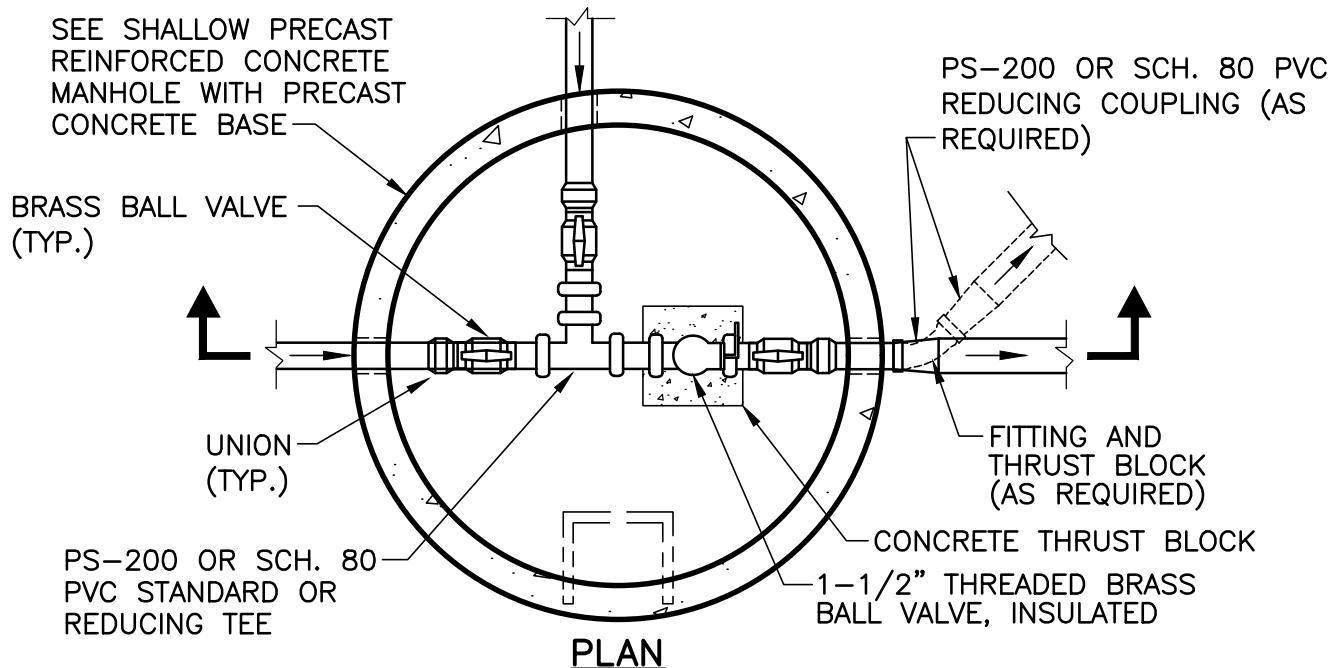
STANDARD DETAILS

CROSSING SIGN FOR

LOW PRESSURE SEWER MAIN

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. LP-12



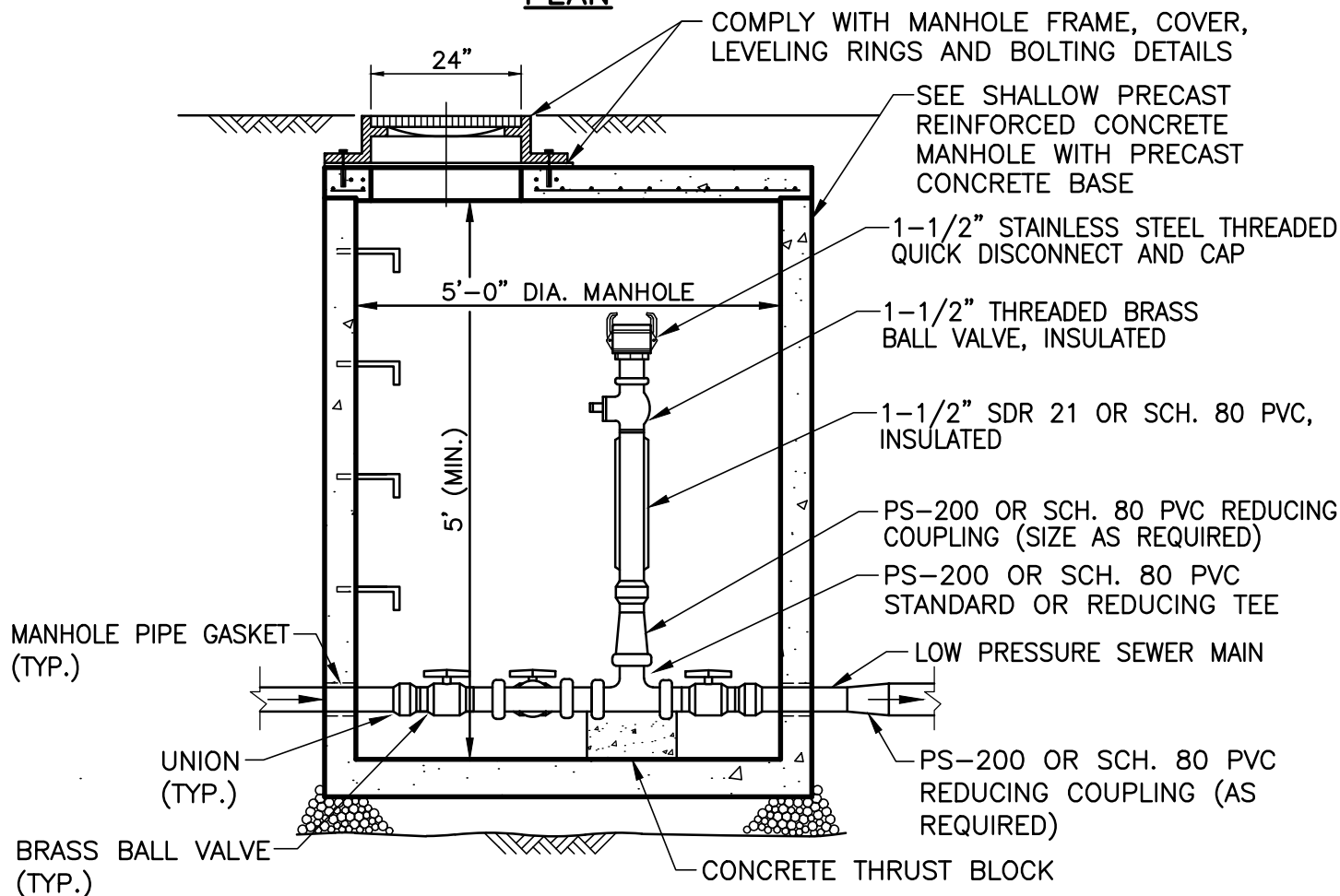
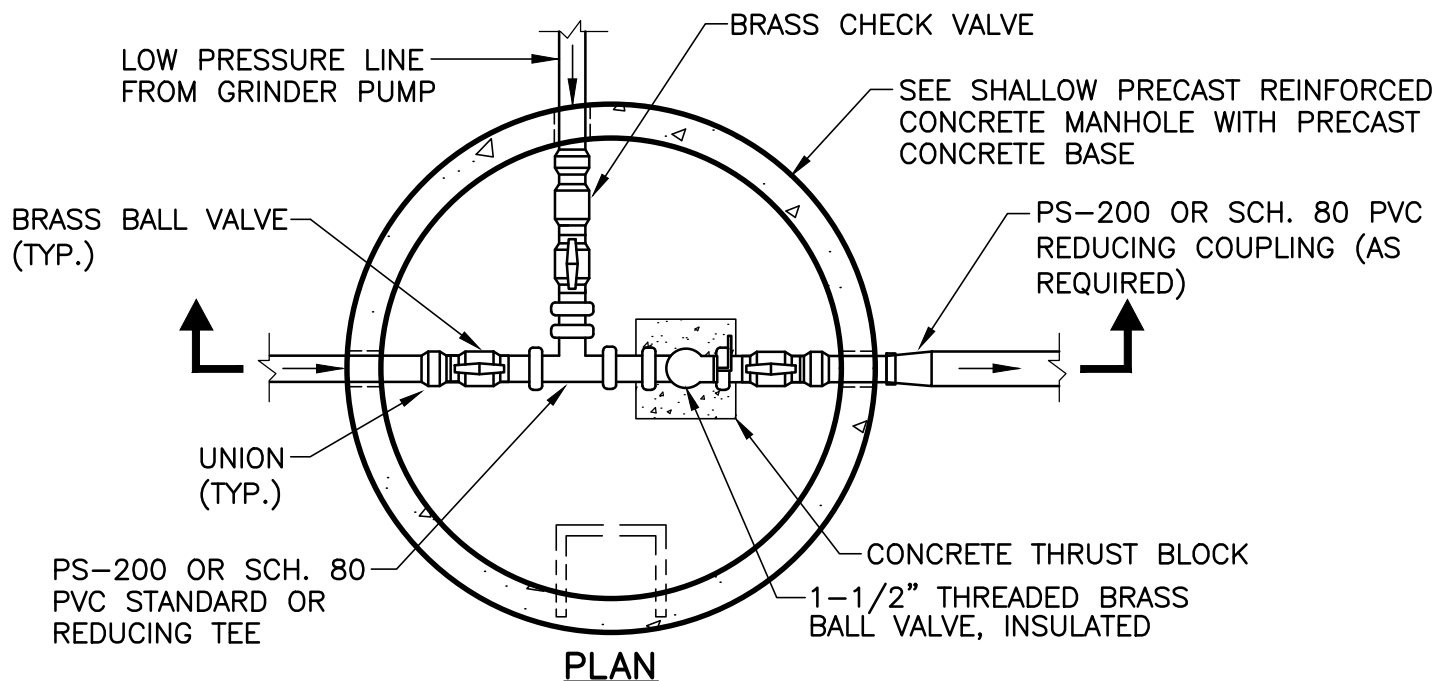
FILE NAME: LP-13-3-WAY IN-LINE-CO-VALVE.DWG

STANDARD DETAILS

3-WAY IN-LINE CLEANOUT/VALVE PIT FOR LOW PRESSURE SEWER MAIN

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
2/17	DWG. CREATED
SCALE NO SCALE	DWG. NO. LP-13



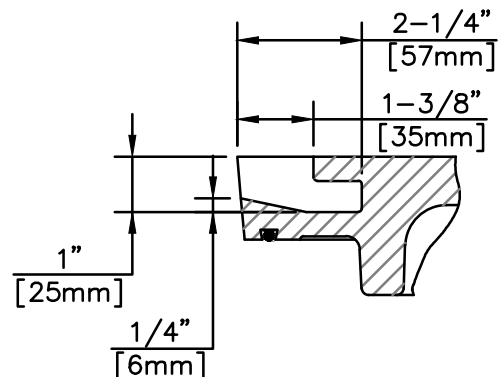
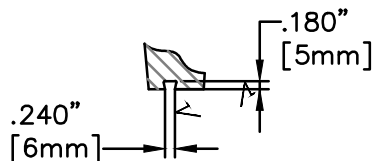
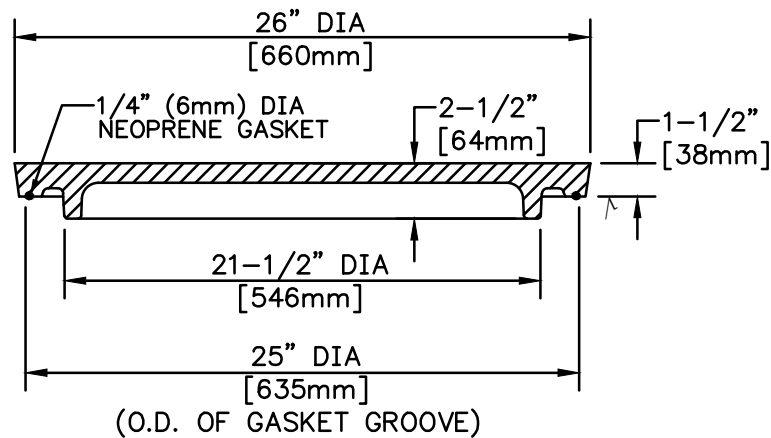
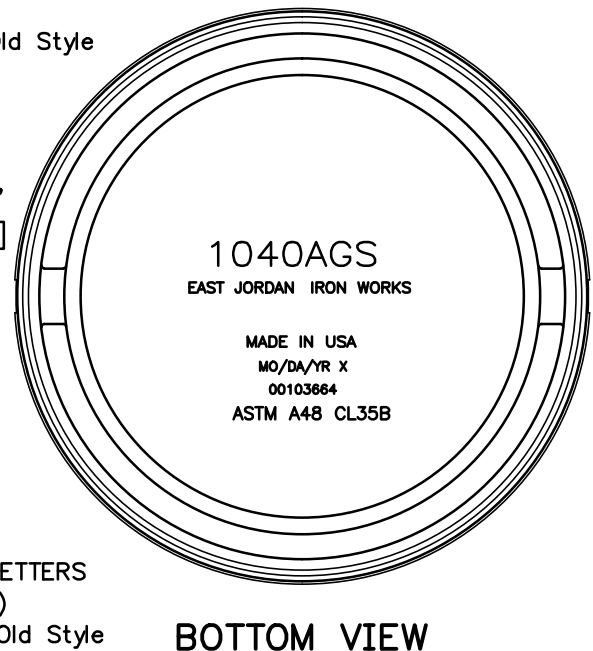
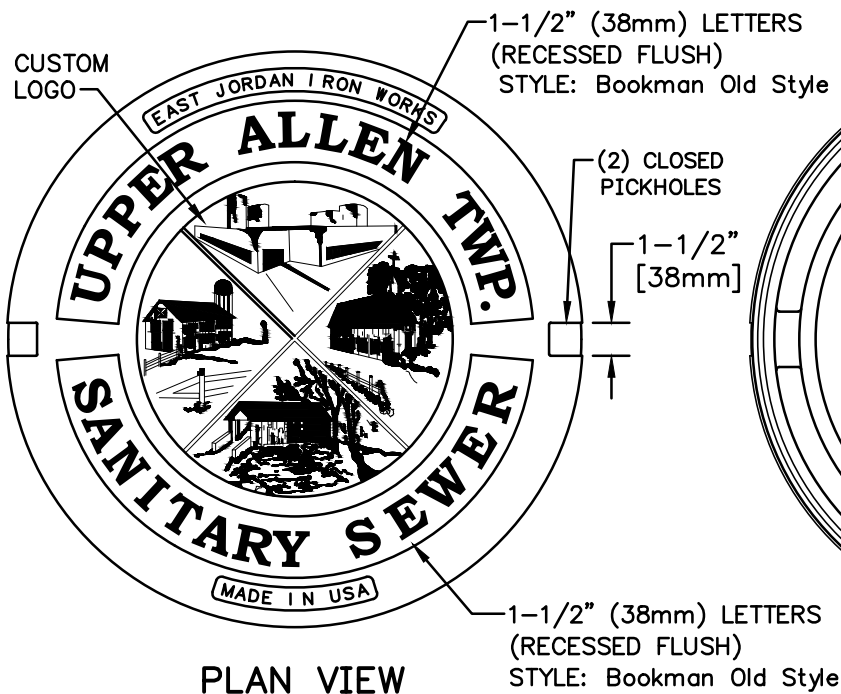
FILE NAME: LP-13A-2-WAY IN-LINE CO-VALVE-CHK. VALVE.DWG

STANDARD DETAILS

2-WAY IN-LINE CLEANOUT/VALVE PIT AND GRINDER PUMP SERVICE LINE CONNECTION

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
2/17	DWG. CREATED
4/18	LABELING MODIFIED
SCALE NO SCALE	DWG. NO. LP-13A



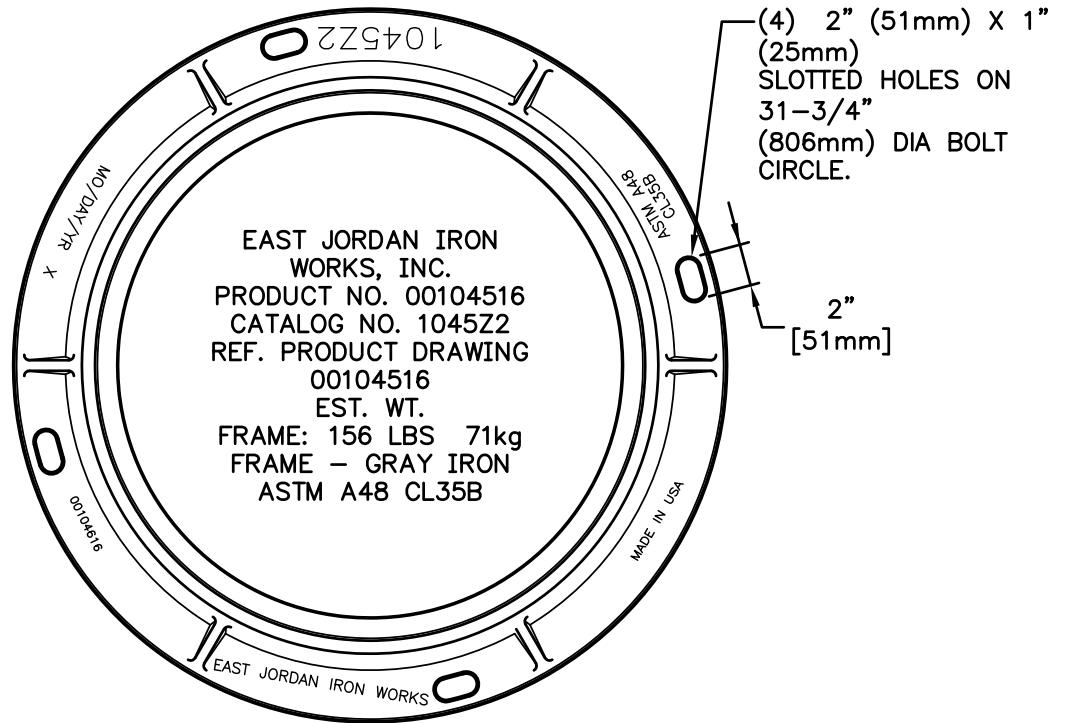
NOTES:

1. SPECIAL LETTERED COVER PRODUCT NO. 00103664
2. REF. LOGO DWG. 00103665
3. EST. COVER WT. 150 LBS. (68 kg)
4. SPECIFIED MATERIAL: GRAY IRON
5. FURNISH FOUR (4) 1" DIA. HOLES IN COVER EVENLY SPACED ON 15" DIA. BOLT CIRCLE WHEN SPECIFIED
6. √ DESIGNATES MACHINED SURFACE

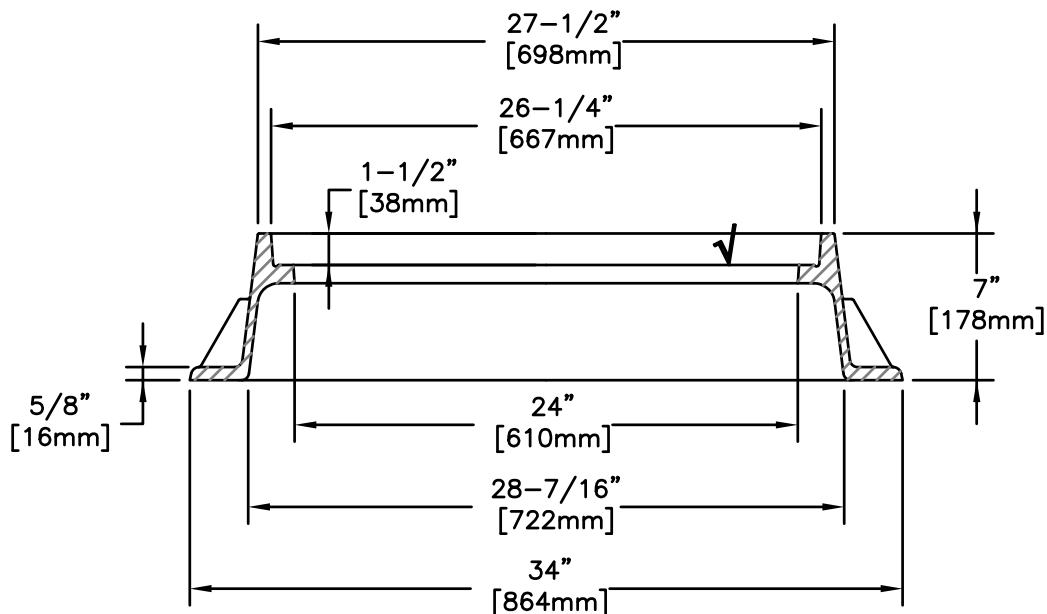
STANDARD DETAILS
**HEAVY DUTY MANHOLE
SELF-SEALING COVER**
UPPER ALLEN TOWNSHIP

FILE NAME: MH-1-HD-COVER.DWG

DATE	REVISIONS
3/08	DWG. CREATED
12/14	DWG. UPDATED
SCALE NO SCALE	DWG. NO. MH-1



PLAN



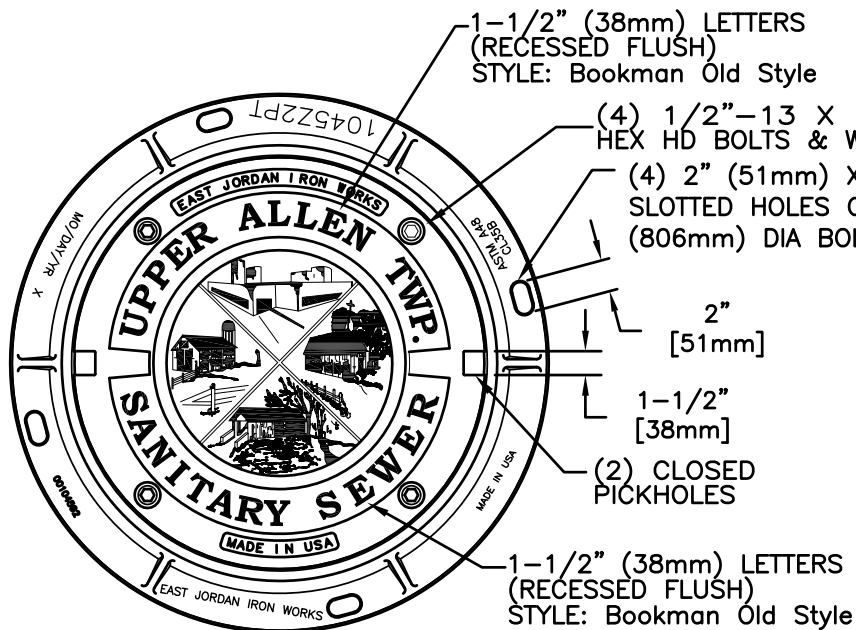
SECTION

✓ MACHINED SURFACE

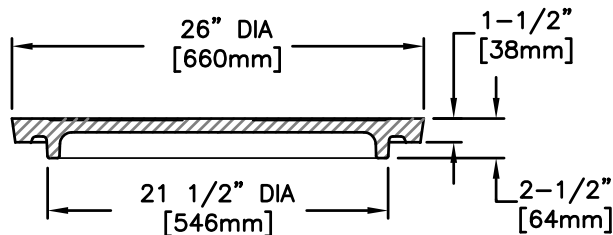
FILE NAME: MH-2-HD-H-25-FRAME.dwg

STANDARD DETAILS
 HEAVY DUTY
 MANHOLE FRAME (H-25)
 UPPER ALLEN TOWNSHIP

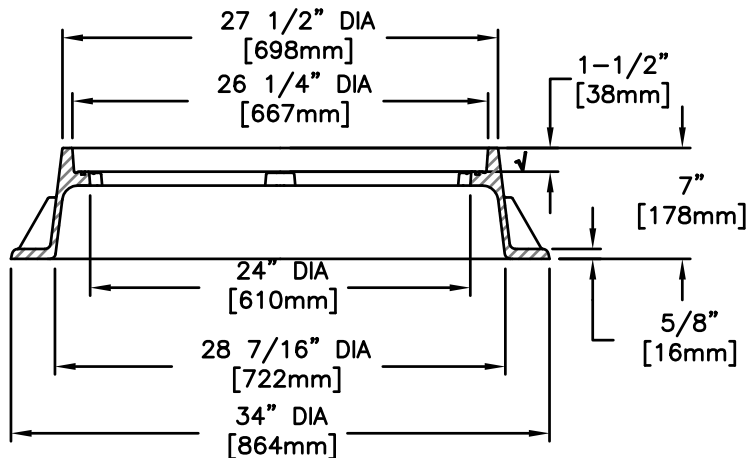
DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. MH-2



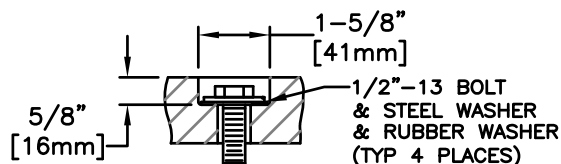
PLAN



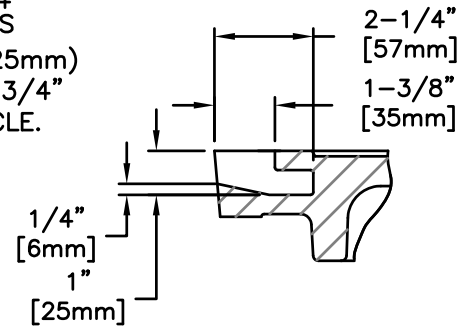
COVER SECTION



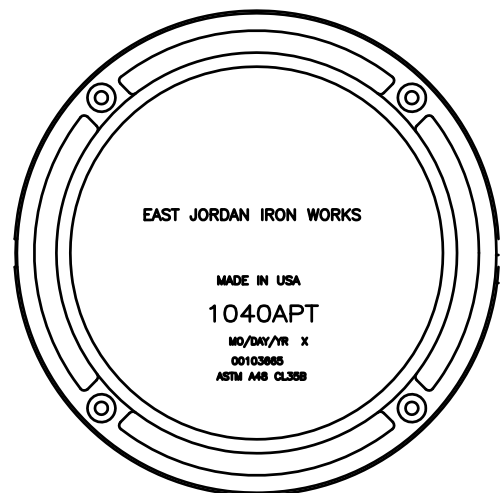
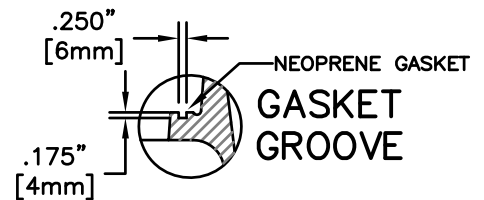
FRAME SECTION



BOLT DETAIL



PICKHOLE DETAIL



BOTTOM VIEW
OF COVER

NOTES (FRAME & COVER):

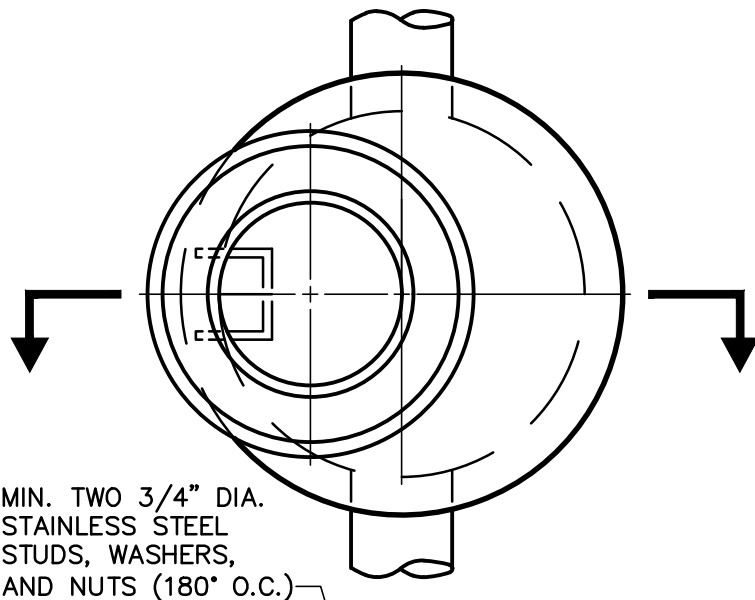
WATERTITE ASSEMBLY
PRODUCT NO.
 00104638
CATALOG NO.
 1040APT, 104522PT
REF SALES DRAWING:
 00104592, 00103665

EST WT.
 COVER-150 LBS (68kg)
 FRAME-156 LBS (61kg)
 UNIT-306 LBS (139kg)
MAT'L SPEC.
 COVER - GRAY IRON
 ASTM A48 CL35B
 FRAME - GRAY IRON
 ASTM A48 CL35B

FILE NAME: MH-3-HD-FRAMECOVER-BOLTED.DWG

STANDARD DETAILS
**HEAVY DUTY MANHOLE WATERTIGHT
 FRAME AND COVER**
 UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. MH-3

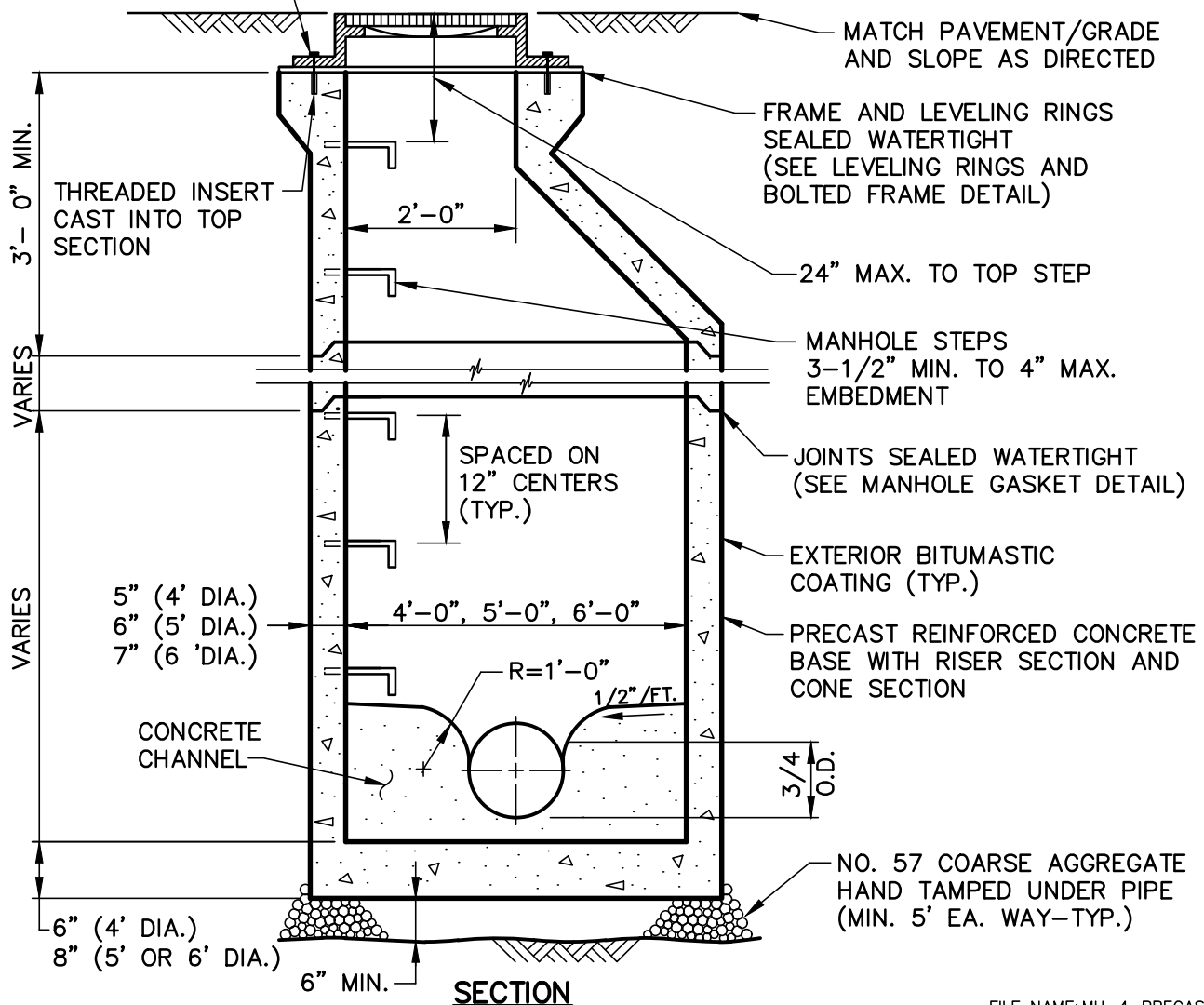


MIN. TWO 3/4" DIA.
STAINLESS STEEL
STUDS, WASHERS,
AND NUTS (180° O.C.)

PLAN

NOTES:

1. BOLTING OF MANHOLE FRAME AND COVER REQUIRED FOR ALL MANHOLES.
2. 3/4" DIA. STAINLESS STEEL EXPANSION ANCHOR BOLTS MAY BE USED IN PLACE OF THREADED STUDS AND INSERTS.
3. MANHOLE THREADED INSERT SPACING TO MATCH HOLE CENTER SPACING ON SPECIFIED FRAME AND COVER FOR EACH MANHOLE.
4. MANHOLE FRAMES SHALL BE SET WITH DOUBLE APPLICATION OF PREFORMED PLASTIC GASKET SEALANT MATERIAL.
5. PIPES SHALL PROTRUDE MIN. 2" INSIDE MANHOLE WALL.
6. ANNULAR SPACE AROUND PIPES TO BE FILLED WITH NON-SHRINK CEMENT GROUT FLUSH WITH MANHOLE WALL.
7. FOR LENGTH OF PIPE CONNECTIONS TO MANHOLES, REFERENCE SPECIFICATION SECTION 02601.
8. REFERENCE SPECIFICATION SECTION 02601 FOR ANTI-FLOATATION REQUIREMENTS.
9. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION.



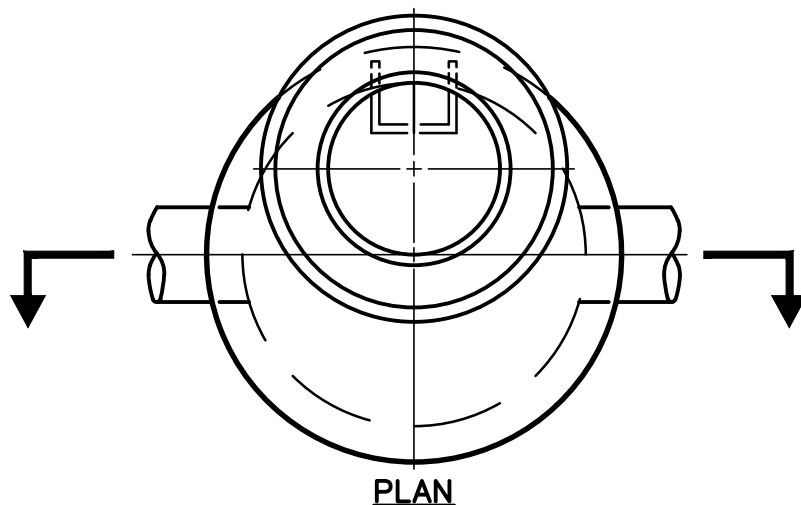
FILE NAME: MH-4-PRECASTCONC-1.dwg

STANDARD DETAILS

STANDARD PRECAST CONCRETE MANHOLE WITH PRECAST CONCRETE BASE

UPPER ALLEN TOWNSHIP

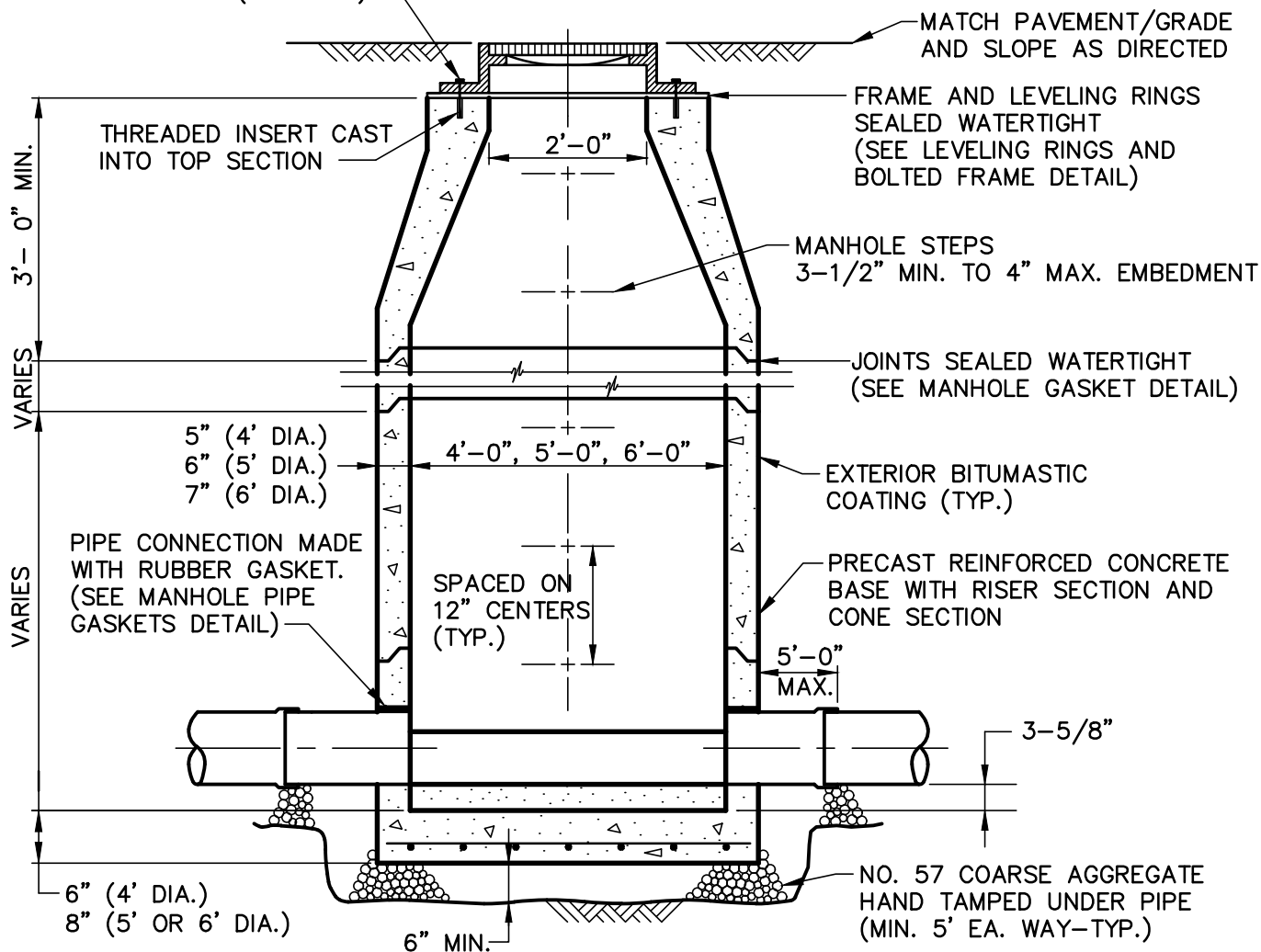
DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
12/16	NOTE REVISIONS
SCALE NO SCALE	DWG. NO. MH-4



MIN. TWO 3/4" DIA.
STAINLESS STEEL
STUDS, WASHERS,
AND NUTS (180° O.C.)

NOTES:

1. BOLTING OF MANHOLE FRAME AND COVER REQUIRED FOR ALL MANHOLES.
2. 3/4" DIA. STAINLESS STEEL EXPANSION ANCHOR BOLTS MAY BE USED IN PLACE OF THREADED STUDS AND INSERTS.
3. MANHOLE THREADED INSERT SPACING TO MATCH HOLE CENTER SPACING ON SPECIFIED FRAME AND COVER FOR EACH MANHOLE.
4. MANHOLE FRAMES SHALL BE SET WITH DOUBLE APPLICATION OF PREFORMED PLASTIC GASKET SEALANT MATERIAL.
5. PIPES SHALL PROTRUDE MIN. 2" INSIDE MANHOLE WALL.
6. ANNULAR SPACE AROUND PIPES TO BE FILLED WITH NON-SHRINK CEMENT GROUT FLUSH WITH MANHOLE WALL.
7. FOR LENGTH OF PIPE CONNECTIONS TO MANHOLES, REFERENCE SPECIFICATION SECTION 02601.
8. REFERENCE SPECIFICATION SECTION 02601 FOR ANTI-FLOATATION REQUIREMENTS.
9. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION.

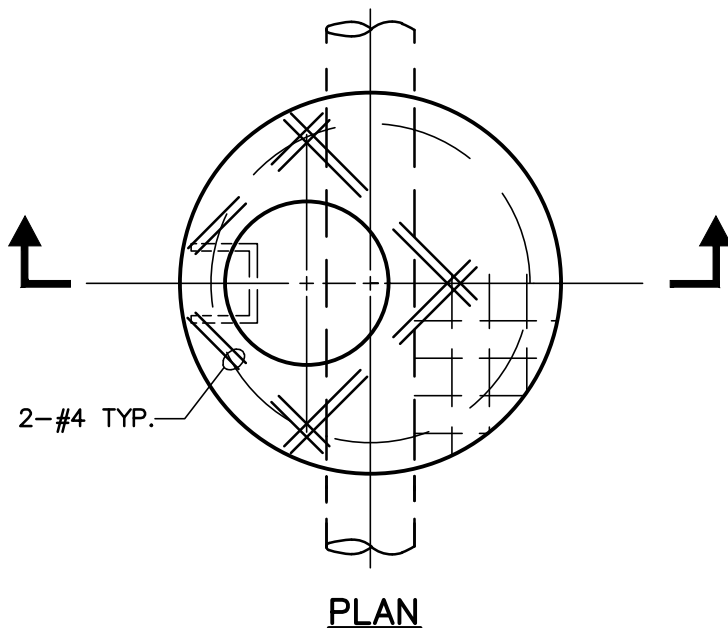


SECTION

FILE NAME: MH-5-PRECASTCONC-2.DWG

STANDARD DETAILS
**STANDARD PRECAST CONCRETE MANHOLE
WITH PRECAST CONCRETE BASE**
UPPER ALLEN TOWNSHIP

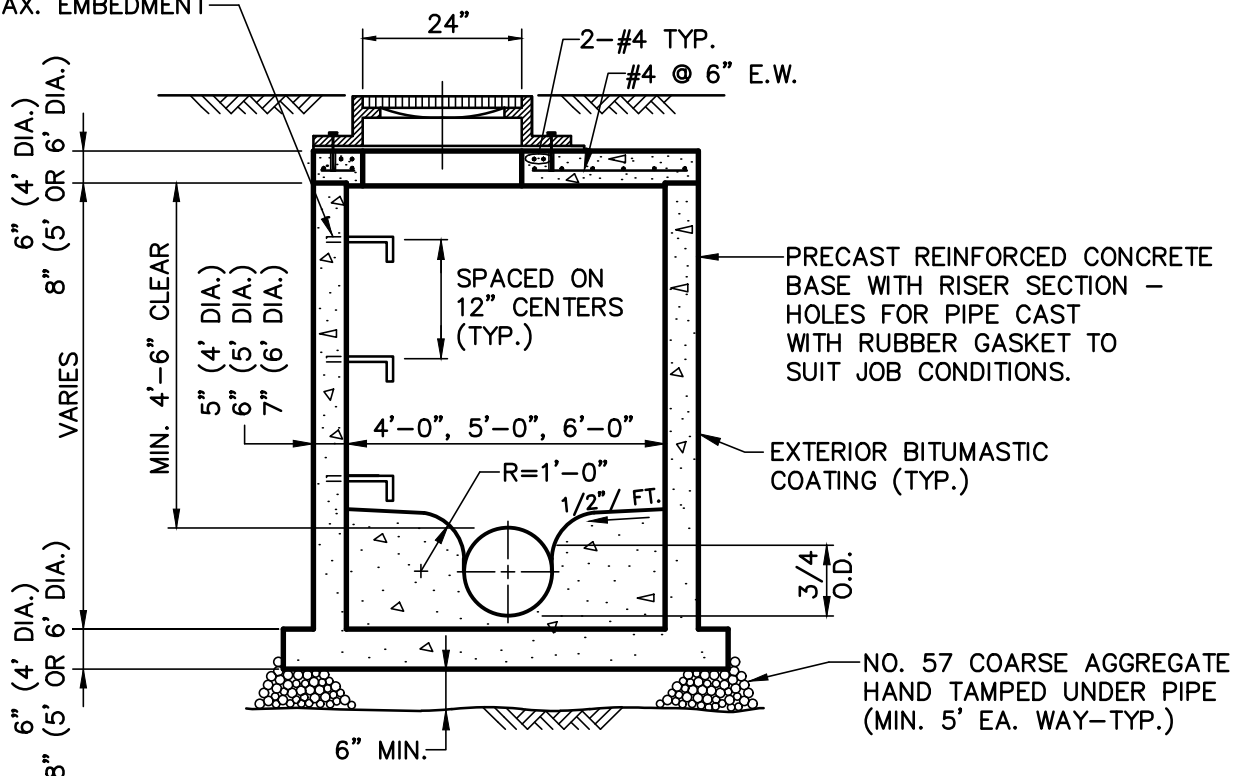
DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
12/16	NOTE REVISIONS
SCALE NO SCALE	DWG. NO. MH-5



NOTES:

1. USE FLAT SLAB TOPS ON MANHOLES FOR CONNECTION SEWER LINES HAVING LESS THAN 5'-0" DEPTH OF COVER OVER SHALLOWEST PIPE OR WHERE INDICATED.
2. BOLTING OF MANHOLE FRAME AND COVER REQUIRED FOR ALL MANHOLES.
3. 3/4" DIA. STAINLESS STEEL EXPANSION ANCHOR BOLTS MAY BE USED IN PLACE OF THREADED STUDS AND INSERTS.
4. MANHOLE THREADED INSERT SPACING TO MATCH HOLE CENTER SPACING ON SPECIFIED FRAME AND COVER FOR EACH MANHOLE.
5. MANHOLE FRAMES SHALL BE SET WITH DOUBLE APPLICATION OF PREFORMED PLASTIC GASKET SEALANT MATERIAL.
6. PIPES SHALL PROTRUDE MIN. 2" INSIDE MANHOLE WALL.
7. ANNULAR SPACE AROUND PIPES TO BE FILLED WITH NON-SHRINK CEMENT GROUT FLUSH WITH MANHOLE WALL.
8. FOR LENGTH OF PIPE CONNECTIONS TO MANHOLES, REFERENCE SPECIFICATION SECTION 02601.
9. REFERENCE SPECIFICATION SECTION 02601 FOR ANTI-FLOATATION REQUIREMENTS.
10. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION.

MANHOLE STEPS
3-1/2" MIN. TO
4" MAX. EMBEDMENT



SECTION

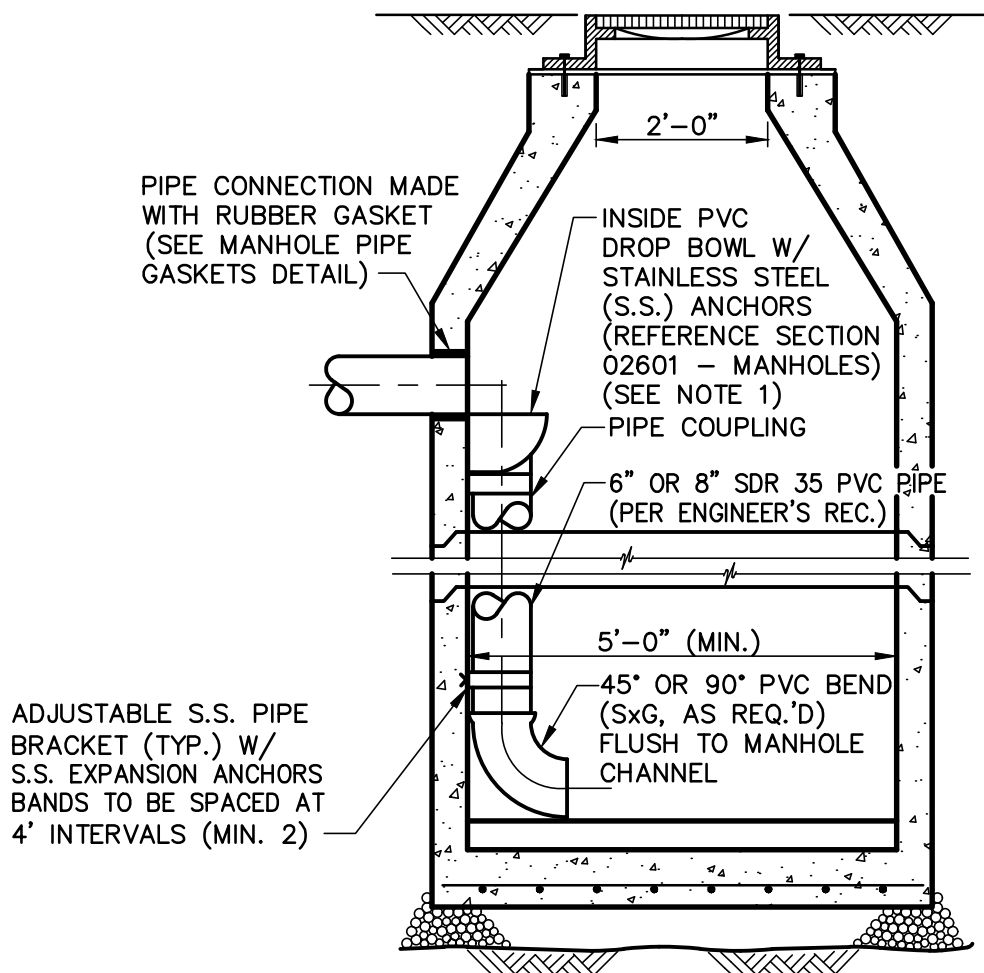
FILE NAME: MH-6-PRECASTCONC-SHALLOW.DWG

STANDARD DETAILS

SHALLOW PRECAST CONCRETE MANHOLE WITH PRECAST CONCRETE BASE

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
12/16	NOTE REVISION
5/18	ANTI-FLOATATION COLLAR ADD.
SCALE NO SCALE	DWG. NO. MH-6



SECTION

NOTES:

1. PVC DROP BOWL SHALL BE AS MANUFACTURED BY RELINER/DURAN, INC. OR APPROVED EQUAL.
2. REFERENCE PRECAST CONCRETE MANHOLE AND MANHOLE COVER AND CASTING DETAILS.

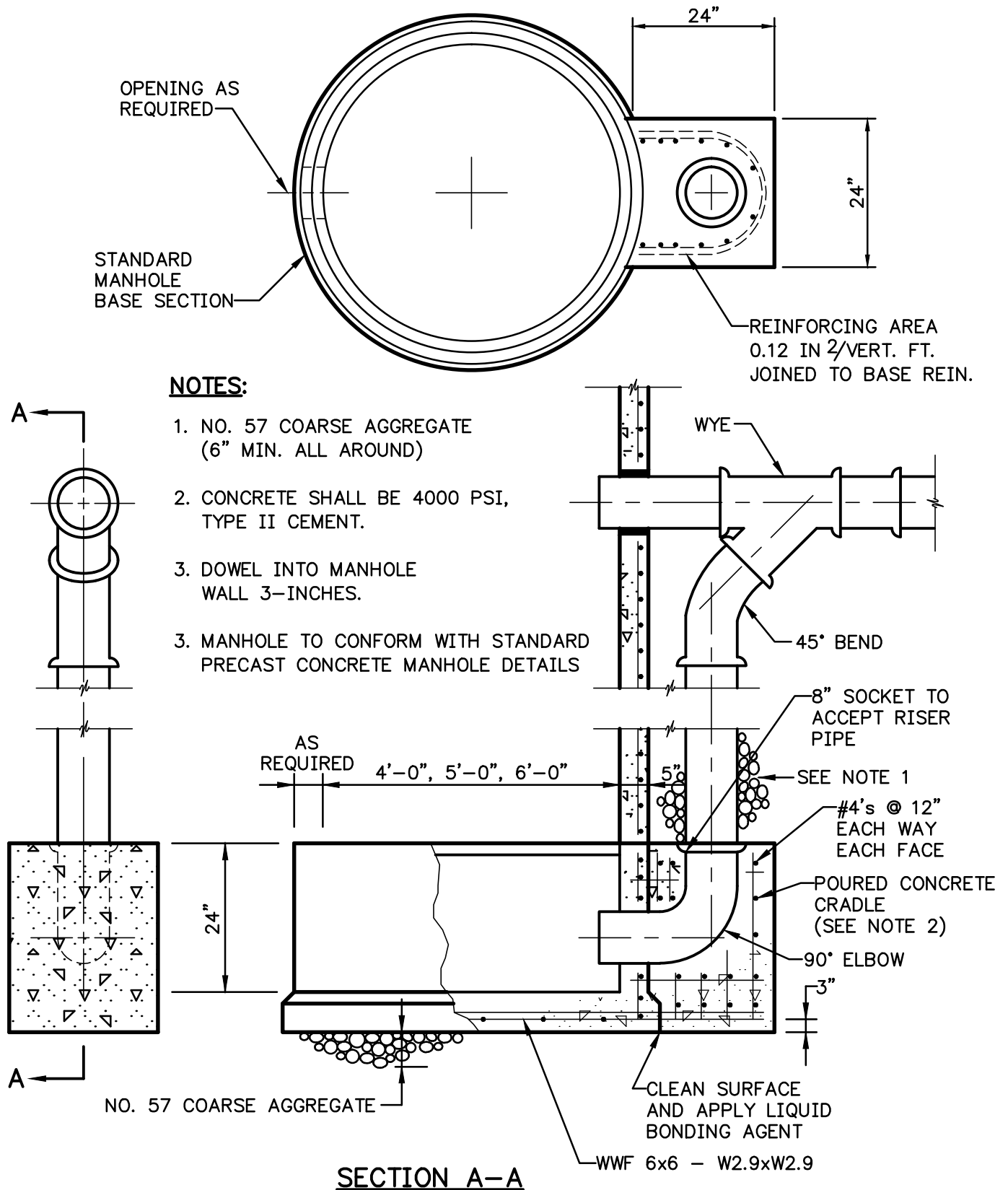
FILE NAME: MH-7-PRECASTCONC-INSIDEDROP.DWG

STANDARD DETAILS

INSIDE MANHOLE DROP CONNECTION

UPPER ALLEN TOWNSHIP

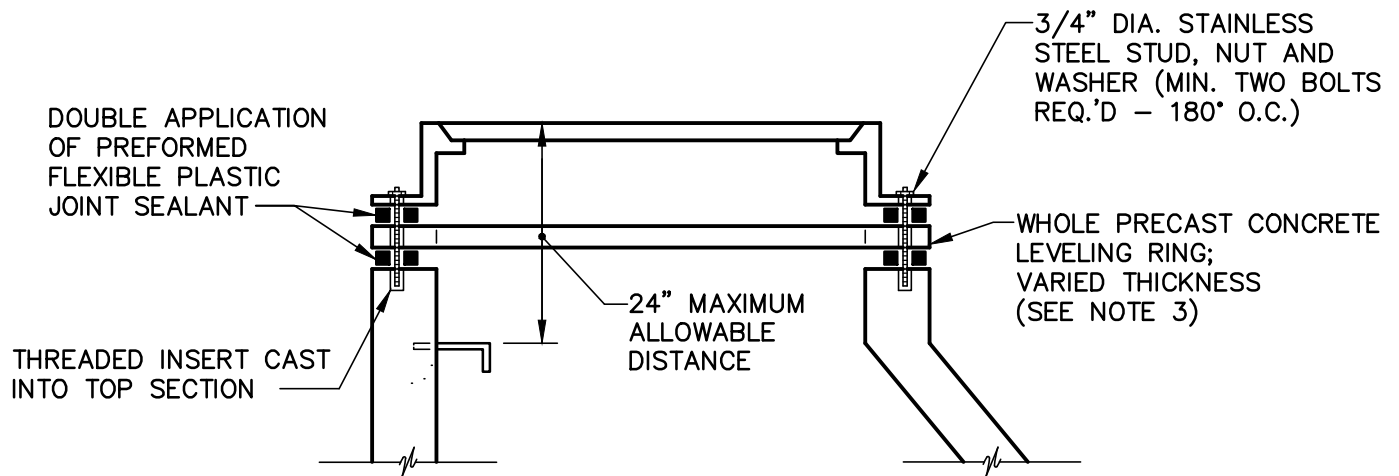
DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
12/16	NOTE/DWG. REVISION
SCALE NO SCALE	DWG. NO. MH-7



FILE NAME: MH-8-PRECASTCON-OUTSIDEDROP.DWG

STANDARD DETAILS
**OUTSIDE MANHOLE
 DROP CONNECTION**
 UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
SCALE NO SCALE	DWG. NO. MH-8



SECTION

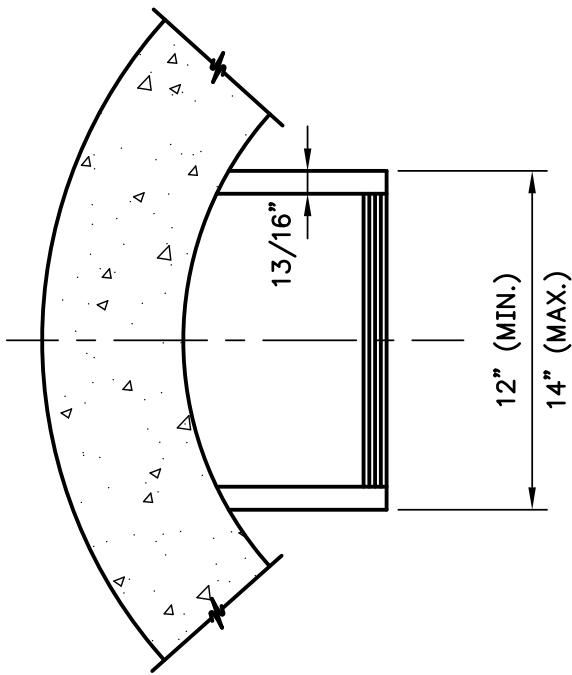
NOTES:

1. NO CEMENT GROUTING BETWEEN MANHOLE, LEVELING RINGS AND FRAME, OR ON INSIDE OR OUTSIDE OF MANHOLE PERMITTED. SEALING WITH APPLICATION OF HIGH BUILD EPOXY COATING PERMITTED (SIKA GUARD 62 OR APPROVED EQUAL).
2. RUBBER ADJUSTMENT RISERS PERMITTED FOR PAVED AREAS AND MAY BE TAPERED FOR STREET GRADE ADJUSTMENT.
3. 3/4" DIA. STAINLESS STEEL EXPANSION ANCHOR BOLTS MAY BE USED IN PLACE OF THREADED STUDS AND INSERTS.

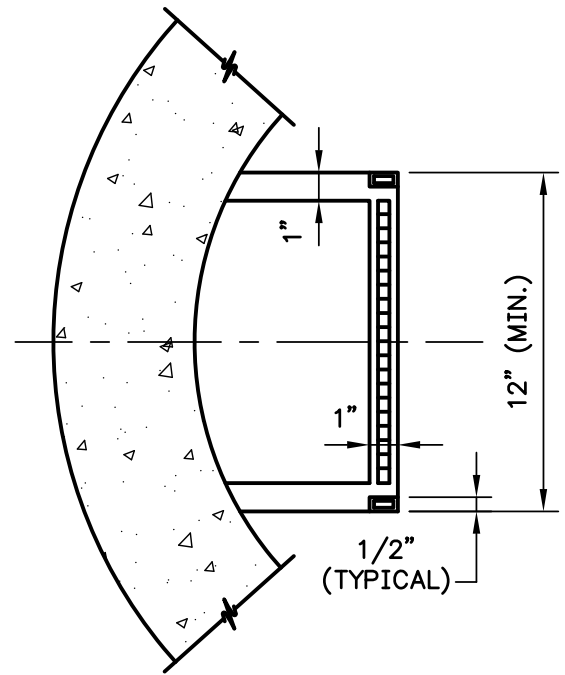
FILE NAME: MH-9-LEV-RINGS-BOLTED-FRAME.DWG

STANDARD DETAILS
**LEVELING RINGS AND BOLTED
 FRAME DETAILS**
 UPPER ALLEN TOWNSHIP

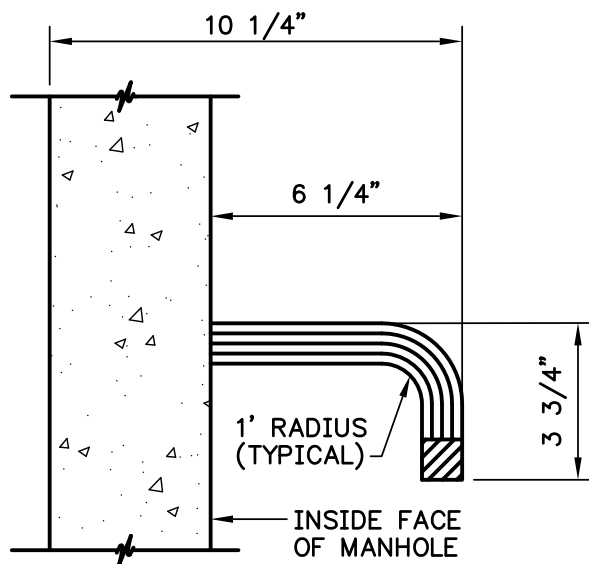
DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
12/16	NOTE REVISIONS
SCALE NO SCALE	DWG. NO. MH-9



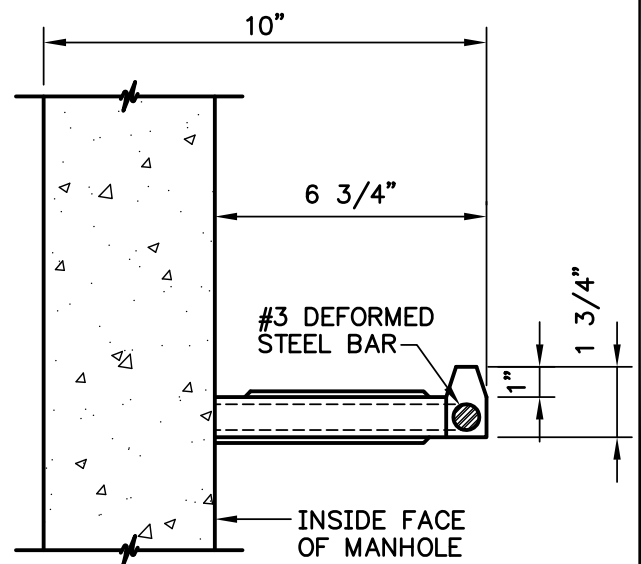
PLAN



PLAN



SECTIONAL ELEVATION
ALUMINUM



SECTIONAL ELEVATION
REINFORCED PLASTIC

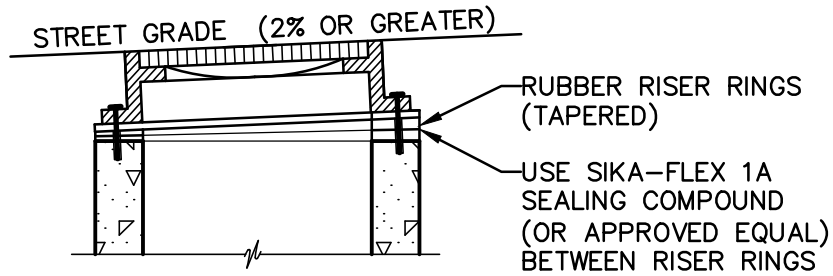
FILE NAME: MH-10-STEPS.DWG

STANDARD DETAILS

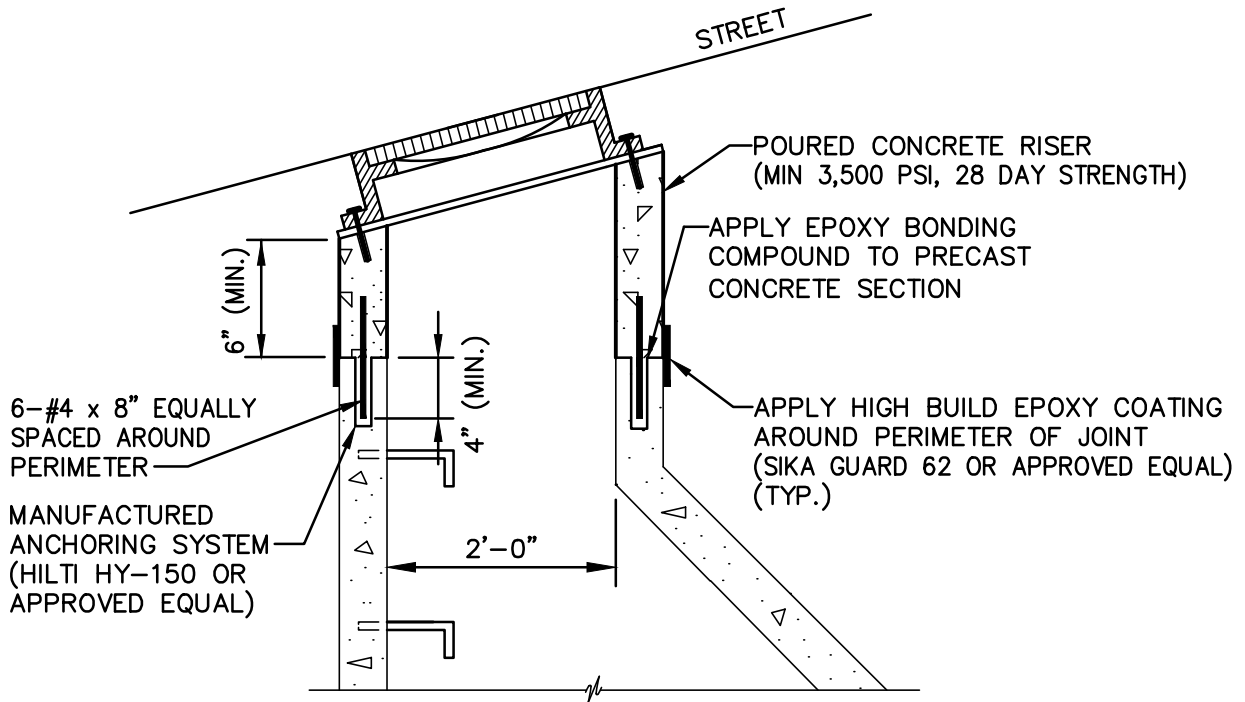
MANHOLE STEPS

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. MH-10



RUBBER RISER RING ADJUSTMENT



SECTION

POURED CONCRETE ADJUSTMENT RISER

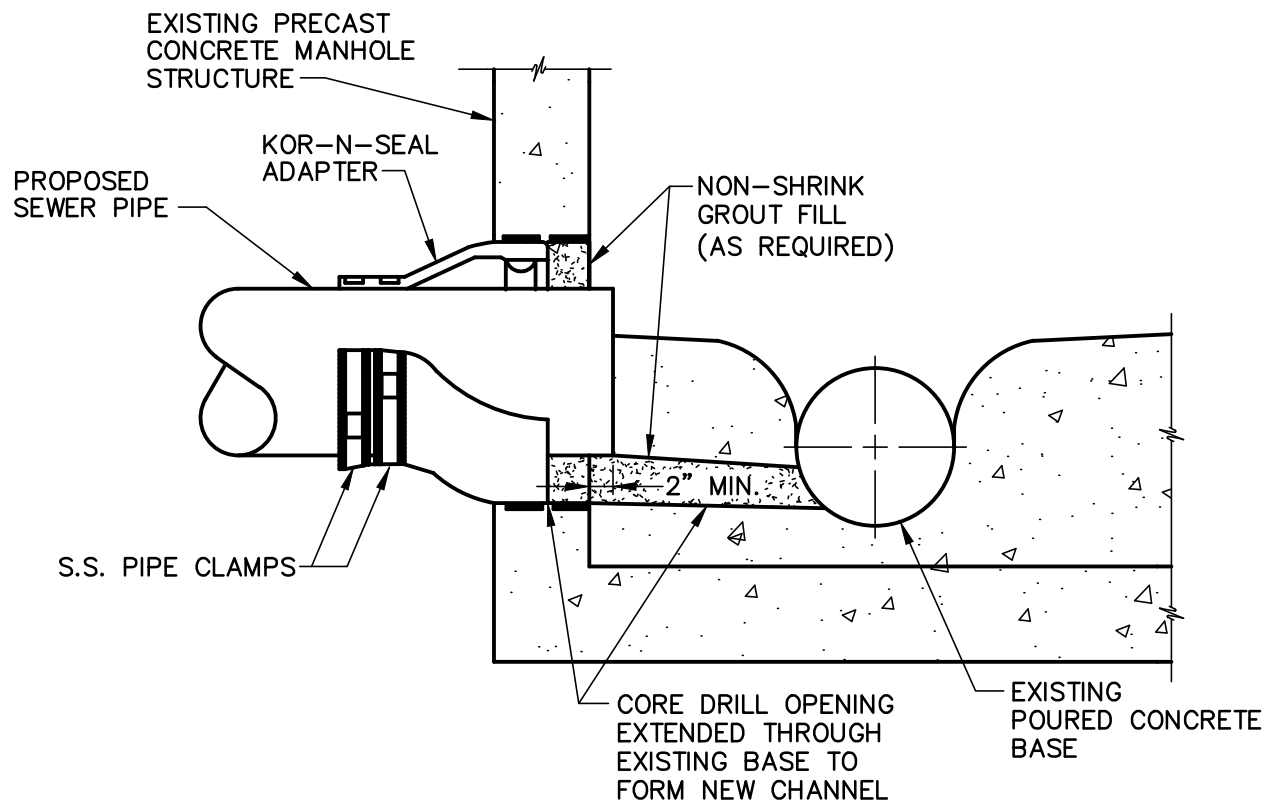
FILE NAME: MH-11-RISER-STEEP-SLOPE.DWG

STANDARD DETAILS

**MANHOLE ADJUSTMENT RISERS FOR
STREET GRADES OF 2% OR GREATER**

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
11/08	RUBBER RISER REVISION
12/16	NOTE REVISIONS
SCALE	
NO SCALE	
DWG. NO.	
MH-11	



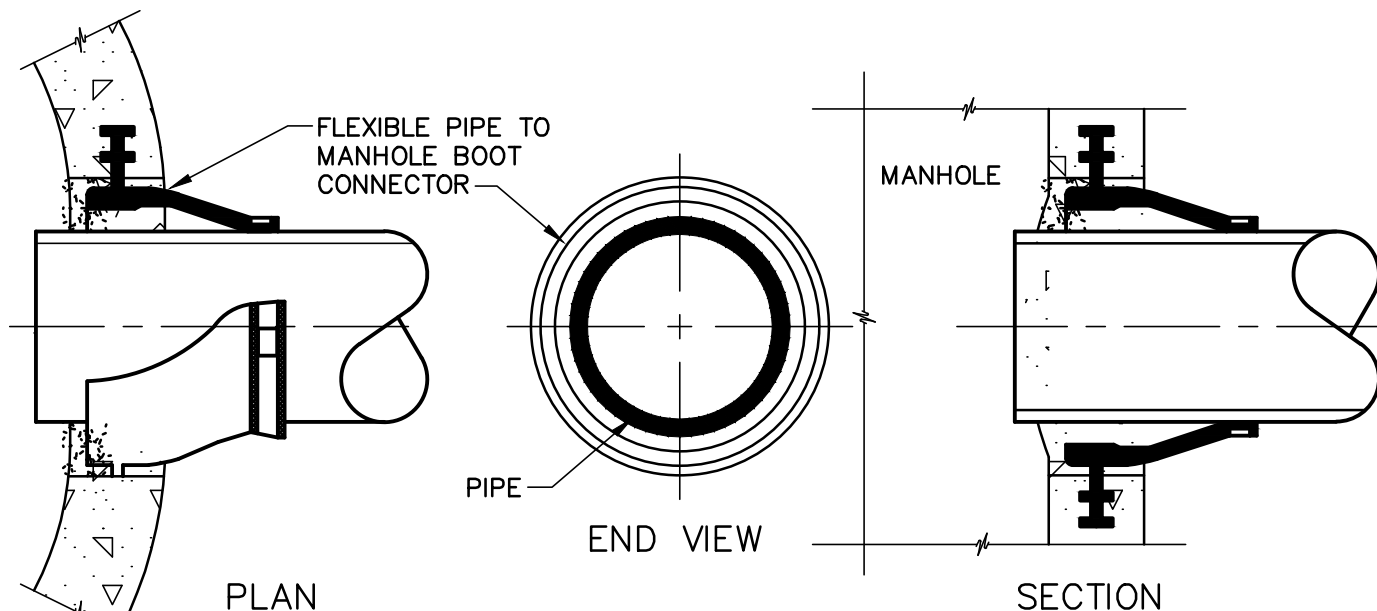
NOTE:

1. NEW PIPE CHANNEL RECONSTRUCTION IN ACCORDANCE WITH TOWNSHIP REQUIREMENTS.
2. NON-SHRINK CEMENT GROUT MUST CONTAIN TYPE II PORTLAND CEMENT FOR SULFATE RESISTANCE.

FILE NAME: MH-12-PIPE-KOR-N-SEAL.DWG

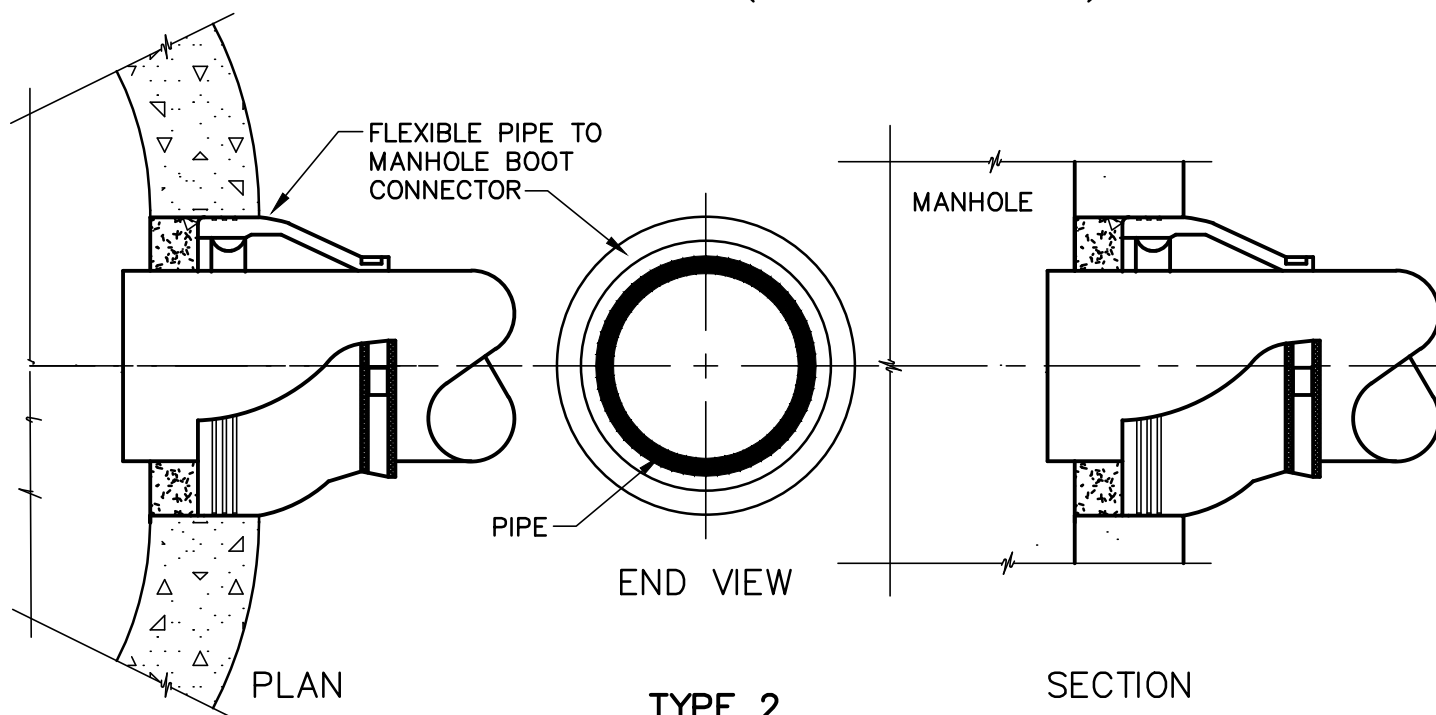
STANDARD DETAILS
**NEW CONNECTION TO EXISTING
 MANHOLE**
 UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
12/16	DWG./NOTE REVISIONS
5/18	TITLE REVISION
SCALE NO SCALE	DWG. NO. MH-12



TYPE 1

RUBBER GASKET CAST INTO
PRECAST STRUCTURE (A-LOK QUIK-LOK)



TYPE 2

RUBBER GASKET COMPRESSION RING INSERT FOR
PRECAST OR CORED PIPE OPENINGS (TRELLEBORG KOR-N-SEAL)

NOTE:

AFTER PIPE-TO-MANHOLE INSTALLATION, SEAL ANNULAR SPACE AROUND PIPE ON INSIDE
OF MANHOLE WITH TYPE II NON-SHRINK CEMENT GROUT. (TYP. OF ALL CONNECTIONS).

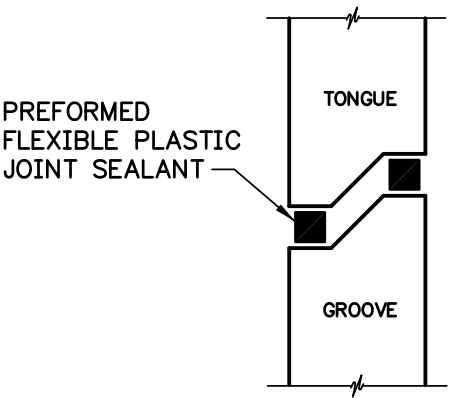
FILE NAME: MH-13-PIPE-GASKETS-2.dwg

STANDARD DETAILS

MANHOLE PIPE GASKETS

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
1/17	DWG. UPDATED
SCALE	
NO SCALE	DWG. NO. MH-13



SECTION

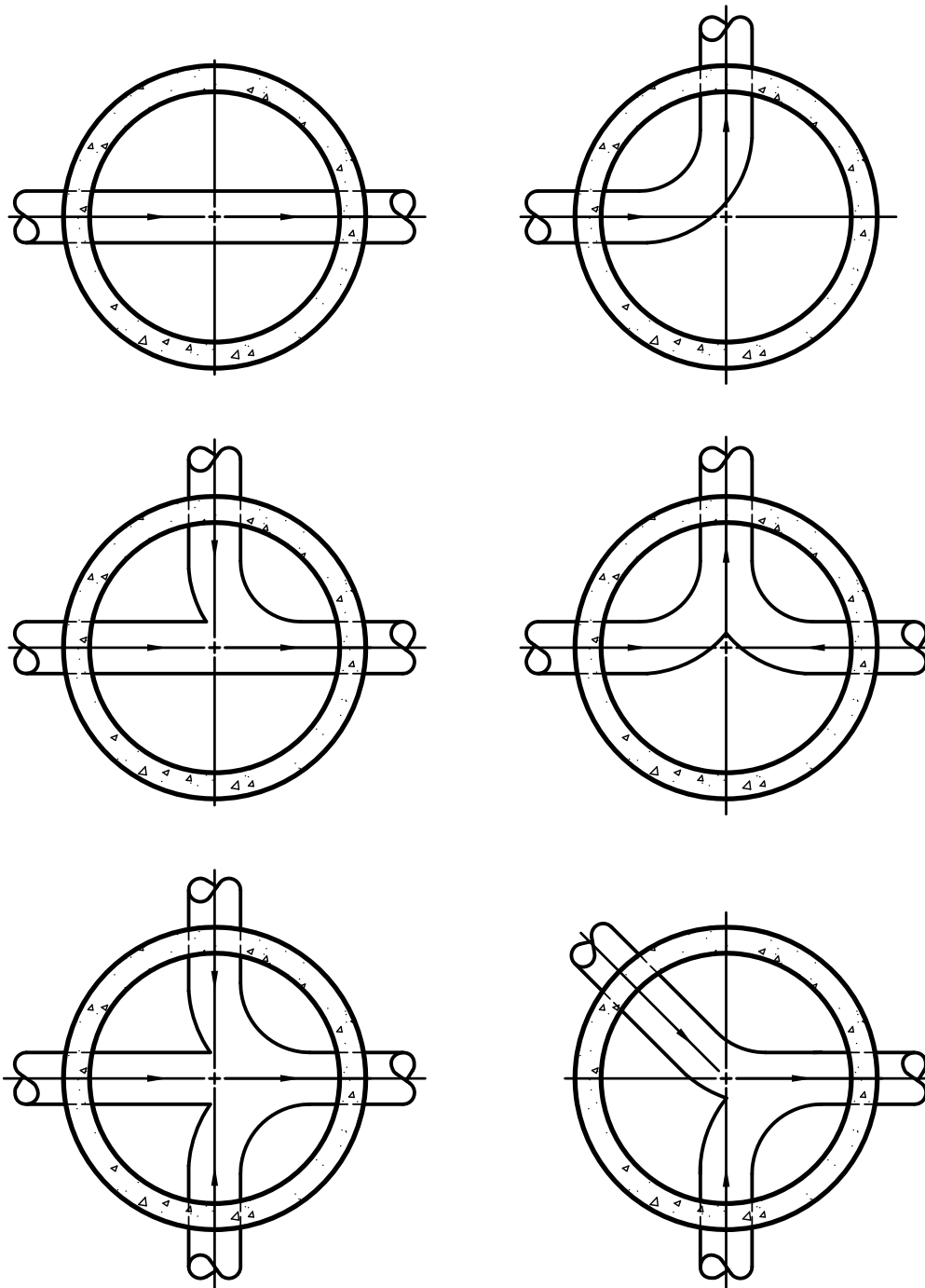
FILE NAME: MH-14-SEAL.DWG

STANDARD DETAILS

MANHOLE SECTION JOINT SEAL

UPPER ALLEN TOWNSHIP

DATE		REVISIONS	
3/08		DWG. CREATED	
SCALE NO SCALE		DWG. NO. MH-14	

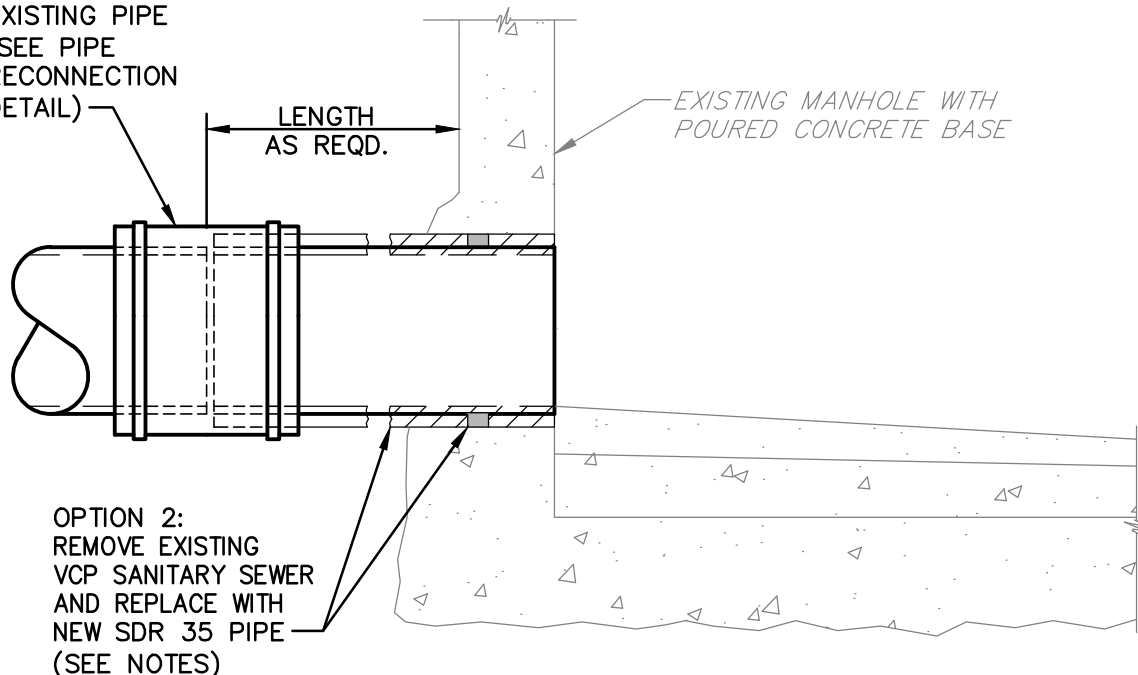


FILE NAME: MH-15-CHANNELS.DWG

STANDARD DETAILS
**TYPICAL PLAN OF
 MANHOLE CHANNELS**
 UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. MH-15

OPTION 1:
RECONNECT TO SOUND
EXISTING PIPE
(SEE PIPE
RECONNECTION
DETAIL)



SECTION

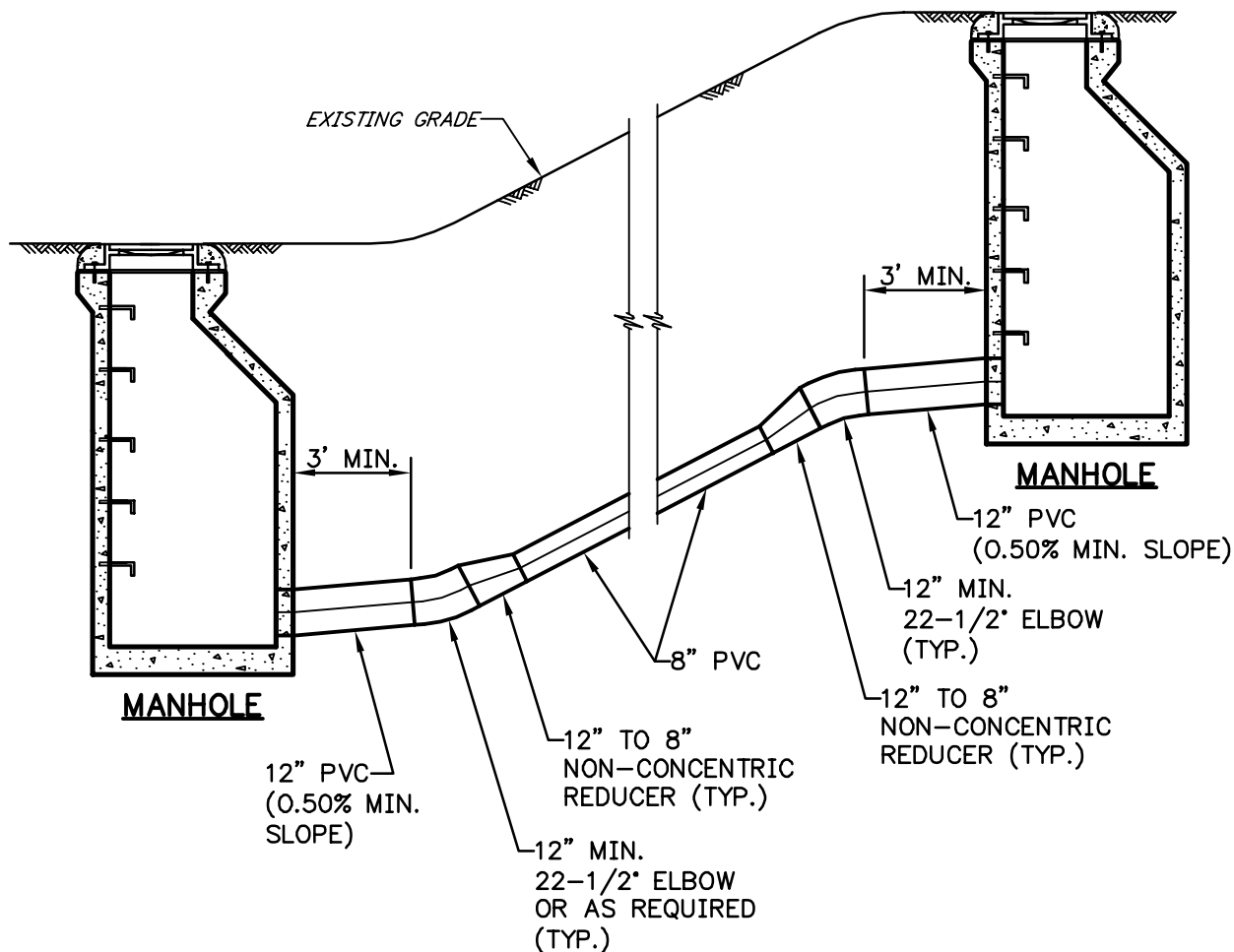
NOTES:

1. CONTRACTOR TO COMPLETELY REMOVE EXISTING VCP IN POURED CONCRETE BASE.
2. CONTRACTOR TO THOROUGHLY CLEAN SURFACE AND APPLY APPROVED CONCRETE BONDING AGENT.
3. CONTRACTOR TO APPLY "VINYLEX SIKASWELL A" WATERSTOP TO PIPE AND SEAL INSIDE AND OUT WITH NON-SHRINK CEMENT GROUT; FOR LARGER OPENINGS "FERNCO" FLEXIBLE CONCRETE MANHOLE ADAPTERS MAY BE USED.
4. METHOD OF PIPE CONNECTION TO MANHOLE TO BE COORDINATED WITH OWNER.

FILE NAME: MH-16-EX-MH-CONNECTION.DWG

STANDARD DETAILS RECONNECTION TO EXISTING MANHOLE DETAIL UPPER ALLEN TOWNSHIP

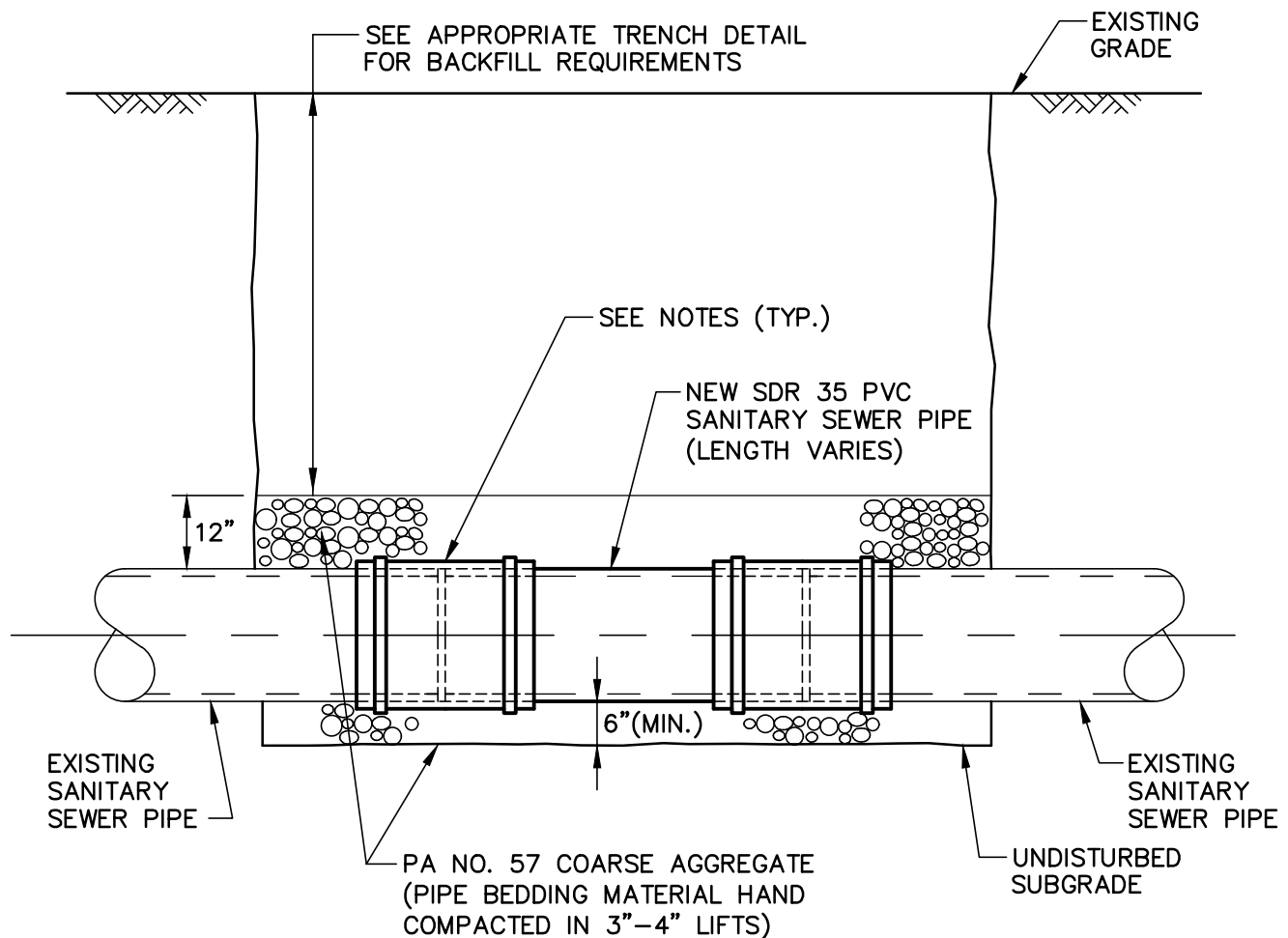
DATE	REVISIONS
3/13	DWG. CREATED
1/17	NOTE REVISIONS
SCALE NO SCALE	DWG. NO. MH-16



STANDARD DETAILS
STEEP SLOPE (GREATER THAN 15%)
SANITARY SEWER DETAIL
 UPPER ALLEN TOWNSHIP

FILE NAME: SEWER-1-STEEP-SLOPE.dwg

DATE	REVISIONS
3/08	DWG. CREATED
11/08	MIN. PIPE LENGTH REV.
SCALE NO SCALE	DWG. NO. SEW-1



NOTES:

1. SLEEVES, ADAPTERS AND COUPLINGS.
 - A. PVC TO PVC CONNECTION USE; GASKETED PVC REPAIR SLEEVE.
 - B. PVC TO TCP/VCP CONNECTION; USE FERNCO STAINLESS STEEL ANTI-SHEAR COLLAR RUBBER ADAPTER, OR APPROVED EQUAL.
 - C. PVC TO DIP/CIP CONNECTION; USE MECHANICAL JOINT COUPLING.
 - D. PVC/DIP TO ACP CONNECTION; USE MECHANICAL JOINT COUPLING OR STAINLESS STEEL ANTI-SHEAR COLLAR RUBBER ADAPTER, AS APPROVED BY TOWNSHIP.
 - E. DIP/CIP TO DIP/CIP CONNECTION; USE MECHANICAL JOINT COUPLING.
2. MECHANICAL JOINT COUPLINGS TO BE SMITH-BLAIR, DRESSER, OR APPROVED EQUAL.
3. RECONNECTIONS TO BE AIR TESTED IN ACCORDANCE WITH SPECIFICATIONS OR AS DIRECTED BY TOWNSHIP.

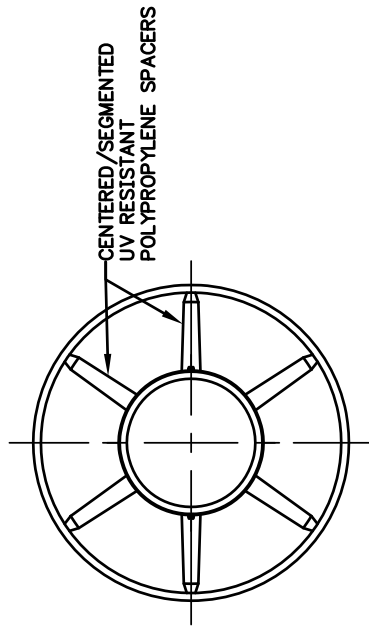
FILE NAME: SEWER-2-PIPE-RECONNECTION.DWG

STANDARD DETAILS

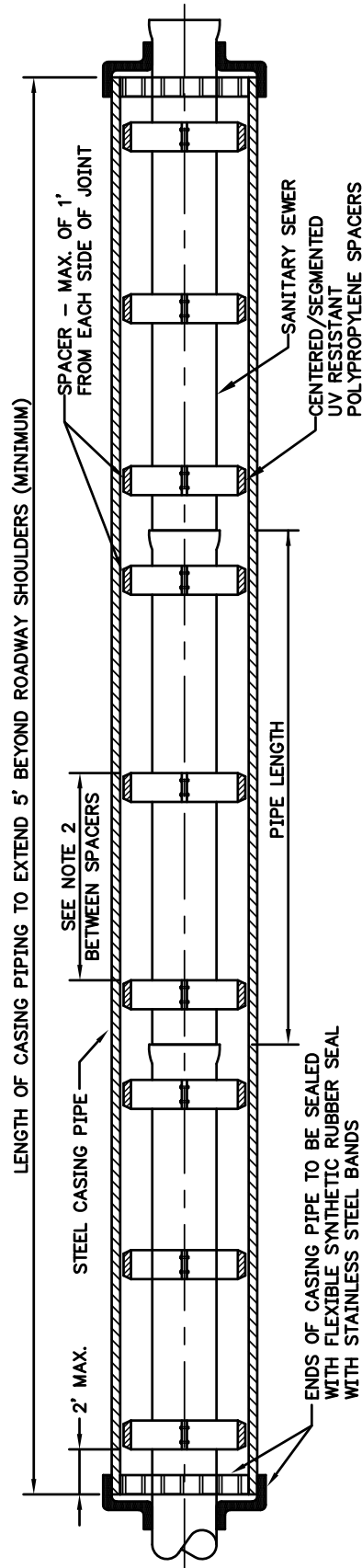
PIPE REPAIR/RECONNECTION DETAIL

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
12/09	GENERAL REVISIONS
12/13	DWG. UPDATED
1/17	NOTE REVISIONS
SCALE NO SCALE	DWG. NO. SEW-2



CASING SECTION
NO SCALE



CASING ELEVATION
NO SCALE

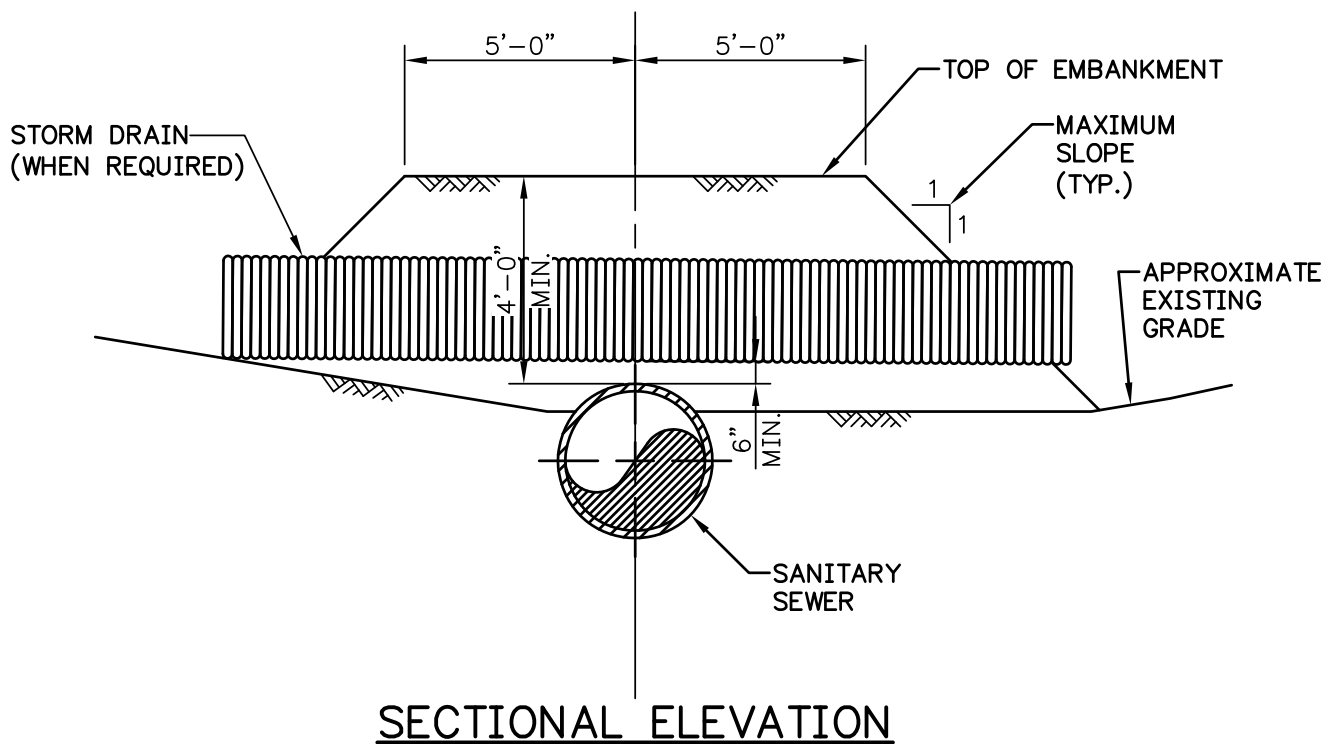
NOTES:

1. MINIMUM CASING SIZE IS 24".
2. CASING SPACERS SKID HEIGHT SPACING:
(MAXIMUM DISTANCE BETWEEN CASING SPACER)
 - a. SKID HEIGHT 1.50"(38mm) TO 1.97"(50mm) = 8'(FEET)
 - b. SKID HEIGHT 2.56"(65mm) TO 3.54"(90mm) = 6'(FEET)
 - c. SKID HEIGHT 3.94"(100mm) AND UP = 5'(FEET)

FILE NAME: SEWER-3-CASING-PIPE.DWG

STANDARD DETAILS
**CASING DETAILS FOR PIPE
BORINGS/TUNNELS**
UPPER ALLEN TOWNSHIP

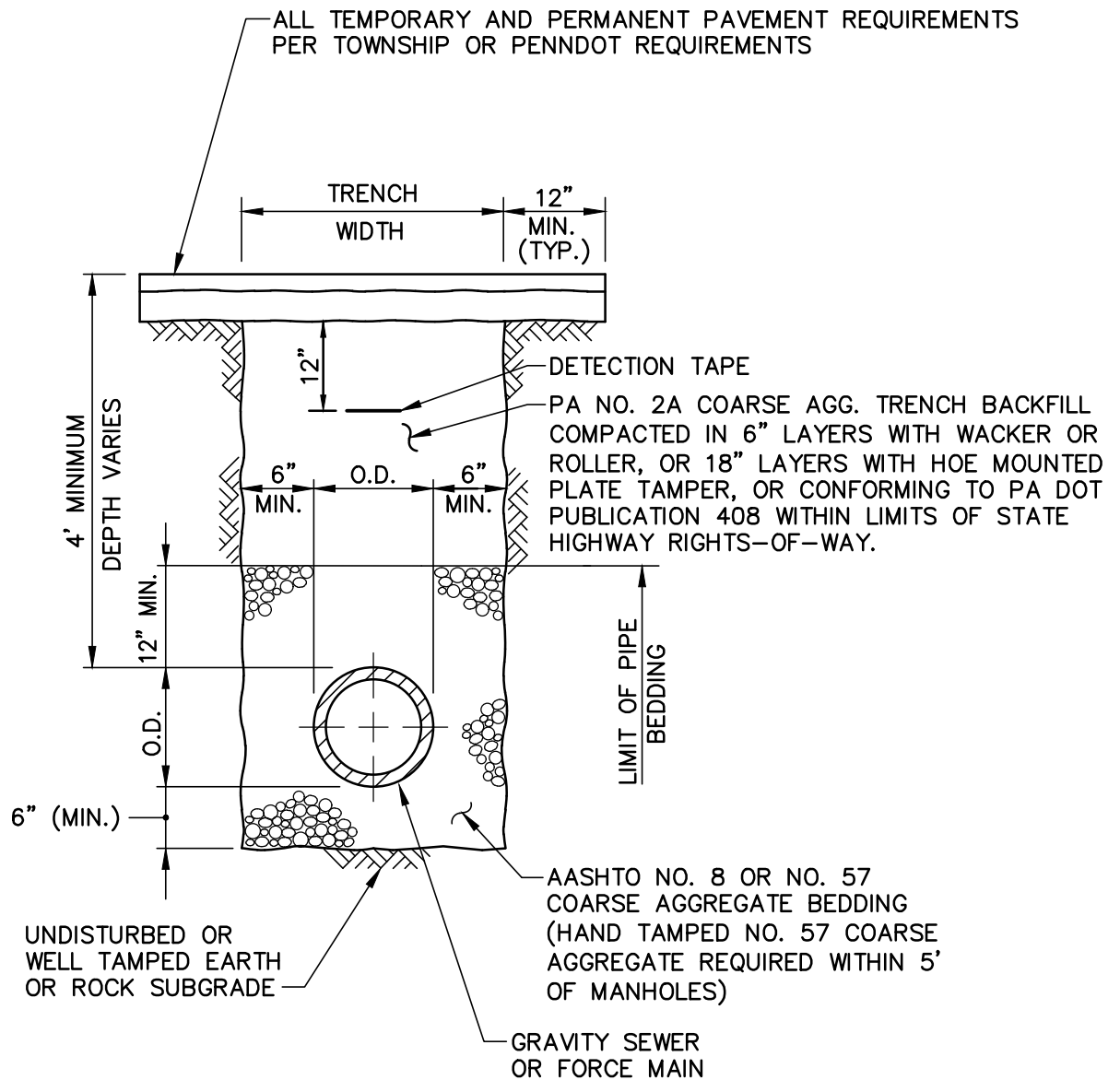
DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. SEW-3



FILE NAME: SEWER-4-EMBANKMENT.DWG

STANDARD DETAILS
**CONSTRUCTED EMBANKMENT TO PROVIDE
 MIN. REQ'D SANITARY SEWER COVER**
 UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. SEW-4



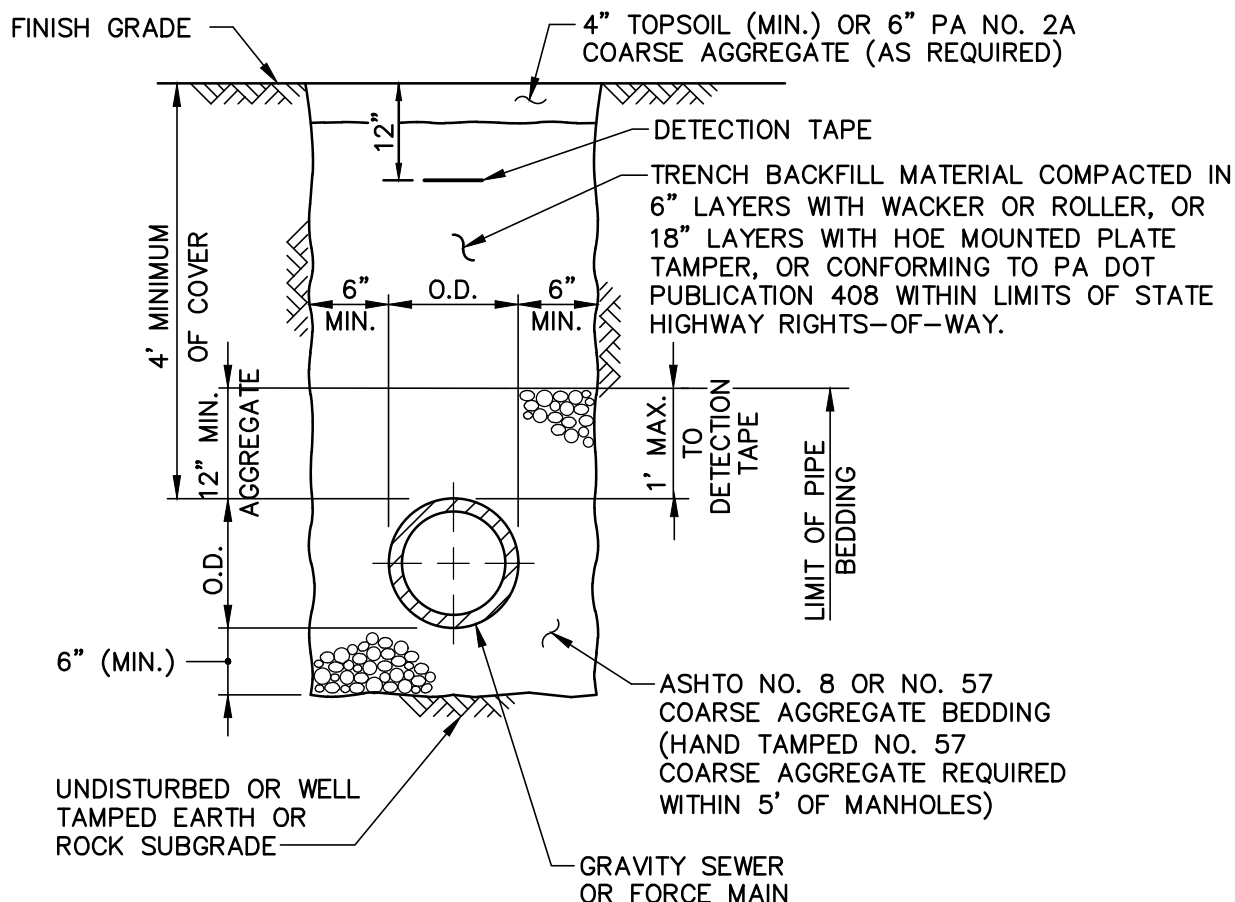
NOTE:

1. BACKFILL AND COMPACTION REQUIREMENT APPLIES TO PAVED ROADWAYS AND SHOULDERS OF PROPOSED AND EXISTING STREETS (OTHER THAN STATE HIGHWAYS), PAVED DRIVEWAYS, AND SIDEWALKS.

FILE NAME: TRENCH-1-PAVED.DWG

STANDARD DETAILS
**TRENCH BACKFILL DETAIL
 IN PAVED AREAS**
 UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
1/17	NOTE REVISIONS
SCALE NO SCALE	DWG. NO. TR-1



BACKFILLING REQUIREMENTS:

1. UNPAVED AREAS OUTSIDE ROADWAYS – SUITABLE ON-SITE BACKFILL COMPACTED AS INDICATED ABOVE TO BOTTOM OF TOPSOIL. REPLACE TOPSOIL TO APPROXIMATE DEPTH OF EXISTING OR MIN. 4".
2. UNPAVED AREAS WITHIN R/W LIMITS OF STATE HIGHWAYS – CONFORMING TO REQUIREMENTS OF PA DOT PUBLICATION 408.
3. UNPAVED SHOULDERS OF PROPOSED AND EXISTING STREETS OTHER THAN STATE HIGHWAYS – AGGREGATE BACKFILL COMPACTED AS INDICATED ABOVE.
4. STONE DRIVEWAYS AND PARKING AREAS – PA NO. 2A COARSE AGGREGATE BACKFILL COMPACTED AS INDICATED ABOVE.
5. UNIMPROVED STREETS – AGGREGATE BACKFILL COMPACTED AS INDICATED ABOVE.

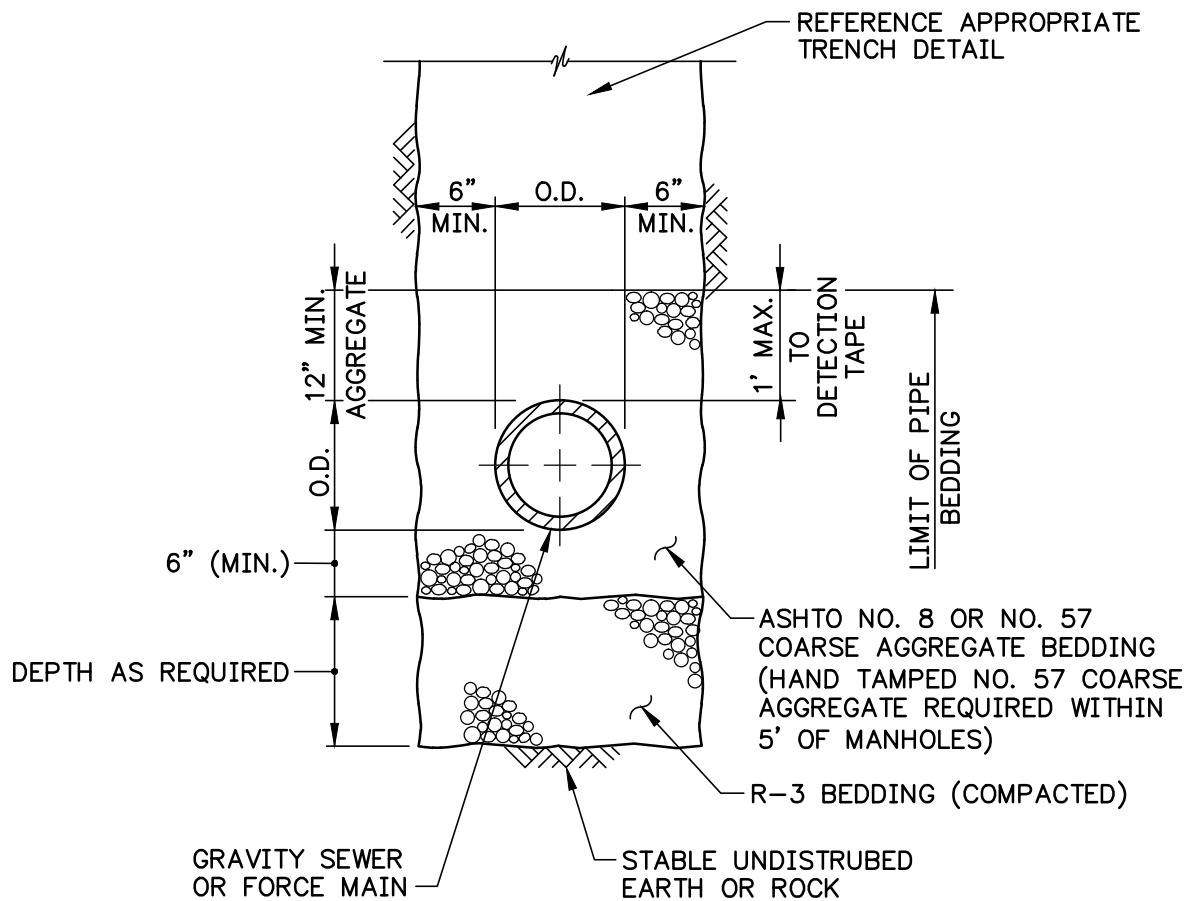
FILE NAME: TRENCH-2-ROW.DWG

STANDARD DETAILS

TRENCH BACKFILL DETAIL IN UNPAVED AREAS

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
1/17	NOTE REVISIONS
SCALE NO SCALE	DWG. NO. TR-2



NOTES:

1. IF STABLE UNDISTURBED EARTH OR ROCK UNATTAINABLE, STABILIZATION METHOD TO BE DETERMINED BY ENGINEER.
2. DETECTION TAPE REQUIRED; REFERENCE APPROPRIATE TRENCH DETAIL.

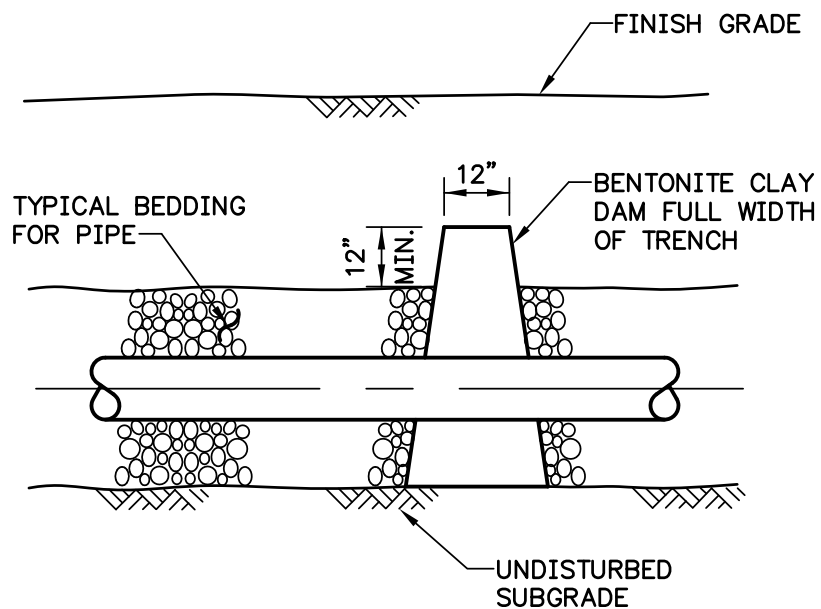
FILE NAME: TRENCH-3-UME.DWG

STANDARD DETAILS

UNSUITABLE MATERIAL EXCAVATION

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
12/13	DWG. UPDATED
SCALE NO SCALE	DWG. NO. TR-3



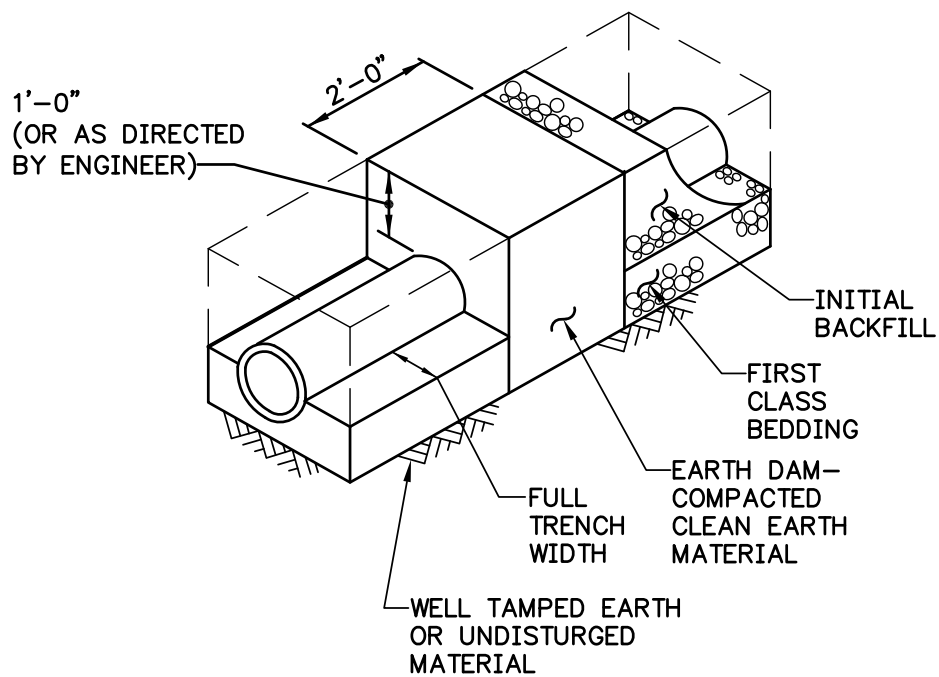
FILE NAME: TRENCH-4-CLAY-DAM.DWG

STANDARD DETAILS

BENTONITE CLAY DAM DETAIL

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. TR-4



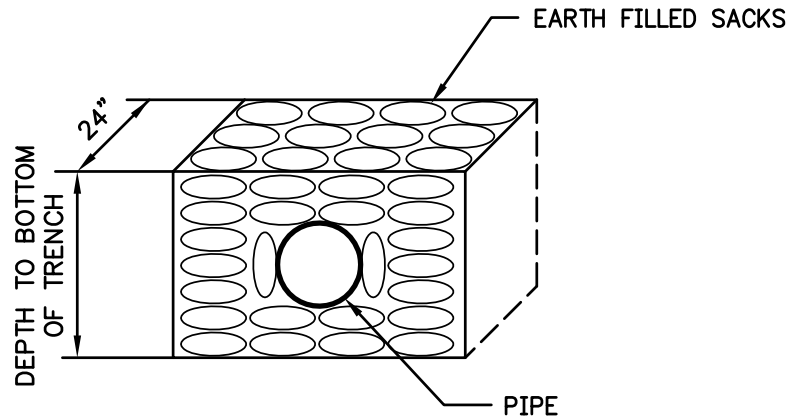
FILE NAME: TRENCH-5-EARTH-DAM.DWG

STANDARD DETAILS

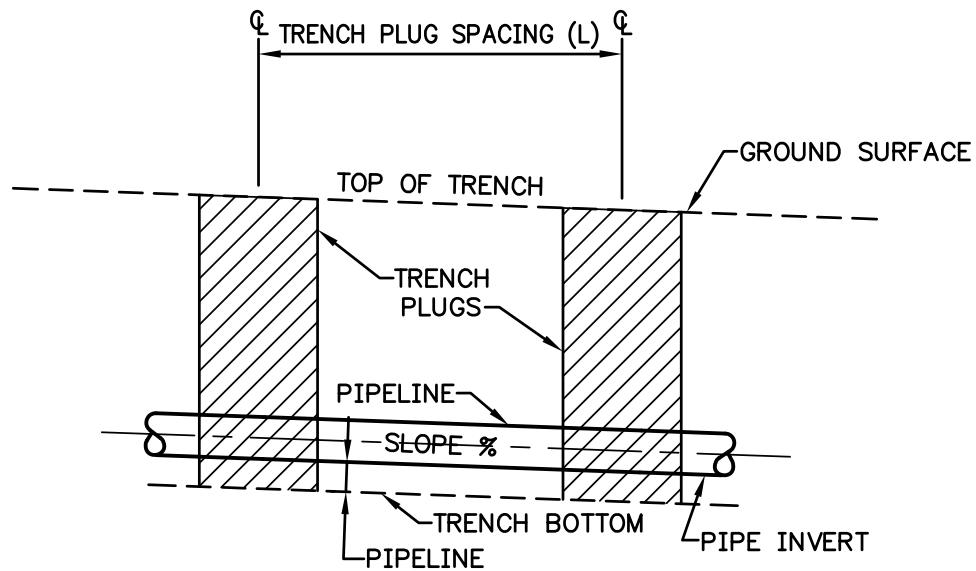
EARTH DAM DETAIL

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. TR-5



SECTION VIEW



ELEVATION

Required Spacing and Materials for Trench Plugs		
Trench Slope (%)	Spacing (ft.)	Plug Material
<5	*	*
5-15	500	** Earth Filled Sacks
15-25	300	** Earth Filled Sacks
25-35	200	** Earth Filled Sacks
35-100	100	** Earth Filled Sacks
>100	50	Cement Filled Bags (Wetted) or Mortared Stone

- * Trench Plugs are required at all stream, river, or water-body crossings regardless of trench slope. Otherwise not required.
- ** Topsoil may not be used to fill sacks.

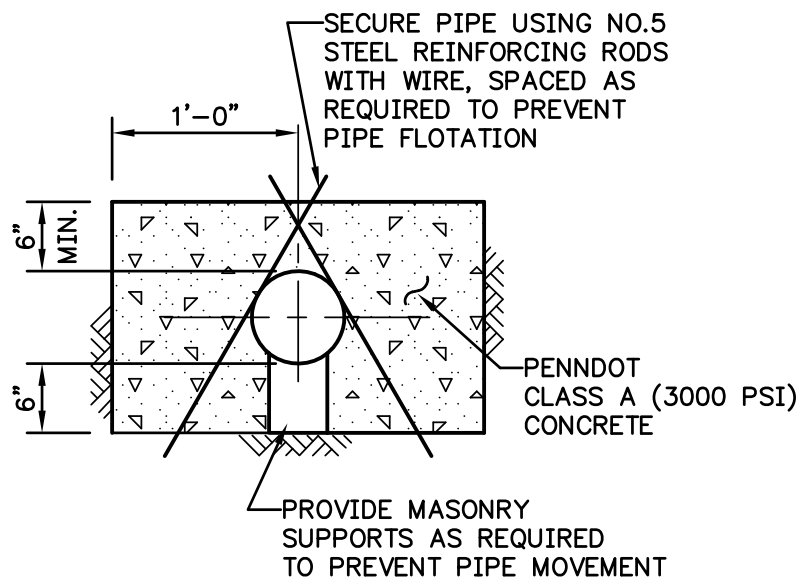
FILE NAME: TRENCH-6-PLUG.DWG

STANDARD DETAILS

EARTH SACK TRENCH PLUG DETAIL

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. TR-6



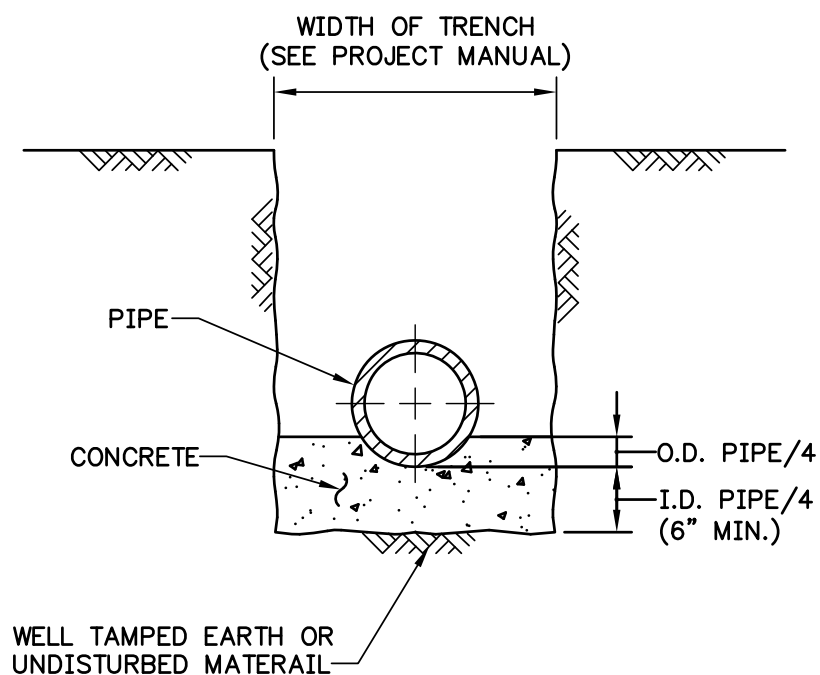
FILE NAME: TRENCH-7-CONC-ENCASEMENT.DWG

STANDARD DETAILS

CONCRETE ENCASEMENT DETAIL

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. TR-7



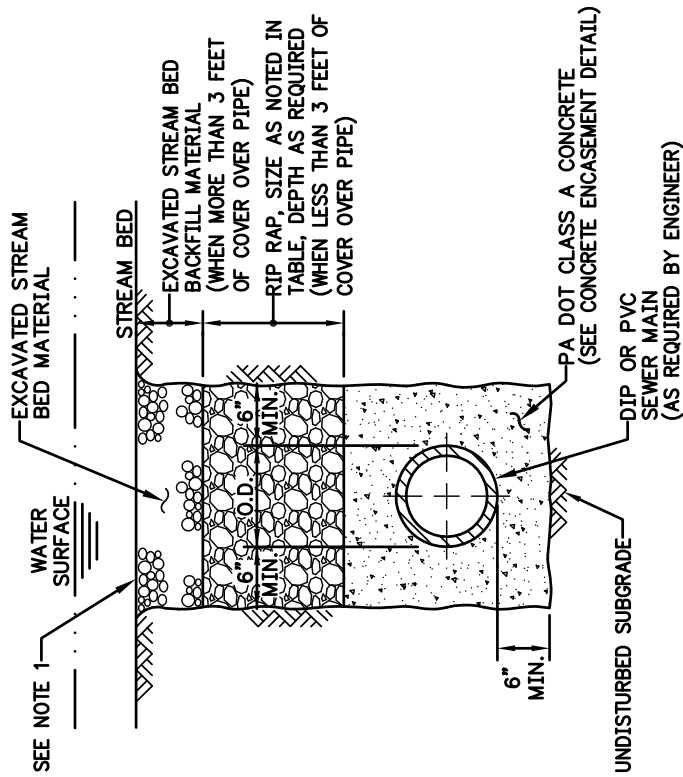
FILE NAME: TRENCH-8-CONC-CRADLE.DWG

STANDARD DETAILS
**CONCRETE CRADLE
 PIPE BEDDING**
 UPPER ALLEN TOWNSHIP

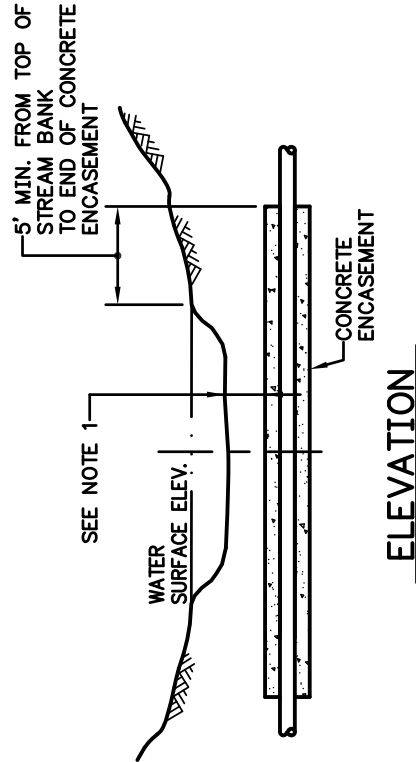
DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. TR-8

NOTES:

1. All utility lines under streambeds shall be located such that there will be a minimum of three feet of cover between the top of the utility line or encasement and the lowest point in the natural contour of the streambed, unless the utility line is in rock, where a minimum cover of one foot shall be provided.
2. Trenches excavated for the installation of utility lines shall be the minimum width necessary. As soon as the utility line is installed backfill material shall be placed in the trench and the area restored to its original condition and elevation and stabilized. Backfill material stored in connection with the installation must be properly retained out of the roadway so as to prevent its discharge, washings or runoff from entering the waterway prior to its placement as backfill.
3. The backfilling of the trench in which the pipe will be laid shall be done so as to eliminate the formation of a permanent ridge in the streambed.
4. Approved Erosion and Sedimentation Control measures shall be used to prevent sedimentation from the trench from entering the stream during construction.
5. Utility line crossings of streams should be accomplished so that the line is at a right angle to the stream where possible.
6. Where ever possible, in accordance with best construction methods, utility line crossings are to be made "in a dry manner" by installing sandbag dams and piping flow through the affected area.
7. Prior to the use of explosives in a watercourse or body of water, the Contractor shall secure a written permit from the Fish and Boat Commission, under the Pennsylvania Fish and Boat Code 30 Pa. C.S. sec. 2906 (relating to permits for the use of explosives). Requests should be directed to the Fish and Boat Commission, Division of Environmental Services, 450 Robinson Ln. Bellefonte, Pa 16823-9620, telephone 814-359-5147.
8. Stream bank stabilization/restoration as noted on drawings.
9. The contractor shall notify the Fish and Boat Commission Regional Fields Office supervisor ten (10) days prior to the start of construction.



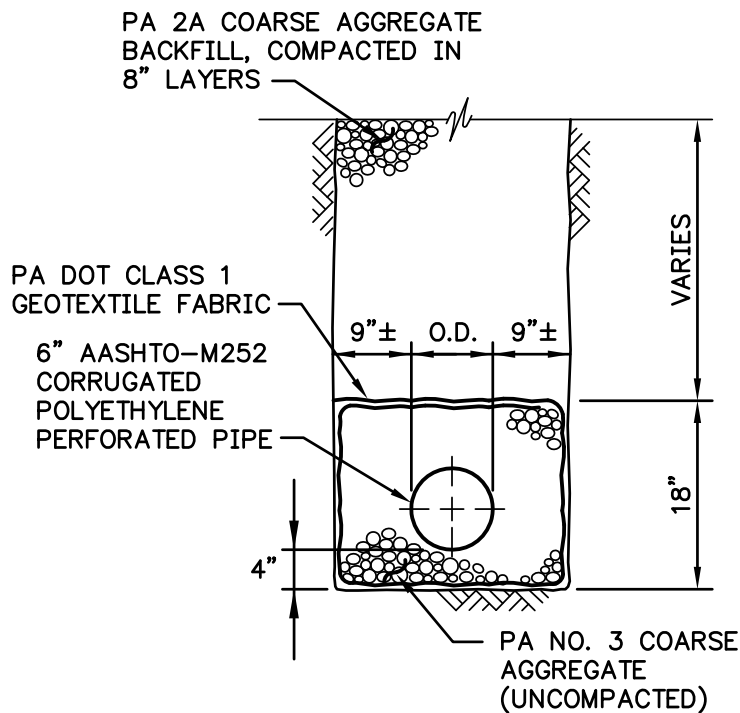
SECTION



STANDARD DETAILS
TRENCH DETAIL FOR
STREAM CROSSING
UPPER ALLEN TOWNSHIP

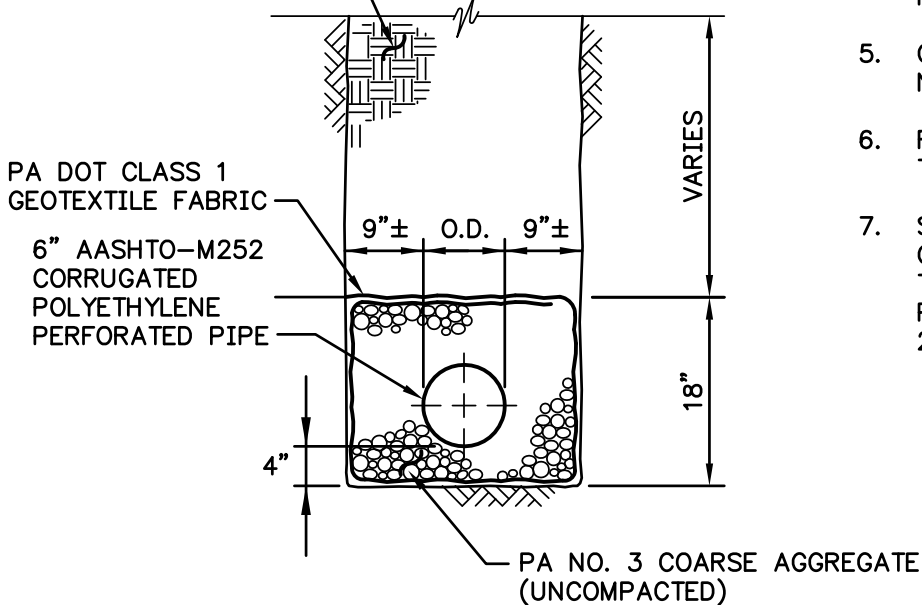
FILE NAME: TRENCH-9-STREAM-XING.DWG

DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. TR-9



DRAIN DETAIL PAVED AREAS

SUITABLE FILL MATERIAL COMPACTED IN 12" LAYERS



DRAIN DETAIL IN RIGHT-OF-WAY

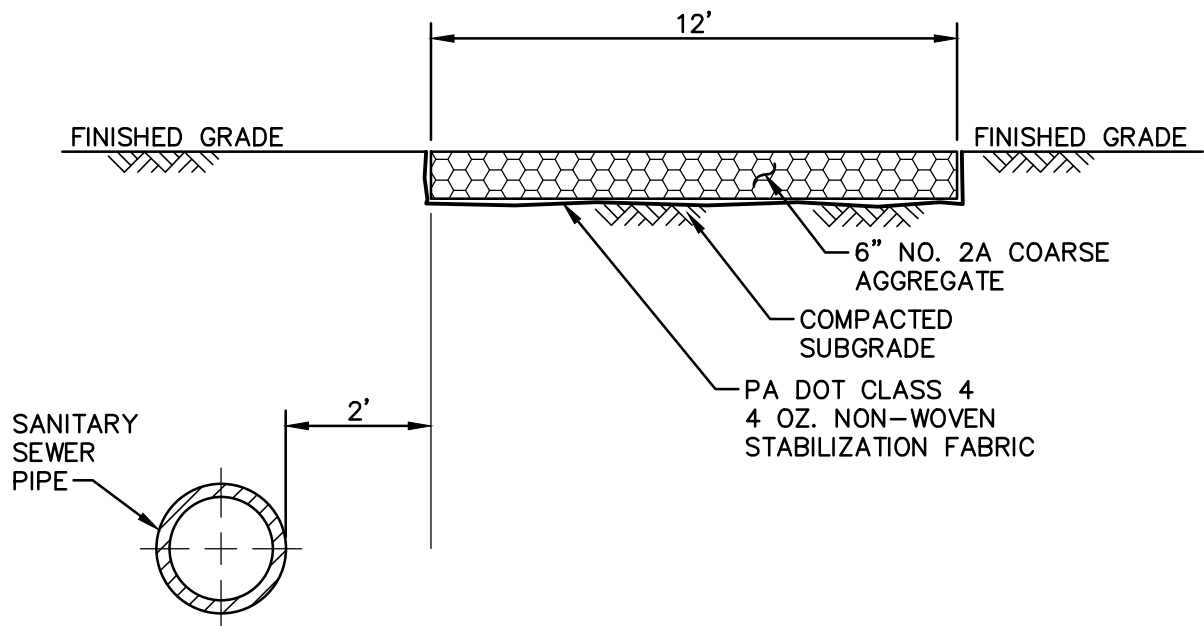
NOTES:

1. PROVIDE SMOOTH SIDE AND BOTTOM TRENCH SURFACES.
2. USE FABRIC OF A WIDTH TO PERMIT A MINIMUM TRENCH WIDTH OVERLAP ACROSS THE AGGREGATE AT THE DRAIN TOP.
3. OVERLAP ENDS AN AMOUNT EQUAL TO THE TRENCH WIDTH.
4. BACKFILL AGGREGATE AND INSTALL PIPE IN A MANNER TO PREVENT DAMAGE TO THE FABRIC.
5. GEOTEXTILE FABRIC TO BE NON-WOVEN, CLOG RESISTANT.
6. FOR PERFORATED PIPE, PLACE THE PERFORATIONS DOWN.
7. SUBSURFACE DRAIN CONSTRUCTION AND MATERIALS TO CONFORM TO PADOT PUBLICATION 408, SECTIONS 212 AND 610.

FILE NAME: TRENCH-10-SUB-FRENCH-DRN.dwg

STANDARD DETAILS
SUBSURFACE FRENCH
DRAIN DETAILS
UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
SCALE NO SCALE	DWG. NO. TR-10



SECTIONAL ELEVATION

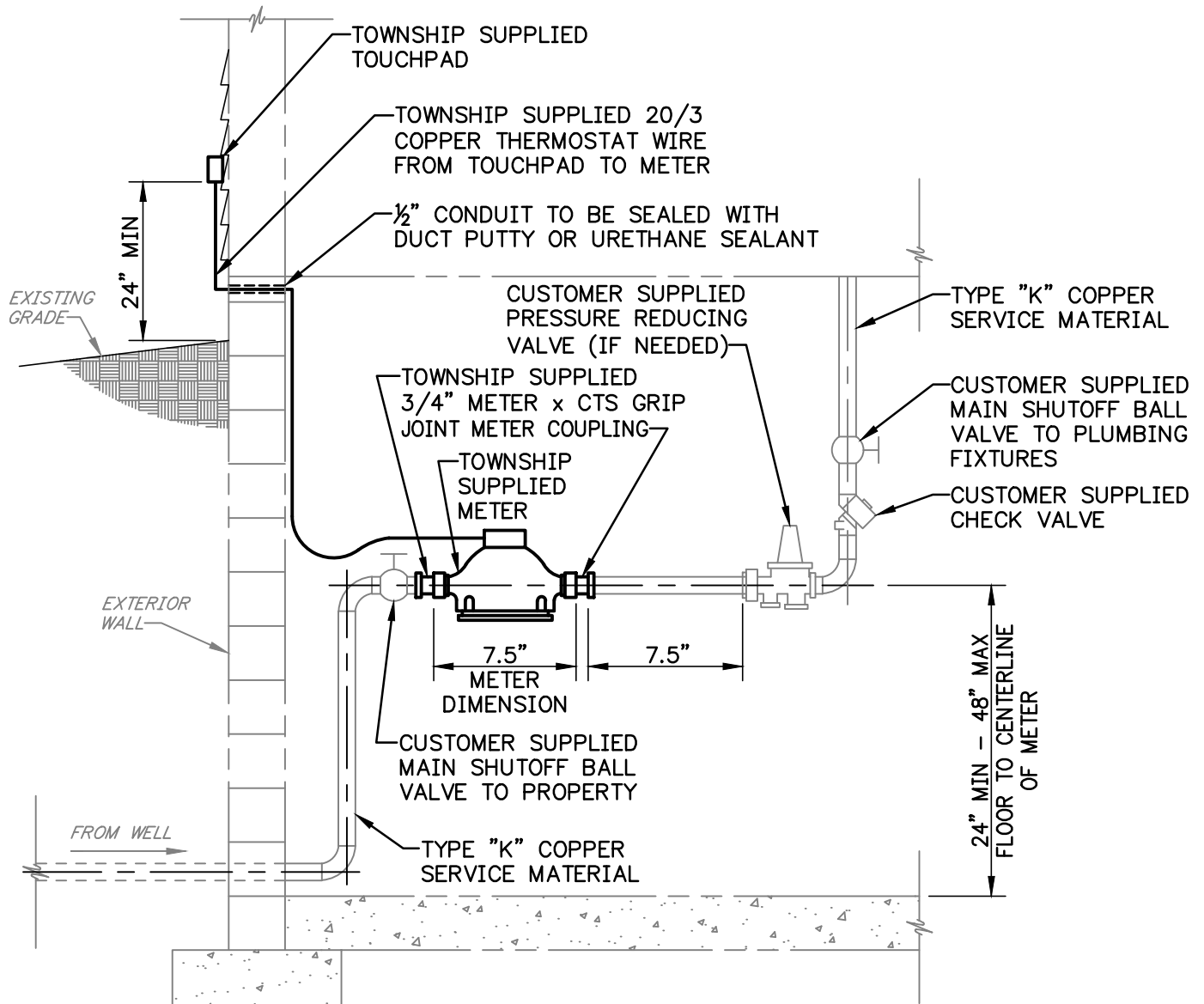
FILE NAME: TRENCH-11-SURFACE-STABILIZATION.DWG

STANDARD DETAILS

SURFACE STABILIZATION FOR SANITARY SEWERS LOCATED IN UNPAVED AREAS

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
3/08	DWG. CREATED
1/17	NOTE REVISION
SCALE NO SCALE	DWG. NO. TR-11



ELEVATION

NO SCALE

NOTES:

1. METER TO BE LOCATED AT A READILY ACCESSIBLE LOCATION (NOT IN CRAWL SPACE).
2. THERMOSTAT WIRE SHALL BE RUN TO THE EXTERIOR OF THE BUILDING AT A READILY ACCESSIBLE LOCATION.
3. SERVICE LINES MUST ENTER BASEMENT THRU SIDE WALL AND NOT FLOOR.
4. WATER SERVICE LINE TO BE SECURELY ANCHORED TO ADJACENT WALL.
5. CUSTOMER RESPONSIBLE FOR INSTALLATION OF METER AND ALL RELATED EQUIPMENT; FINISHED INSTALLATION TO BE INSPECTED BY TOWNSHIP.

FILE NAME: W-1-WATER-METER

STANDARD DETAILS TYPICAL 5/8" x 3/4" WATER METER INSTALLATION DETAIL

UPPER ALLEN TOWNSHIP

DATE	REVISIONS
8/09	DWG. CREATED
SCALE NO SCALE	DWG. NO. W-1