

**STANDARD CONSTRUCTION  
AND MATERIAL SPECIFICATIONS**

**FOR**

**SANITARY SEWER  
SYSTEM EXTENSIONS**

**November 14, 2017**

**NORTH CORNWALL TOWNSHIP,  
LEBANON COUNTY, PENNSYLVANIA**

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**ACT ONE & Associates**

CONSULTING ENGINEERS & SURVEYORS

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## SECTION 1 - GENERAL INSTRUCTIONS

- 1.01 DEFINITIONS: 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:
- A. Approved, etc. The words "approved", "acceptable", "satisfactory", or words of like import, shall mean approved by, or acceptable, or satisfactory, to the Engineer, unless another meaning is plainly intended or otherwise specifically stated.
  - B. Authority: North Cornwall Township Authority, acting directly or through any agent, officer or employee duly authorized to act for the said party. Any reference to the "Authority" or "North Cornwall Township Authority" throughout these specifications should be understood to be interchangeable with the term "Township" or "North Cornwall Township".
  - C. Building Sewer: The private sewer located between the edge of the legal right-of-way line and the building. The building sewer is generally 4-inch diameter pipe for residential properties.
  - D. Completion Certificate: The certificate of the Engineer approved by the Township indicating the completion and acceptance of all work specified and performed under the Contract.
  - E. Contract: The written agreement executed by and between the Developer and the Contractor, covering the performance of the work and the furnishing of labor, materials and service in the construction of sewer extensions to the North Cornwall Township Wastewater Collection System.
  - F. 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 under contract.
  - G. DEP: The Pennsylvania Department of Environmental Protection or the agency responsible for protecting and preserving the land, air, water and public health through enforcement of the state's environmental laws.
  - H. Developer: Party of the First Part or First Party to the Contract; the corporation, partnership, or individual intending to develop for residential or other purposes a certain tract of land situated within the sewer franchise area of the Township, acting directly or through any authorized lawful agents, legal representatives or employees appointed to act for said party in the execution of the work of the Contract.

- I. 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 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.
- J. Engineer: The person or organization duly employed by the Township as sewer engineer/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 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.
- K. FOG: Fats, oils and greases or the organic compounds derived from animal, vegetable, petroleum or mineral origins that contain multiple carbon triglyceride molecules. These substances are detectable and measurable using analytical procedures established in Title 40 of the Code of Federal Regulations Part 136. FOG is either polar (animal or vegetable) or nonpolar (petroleum or mineral origin).
- L. Industrial Establishment: Organized economic activity concerned with manufacture, extraction, processing of raw materials, or construction.
- M. Inspection: The examination of the work performed by the Contractor to ascertain its conformity with the Specifications.
- N. Lateral: The portion of the sewer located between the sewer main and the edge of the legal right-of-way line. The lateral sewer is generally 6-inch diameter pipe for residential properties.
- O. Line Acceptance Test: Shall mean testing performed after a section of sewer and its laterals are constructed between adjacent manholes, backfilled and successfully cleaned. Testing includes a low pressure air test, a mandrel test, and internal CCTV inspection.
- P. Maintenance Bond: The approved and executed form of security furnished by the Developer and his Surety as a guaranty against all defects in workmanship and materials which may become apparent for a specified period after receipt of the deed of dedication.
- Q. Observation Tee: A double sweeping tee placed at or near the transition between the lateral sewer and the building sewer.

- R. Project: All the necessary performance, services and materials required for the satisfactory completion of the work under Contract as described in the Specifications and indicated on the Drawings.
  - S. Sewer Extension Agreement: The written agreement executed by and between the Township and the Developer 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.
  - T. Specifications: Collectively, all of the definitions, descriptions, directions, provisions, requirements, terms and stipulations contained in these Standard Specifications; and all written supplements thereto, made or to be made, pertaining to the Contract, and the materials and workmanship to be furnished under the Contract.
  - U. Subcontractor: A person, firm or corporation having a direct contact with the Contractor to perform part of the latter's contract; such as one who installs or furnishes and installs equipment 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.
  - V. Township: North Cornwall Township, acting directly or through any agent, officer or employee duly authorized to act for the said party. The Township is the owner and operator of the Wastewater Collection System. Also referred to as Owner throughout this document.
  - W. Waste: The liquid and water-carried domestic and industrial wastes from dwellings, commercial establishments, industrial facilities and institutions, whether treated or untreated. The terms "Sewage" and "Wastewater" shall be deemed as waste by definition.
  - X. Wastewater Collection System: The sanitary sewer system, including mains, interceptors, pumping stations, treatment plant, force mains, etc. owned by North Cornwall Township. The sewer system contributes wastewater flows to the City of Lebanon Authority Wastewater Treatment Plan.
- 1.02 DRAWINGS AND SPECIFICATIONS: The Drawings and Specifications are complementary, and the requirements of any one shall be considered as the requirements of all.
- A. 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.

- B. 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 these 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 set forth in Section 01300.
- C. Deviations from the Drawings or Specifications required by the exigencies of construction will be determined by the Engineer only, and authorized in writing.
- D. 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.

1.03 PRELIMINARY INSPECTION: 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.

1.04 COMPETENT WORKMEN: The Contractor shall employ only competent and efficient superintendents, foreman, 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.

The Contractor shall provide a competent and reliable person, who is delegated to be readily available and have full authority to act in 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.

1.05 WORKING CONDITIONS

- A. No construction work shall be done prior to 7:00 a.m. nor later than 5:00 p.m. unless special conditions require such work hours. These conditions must be pre-approved by the Township. 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 5 business days notification prior to construction to schedule inspection.

1.06 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.

#### 1.07 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.

- 1.08 ASSIGNED WARRANTIES: 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.

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

- 1.10 PERMITS AND LICENSES: 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. Certain permits required in connection with a sewer extension must 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, as applicable, must be acquired in the Township's name:

- A. 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 must also be included.
- B. PennDOT Highway Occupancy Permit. If the sewer extension is to be located in State highway, obtain and complete the Highway Occupancy Permit application form (PennDOT form M945A) and submit to the Township.
- C. Railroad Occupancy License. If the sewer extension is to cross or be located in railroad property, The Developer must determine the requirements of the railroad. He must complete all application forms and ensure that the sewer design conforms to the requirements of the railroad. The Developer must submit to the Township the completed forms and design information necessary for submission to the railroad.
- D. Any "pave cut" or "pave cut excavation" permits required by North Cornwall Township.
- E. 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 agency.

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.

Information on the permit forms specific to the Township as applicant may be obtained from the Township's Engineer.

- 1.11 CARE OF PUBLIC AND PRIVATE PROPERTY: 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 must 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.

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.

- 1.12 PENNSYLVANIA ONE-CALL: Attention is directed to the provisions of the Underground Utility Line Protection Law Act No. 287 (1974), as amended by Act 121 of 2008 and Act 160 of 2016, and full compliance therewith is required of the Contractor

The Contractor shall not proceed with excavation in any work area until he has fulfilled the notification requirements of the Act, as amended.

1.13 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 must 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.
- 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 and rescue procedures [29 CFR 1926.21 (b) (6)]. 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 (e) (3)].
- 1.14 REGULATIONS OF THE DEPARTMENT OF LABOR AND INDUSTRY: 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.
- 1.15 REGULATIONS AND REQUIREMENTS OF THE DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP): 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.
- 1.16 OBSERVANCE OF LAWS: 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.

- 1.17 CLEANING SITE: 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.
- 1.18 ENGINEER'S DUTIES, EXAMINATION AND INSPECTION: 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.

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.

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.

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.

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.

Any verbal opinion or suggestion which the Engineer may give the Contractor shall in no wise be construed as binding the Township in any way.

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.

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 notify the Township that connection permits may be issued.

- 1.19 **DEFECTIVE WORK:** 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.

The Contractor shall remove any work or material condemned, and shall rebuild and replace the same.

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.

- 1.20 **NOTICE:** 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.
- A. When delivered, in writing, to the person in charge of the office used by the addressee to conduct business;

- B. When delivered, in writing, to the addressee or any of his authorized agents in person;
- C. 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;
- D. 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
- E. When filed at any company operated office of the Western Union Telegraph Company and addressed to the party intended for such service at his last known place of business or for conducting the business of the Contract at the Site of the work.

1.21 ENGINEERING STAKES: 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.

1.22 INSURANCE AND INDEMNITY REQUIREMENTS: 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; and/or its designated agent,

- A. Duties of the Developer. Four (4) copies of the original certificates must 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 must 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.
- B. 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 the 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:



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TYPE OF INSURANCE

LIMITS OF LIABILITY

(1) COMMERCIAL GENERAL

Each      Aggregate  
Occurrence

LIABILITY Insured: Contractor or

Developer

Additional Insureds: North Cornwall Township and its Engineer

Required Submission: Certificate, 4 copies

Premises-Operations	*General Aggregate	\$2,000,000
Explosion and Collapse Hazard	Product-Completed	
Underground Hazard	Operations Aggregate	\$1,000,000
Contractual Insurance	Bodily Injury and Property	
Broad Form Property Damage	Damage - Combined	\$1,000,000
Independent Contractors	Personal and	
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.

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**TYPE OF INSURANCE**

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**LIMITS OF LIABILITY****(2) AUTOMOBILE LIABILITY**

Insured: Contractor or Developer

Additional Insureds: North Cornwall Township, and its  
Engineer.

Required Submission: Certificate, 4 copies

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: North Cornwall Township, and its  
Engineer

Required Submission: Certificate, 4 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 1.22 paragraphs (a), (b), (d) and (f).

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**(4) WORKER'S COMPENSATION**

Insured: Contractor or Developer Required

Submission: Certificate, 4 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)

(c) 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: NORTH CORNWALL TOWNSHIP  
320 South 18<sup>th</sup>  
Street Lebanon,  
PA 17042

ENGINEER: TL Shaffer LLC, d/b/a  
ACT ONE & Associates- 200 S. 41<sup>st</sup> Street,  
Suite A. Harrisburg PA 17111

PROJECT NAME: \_\_\_\_\_ (Enter Project Name here) \_\_\_\_\_

- C. Coverage Modifications Which Must be Obtained: Township its Board Members and its Engineer and each of their Officers, Agents, Employees and/or servants 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.

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.

Waiver of Subrogation in favor of the Township, its Board Members, its Engineer and each of their Officers, Agents, Employees and/or servants applying to all Workers' Compensation coverages must be provided by the Developer unless not permitted by laws of the state in which this Agreement applies.

- D. Indemnification of Township and Engineer by Developer: Developer is responsible for all liabilities and duties assumed by Developer, and/or under the control of the Developer, its Officers, Agents, Employees and/or servants, or any Contractor or Subcontractor thereof, including but not limited to the indemnity liability in the Agreement between Township and Developer and the provisions of this subparagraph (e) and shall provide such protections for the Township, its Board Members, its Engineer and each of their Officers, Agents, Employees and/or servants whether or not such claims, losses, liabilities or expenses are covered by insurance.

The Developer shall at all times, indemnify and save harmless and Township, its Board Members, its Engineer and each of their Officers, Agents, Employees and/or servants of and from all actions, claims, demands, losses, expenses, reasonable attorneys fees, engineering fees and costs of whatsoever kind and nature, including without limitation claims made by or imposed against the Township, its Engineer and each of their Officers, Agents,

Employees and/or servants; and 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.

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.

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.

- E. Minimum Standards of Financial Strength and Policyholder Service Required of Insurance Carriers Providing Coverage for the Work: Insurance Companies used must be admitted carriers authorized to transact business in the Commonwealth of Pennsylvania unless Township is notified and waives this requirement. Insurance Companies used shall be rated (A 10) or better by Best's Rating Service unless the Township is notified and waives this requirement.

1.23 FEE REQUIREMENTS: The Developer shall be required to pay the following fees applicable to the sewer extension.

- A. Township Review Fee. An initial fee will be made payable to the North Cornwall Township with the first submission of documents to the Township for review. Additional fees 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 as described below.
- B. DEP Filing Fee. All applicable fees required by DEP shall accompany the permit application to DEP. The check shall be made payable to the Pennsylvania Department of Environmental Protection.
- C. Escrow Account. When the sewer extension is approved for construction, the Township will estimate the anticipated cost of inspection and administrative costs by the Township. The Developer will then be required to put that amount

of money into an escrow account from which the actual costs of inspection and project administrative costs can be drawn.

- D. Any other fees and inspection costs associated with other permits or licenses that are applicable to the extension.

#### 1.24 ITEMS REQUIRED PRIOR TO BEGINNING CONSTRUCTION

- A. Execution of a “Sewer Extension Agreement” with Township.
- B. An escrow account in the Township’s name for payment of the Township’s costs associated with inspection, legal counsel, and administration must be established.
- C. Evidence that the final subdivision plan has been filed by the Township at the county courthouse, Recorder of Deeds office, if applicable.
- D. Financial security to assure completion of the sewer extension and to cover the warranty period.

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.”

- E. Receipt of a letter from the Developer stating the name of the Contractor who will be installing the sanitary sewer extension.
- F. 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.
- G. Receipt from the Township of a copy of the Water Quality Management Permit issued by DEP, if applicable.
- H. Receipt from the Township of the PennDOT Highway Occupancy Permit, if applicable.
- I. A list of suppliers for the materials to be used in the sanitary sewer construction.
- J. Shop drawings of manhole bases, manhole risers, manhole frames and covers, pipe and other necessary construction materials approved by the Township Engineer.

- K. Certification from the pipe manufacturer that the pipe meets or exceeds the requirements of the Township's standard specifications.
- L. Written approval by the Township to proceed with construction.
- M. Receipt by the Township of the executed deeds of easements for all lots and properties that contain a sanitary sewer right-of-way.

1.25 DEDICATION OF SANITARY SEWER EXTENSION TO THE TOWNSHIP: The Developer shall deliver a Deed of Dedication transferring ownership of the sanitary sewer extension to the Township. Upon receipt of the executed Deed of Dedication from the Developer, the Township will release the Developer from all obligations to the Township with respect to the extension, except that the Developer shall guarantee the extension installation including materials and workmanship for a period of eighteen (18) months from the date of the deed, or longer if required by permitting agency.

1.26 STEEL PRODUCTS PROCUREMENT ACT. 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.

END OF SECTION

## SECTION 01010

### SUMMARY OF WORK

#### PART 1 GENERAL

##### 1.01 SITE LOCATION

- A. Locations will be in North Cornwall Township, Lebanon 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 system in accordance with these Specifications and the Sewer Detail Drawings bound herein.
- B. The Standard Construction and Material Specifications for Sanitary Sewer System Extensions manual may be downloaded at: <http://www.nctown.org/departments-services/sewer>. A hard copy can be purchased at the following address for a printing cost of \$50.00:  
North Cornwall Township  
320 South 18<sup>th</sup> Street  
Lebanon, Pennsylvania 17042  
Telephone No.: (717) 273-9200  
(Make payment payable to North Cornwall Township)
- C. Sewer Detail Drawings: The Sewer Detail Drawings listed in the table of contents represent the standards of construction of the North Cornwall Township and are bound at end of this Specifications manual.

On the Sewer Detail Drawings, the words “Project Manual” are to be defined as these Standard Specifications.

##### 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 North Cornwall Township, other governing municipality in the immediate vicinity, or the Commonwealth of Pennsylvania Department of Transportation, as applicable.
1. The cost of inspection by personnel of the Commonwealth of Pennsylvania Department of Transportation shall be paid by the Developer.
  2. Perform work within the right-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. The Regulations are made a part of these Specifications.
- C. DEP Regulations and Requirements: The Contractor and Developer are advised that they 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 for download online or can be obtained from DEP at:
- Pennsylvania Department of Environmental Protection  
909 Elmerton Avenue  
Harrisburg, Pennsylvania 17110-8200  
Telephone No.: (717) 705-4707
- D. Building Sewer Requirements: If as part of the work of this project, building sewers are constructed from the Inspection Tee to the building, use materials required by the Codified Ordinances of North Cornwall Township, as amended.
1. Construct the inspection riser and connect the house or building in accordance with the Building Sewer and Lateral Detail Drawing (BS).
  2. The Developer or Applicant must submit a sanitary sewer connection application, along with a check made payable to the North Cornwall Township, for the total tapping fee amount. Before any building sewer is constructed, the Developer or Applicant must contact the Township's appointed Sanitary Sewer Inspector. Notification is required 5 business days prior to inspection.
- 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. If sewers must be located outside of public rights of way, a right-of-way 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 in accordance with the SURFACE STABILIZATION FOR SANITARY SEWERS LOCATED IN UNPAVED AREAS (SS) Detail Drawing.



2. The Township will not grant final approval of the sewers for the project and will not grant approval to proceed with sanitary sewer construction until the Township is in receipt of Township approved executed deeds of easement for the rights-of-way by the property owners.
- F. Unauthorized Connections to Sewers: No Person shall contribute or cause to be contributed, directly or indirectly, wastewater which will interfere with the operation or performance of the Township's Sewer System and/or the City of Lebanon Authority Treatment Plant. The Township reserves the right to refuse permission to connect to the Sewer System, to compel discontinuance of use of the Sewer System, or to compel pretreatment of Wastewater by any Industrial Establishment in order to prevent discharges deemed harmful.
- G. Pretreatment: Where necessary in the opinion of the Township, the City of Lebanon Authority, or its agents, the Township may require the Owner of an Industrial Establishment to provide, at such Owner's expense, such facilities for preliminary treatment, or implementation of strength of waste surcharges. Industrial Wastes as may be necessary to reduce objectionable characteristics or constituents of such Industrial Wastes in order to being the same within the maximum limits permitted and to control the quantities and rates of discharge of such Industrial Wastes over a twenty-four (24) hour day and a seven (7) day week. Plans, specifications and any other pertinent information relating to proposed facilities for preliminary treatment and handling of Industrial Wastes shall be submitted for approval of the Township; and no construction of any such facility shall be commenced until approval thereof first shall have been obtained in writing, from the Township, and until approval thereof first shall have obtained from any governmental regulatory body having jurisdiction.
- H. Inspection Tee Requirement: when a house or building sewer is repaired or replaced and reconnected to a lateral that does not contain an inspection riser a test tee, make the new connection to the lateral in accordance with the BUILDING SEWER AND LATERAL DETAIL Drawing (BS). A 6x6x6 double sweeping tee is required at or near the right-of-way line for the Owner's use in inspection and testing of building sewer lines. A second 4x4x4 tee and riser can be installed between the Observation Tee and the building for testing purposes if an inside cleanout is not available for air test. In no case can a test tee be installed for testing and subsequently buried.
- I. Fats, Oils & Greases: Waste, which contains fats, oils or greases, shall be discharged into the Township's Sewer System only under the conditions of the most recent Fats, Oils and Grease Control Ordinance.
1. Sizing of the grease interceptor must be in accordance with the latest version of the Fats, Oils and Grease Control Ordinance.
  2. Toilets, urinals and other similar fixtures shall not discharge through a grease interceptor.
  3. The applicant is responsible for obtaining applicable permits for the

- installation and maintenance of a grease interceptor.
4. All grease interceptors shall have provisions for effluent sample collection. Exterior or recessed grease interceptors shall be required to install an effluent sampling well or sampling manhole immediately following the interceptor. Interior grease interceptors shall be equipped with an effluent valve assembly or other method that allows for effluent sample collection.

#### 1.04 PROJECT CONDITIONS

- A. Design Criteria: In addition to the design requirements of the Pennsylvania Department of Environmental Protection (DEP), comply with the following:
  1. Grade of Proposed Sewers: Minimum 0.60 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 sewer mains measured from finished grade elevation.
  3. If pipe cover from finished grade is in excess of 18 feet, the entire run between the manholes shall be ductile iron pipe (DIP), or SDR-26. Cover in excess of 20 feet shall not be permitted unless specifically approved by the Township.
  4. 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.
  5. Utility Crossings: All subsurface crossings of sanitary sewer facilities shall be no less than 70 degree angle, unless otherwise approved in writing by the Township.
- B. DIP and Concrete Encasement Requirement: Wherever the required clearances between the sanitary sewer and domestic water supply lines, or the minimum cover over the sanitary sewer cannot be provided, the sanitary sewer shall be run in Protecto 401 Ceramic Epoxy lined ductile iron pipe (DIP) and encased in concrete.
  1. Concrete encasements shall extend a minimum distance of ten feet on either side of the area of sub-standard clearance or minimum cover deficiency.
  2. Whenever concrete encasement of the sanitary sewer is required, the entire length of sewer between manholes shall be run in DIP.
- C. Concrete Anchors: Whenever the sanitary sewer is constructed at a slope of twenty percent or greater, concrete anchors shall be used at intervals identified by DEP.
  1. Where concrete anchors are required on the sanitary sewer the entire length of sewer between manholes shall be run in DIP.

D. Protection of Water Supplies:

1. Interconnections-There shall be no physical connection between a public or private water supply system and a sewer, or appurtenance thereto, which would permit the passage of any sewage or polluted water into the potable water supply. No water pipe shall pass through or come in contact with any part of a sewer manhole.
2. Relation to Waterworks Structures-While no general statement can be made to cover all conditions, it is generally recognized that sewers shall be kept remote from public water supply wells or other water supply sources and structures. When sewers are proposed in the vicinity of any water supply facilities, requirements in the state's Water Supply Manual should be used to confirm acceptable isolation distances. In general, sanitary sewers should be located at least 100 feet from public water supply sources and 50 feet from private water supply sources unless the sanitary lines are encased in concrete or constructed of ductile iron pipe with mechanical joints or equivalent.
  - a. Horizontal Separation-Whenever possible, sewers should be laid at least 10 feet, horizontally, from any existing or proposed water mains. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if:
    - i. It is laid in a separate trench; or if
    - ii. It is laid in the same trench, with the water main located at one side of a bench of undisturbed earth; and if
    - iii. In either case the elevation of the top of the sewer is at least 18 inches below the bottom of the water main.
  - b. Vertical Separation-Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation, for a distance of 10 feet extending on each side of the sewer. If possible, on full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible. The water main should be constructed of slip-on or mechanical joint cast-iron pipe, PVC pipe, or pre-stressed concrete cylinder pipe and the sewer constructed of mechanical-joint cast iron pipe for any portion within 10 feet of the water main. Both services shall be pressure tested to assure water tightness prior to backfilling. Where less than an 18-inch vertical separation exists between the water and sewer line, the sewer line may be concrete encased. If possible, sewer crossing water mains shall be constructed so that the sewer joints will be equidistant and as far as possible from the water main joints. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer to prevent damage to the water main.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

## SECTION 01300

### SUBMITTALS

#### PART 1 GENERAL

##### 1.01 SUBMISSIONS REQUIRED

- A. General Requirements: Developer shall comply with the most recent version of the North Cornwall Township sewer use ordinance. Those requirements are in addition to the requirements stated herein. The description under the SUBMITTALS Article in each Specifications Section indicates the type of submission required. In addition, submit copies of Developer's plans and a construction progress schedule.
  - 1. Make each submission to the office of the Township unless otherwise directed by the Township.
- B. Definition: The term shop drawing used throughout this document includes manufacturer's product data, shop drawings, samples and certificates.
  - 1. Product Data: Manufacturer's descriptive literature, product specifications, and performance requirements.
  - 2. Shop Drawings: Manufacturer's published detail drawings, and also Contractor prepared drawings.

##### 1.02 PROCEDURES FOR SUBMISSIONS

- A. Preliminary Submissions: At the time of submission of preliminary plans for the subdivision to the Township, complete the necessary documents and submit them 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.

#### 1.03 CONTRACT DRAWINGS - DEVELOPER SUBMISSION

- A. General Requirements: Submit two copies of drawings for review. After review of these drawings, make any corrections required and submit six corrected copies.
1. Sheet Size: 24-inches or 30-inches by 36-inches.
  2. Base elevations on the datum of the existing sewers.
  3. Include the following notes on the drawings:
    - a. ALL SANITARY SEWER CONSTRUCTION METHODS AND MATERIALS SHALL CONFORM TO THE LATEST STANDARDS OF NORTH CORNWALL TOWNSHIP, PENNSYLVANIA AND SHALL BE SUBJECT OF APPROVAL BY TOWNSHIP'S ENGINEER.
    - b. THE PERMITTEE FOR THIS SEWER EXTENSION IS THE NORTH CORNWALL TOWNSHIP.
    - c. ALL LOTS WILL BE SERVED WITH GRAVITY BASEMENT DRAINAGE EXCEPT WHERE NOTED.
  4. For details of manholes, bedding, encasement, service connections, etc., make reference to the appropriate "Sewer Detail Drawing" bound herein.
    - a. Do not show "Sewer Details" on contract drawings unless specifically required by the Engineer.
  5. Bind drawings in sets and number them consecutively.
  6. Include on the drawings a list of Act 287 (as amended) users. The list of Act 287 users may be obtained from the Lebanon County Recorder of Deeds, and shall include the name, address, phone number, and person to contact of each utility maintaining facilities in the area of the proposed extension.
  7. All main sewers shall have a minimum of five (5) feet of cover.
- B. Indicate on the drawings the following general items:
1. Name of the Design Engineer.
  2. Seal of the Design Engineer.
  3. Signature of the Design Engineer.
  4. Name of the development and the owners.
  5. Date.
  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 drawings:
1. Location Plan: Showing approximate area of the municipality in which the project is located. No particular scale is required.  
Index Map(s): Drawn to a scale of 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 the Township's Engineer to coordinate manhole numbering system.)
3. Detail Sheets (Plan and Profile): Plan View drawn to a scale of 1-inch equals 50-feet and Profile View drawn to a horizontal scale of 1-inch equals 50-feet and a vertical scale of 1-inch equals 10-feet, or 1-inch equals 5-feet, and having the following items included thereon:
- 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. Sewer ties to existing permanent and semi-permanent features (Plan View).
  - c. Top elevations of manholes (Profile View).
  - d. Invert elevations of manholes (Profile View).
  - e. Manhole numbers corresponding to those on Index Map (Plan View and Profile View).
  - f. Distance between manholes (Profile View).
  - g. Grade of proposed sewer (Profile View).
  - h. Size of proposed sewer (Profile View).
  - i. Location, size and elevation of all existing and proposed underground utilities (Plan View and Profile View).
  - j. The permit number and permittee of the existing receiving sewer (Plan View).
  - k. The lots which will not be provided with gravity basement drainage (Plan View).
  - l. Right-of-way limits (Plan View).
  - m. Lateral Ties:
    - 1) The measurement to locate the tee branch is the horizontal distance measured along the centerline of the main sewer from the downstream manhole to the centerline of tee branch.
    - 2) The ties and measurements necessary to locate the upper free end of the laterals are:
      - a) The horizontal distance measured to the closest tenth of a foot from the downstream and upstream property markers or house corners to the end of the lateral.
      - b) The horizontal distance from the center line of the main sewer to the end of the lateral.
      - c) The depth from the ground surface or the top surface of curb to the invert of the lateral.

D. Submit the following information as a supplement to the construction drawings:

- 1. Number of persons to be served initially.
- 2. Number of persons to be served in the future.
- 3. Number of acres to be served initially.
- 4. Number of acres to be served in the future.

5. Initial and future sanitary sewer flows if the development is other than residential.
- E. Record Drawings: Before the work will be accepted by the Township, submit two (2) sets of prints and one (1) electronic data file on CD or DVD. The electronic data file must be in a format that can be integrated into Geographical Information System (GIS) software. Generally, Record Drawings developed in AutoCAD or any GIS software application is acceptable for an electronic data file. Adobe PDF files do not meet the requirements of an electronic data file.
  1. Submit a certificate from the Developer's engineer with the record reproducibles attesting to the correctness of all information shown on the Drawings. The Township intends to use prints of the reproducibles to provide information to designers and contractors as required by the Commonwealth of Pennsylvania Act 287 (as amended).

#### 1.04 RIGHT-OF-WAY AND DEDICATION DOCUMENTS

- A. Provide six (6) copies of plats and descriptions for each lot or property on which a sanitary sewer right-of-way is located. The Township will prepare the deeds of easement for execution by the property owner. The Township will not grant final approval of the sewers for the project and will not grant approval to proceed with sanitary sewer construction until the Township is in receipt of the executed deeds of easement.
- B. Following completion of construction, provide six (6) copies of a plat and description of the sanitary sewers to be dedicated to the Township. The Township will prepare the deed of dedication for execution by the Developer. The sewers will not be released to the Township to perform the line acceptance test until the Township is in receipt of the executed deed of dedication.

#### 1.05 CONSTRUCTION PROGRESS SCHEDULE - CONTRACTOR SUBMISSION

- A. Schedule Requirements: Within seven days before work is commenced, submit three copies of a practicable and feasible progress schedule showing the order in which the Work is to be carried on, the dates on which salient features will start (including procurement of materials and equipment), and the contemplated dates for completing such work.
  1. Prepare the schedule in chart form and of suitable scale so as to appropriately indicate the percentage of Work completed at any time.
  2. Revise the Construction Progress Schedule as directed by the Engineer until finally approved by him and after such approval, strictly adhere to such schedule unless, upon written order of the Engineer, it is changed.
  3. It is hereby understood and agreed that the Owner reserves the right to determine the order of precedence and the times at which various portions of the Work are to be performed, and at no additional cost to the Owner.
- B. Schedule Updates: At the end of each month update the Construction Progress Schedule by entering the actual progress of the Work on the schedule.



1. Deliver three copies of the updated Construction Progress Schedule to the Engineer immediately after its completion.
2. If the monthly update of the Construction Progress Schedule indicates variations in the schedule as previously approved, submit a revised Construction Progress Schedule to the Engineer for approval in accordance with requirements specified previously.

#### 1.06 SHOP DRAWINGS - CONTRACTOR SUBMISSION

- A. Submit five (5) copies of each contractor approved shop drawing with such promptness as to avoid delay in the work. If shop drawings are submitted in an electronic format, they will be returned in an electronic format.
- 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 with Changes Noted, Returned for Correction or Not Approved.

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 with Changes Noted: When shop drawings are returned "Approved with Changes 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 with Changes Noted" will not require re-submission.
3. Returned for Correction: When shop drawings are returned noted "Returned for Correction" that means the Contractor shall make the required corrections and resubmit five copies of 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 five copies to the Engineer for review.

## PART 2 PRODUCTS

NOT USED

## PART 3 EXECUTION

NOT USED

END OF SECTION

## SECTION 01500

### TEMPORARY FACILITIES AND CONTROLS

#### PART 1 GENERAL

##### 1.01 TEMPORARY SERVICES

- A. General Requirements: Provide for the following temporary services at the site of the work throughout the entire period of construction and until the work is completed and the new facilities are placed in operation of the Township's personnel.
- B. Temporary Stormwater Control: The Contractor is responsible for maintaining temporary stormwater control 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 of work, 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 to completed work.
  - 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 capacity.
  - 4. Do not pump or otherwise permit groundwater to flow into existing wastewater pipelines during the construction.
- C. Temporary Wastewater Flow Control: During the connection into 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. In either case, the bypassing shall be through a properly sized and fail-safe means.
  - 2. Unlawful Sewage Discharges: The Contractor is hereby made aware that it is unlawful to permit wastewater (sewage) flow from existing sewers to discharge into nearby waterways or to flow on surface areas. Furthermore, should an accidental discharge occur, notify the Department of Environmental Protection immediately at (717) 787-4343.
    - a. Fines and related costs resulting from failure to provide adequate protection against wastewater overflow are the obligation of the Contractor.
- D. Dust Control: Contractor may be required to apply dust control materials to minimize raising dust from construction operations.

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 when work is being performed within existing street right-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. Requirements of Regulatory Agencies: State Highways, and Roadways other than State Highways, shall not be unnecessarily obstructed, and the Contractor shall take such measures to keep the highways open and safe for at least one lane of traffic at all times.
  - 1. The specific requirements for traffic control provided herein are for the convenience of the Contractor and shall in no way be construed as a release from the PennDOT requirements referenced herein.
  - 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. Provide a sufficient number of watchmen (when required) and take necessary and lawful precautions for protection of work and safety of the public.
  - 5. Barricades, danger signals, signs and obstructions shall be illuminated from sunset until sunrise.
  - 6. 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 212 - Work Zone Traffic Control.
  - 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 901 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: If roads will be closed and detoured as part of the proposed construction, the Township may require the Developer to prepare and submit to the Engineer for review Traffic Control Plans. Each Traffic Control Plan shall have a narrative describing what work is being performed and the order of that work. Traffic control requirements of the construction site within state highway right-of-way shall be illustrated on these Traffic Control Plans by way of figures taken from Publication 213 (67 PA Code, Chapter 212) Official Traffic Control Devices.
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.
  2. Construction shall not commence without an approved Traffic Control Plan.
- D. Police Traffic Control: When required by local traffic regulations provide traffic control in the form of police physically directing traffic. The costs for such police activity shall be the local police force direct charges, without Contractor's mark-up, passed on to the Owner 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 901 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 Publication 213 (67 PA Code, Chapter 212) - Work Zone Traffic Control Guidelines which complements Section 901.
  2. Provide danger signals and warning signs in the approved orange color.

## PART 3 EXECUTION

### 3.01 FLAGGING

- A. Flagging must be done in accordance with PennDOT Publication 213 and all flaggers are to be properly trained. Upon request, flaggers shall produce their card certifying they are properly trained.

NOT USED

END OF SECTION

## SECTION 02010

### SUBSURFACE EXPLORATION

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Digging Test Pits: In locations where new underground utilities are to be connected to existing underground utilities, the Contractor will not be permitted to proceed with the new construction until he has dug test pits and determined the exact location and elevation of the existing underground utilities.
1. The Contractor is advised that no excavation, pipe laying or other work is permitted at above referenced locations without the presence or approval of an authorized representative of the owner of the subsurface utility.
  2. Test pits or other miscellaneous excavation dug to obtain information on subsurface conditions or underground obstructions without written requirement of the Engineer will be at the Contractor's expense.
  3. The Contractor is responsible for obtaining all necessary street cut permits prior to performing any subsurface exploration.

#### PART 2 PRODUCTS

NOT USED

#### PART 3 EXECUTION

NOT USED

END OF SECTION



## SECTION 02151

### SHORING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section Includes: This Section includes the provision for 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 duty or responsibility for inspection, determination, compliance and enforcement of Federal, State, local laws, rules, regulations, requirements, precautions, orders and decrees rests with such department or agency and not with the Owner 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 Owner.
  - 2. No delay 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 Section specifies trench and structure excavation, backfilling and compacting as well as associated site restoration work.
- B. Related Sections:
  - 1. Subsurface Exploration: Section 02010.
  - 2. Shoring: Section 02151.
  - 3. Erosion and Sediment Pollution Control: Section 02270.
  - 4. 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).

##### 1.03 DEFINITIONS

- A. Unclassified Excavation: Removal of materials of whatsoever nature in the excavation, including both earth and rock formations, and other consolidated mineral masses, as well as existing structure foundations as may be encountered in the excavations.

- C. Unclassified Excavation below Subgrade: Same as unclassified excavation except such excavation is performed below elevations given as subgrade.
- D. Subgrade: Trench bottom prepared as specified to receive Pipe Zone Bedding, Concrete Cradle or Concrete Encasement or the bottom of excavations prepared to receive pipe line structures.
- E. 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. Samples: Submit aggregate samples to the Engineer's Field Office. Make such other required submissions to the Engineer's Business Office street address.
  - 1. Aggregates: Submit a ten pound sample, packaged in container of suitable strength, for Engineer's verification and certification for submission to testing laboratory.
- B. Test Reports:
  - 1. Aggregate Material Tests: Submit testing laboratory aggregate test reports based on requirements stated in Source Quality Control.
  - 2. Compaction Density Tests: Submit compaction density test reports based on method of density determination as specified in Reference Standards and the method as approved by the Engineer.
- C. Aggregate Certificates: When requested by the Engineer, submit certificate from aggregate supplier certifying conformity to the requirements stated in the Source Quality Control Article.

#### 1.05 QUALITY ASSURANCE

- A. Laboratory Tests: In accordance with Article 1.06 of the General Instructions, the specified aggregate materials shall require advance examination or testing according to methods referenced, or as required by the Engineer.
  - 1. The testing laboratory shall furnish both Engineer and Contractor two copies of test result reports. The same reports will be considered as sufficient evidence to serve as the basis for acceptance or rejection of materials represented.
- B. On-Site Backfill Tests: Obtain samples of on-site backfill for testing in the presence of an inspector as provided by 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 inspector.

1. The Contractor shall reimburse the Township for inspection services provided by the Township.
- C. Aggregate Material Tests: Conduct aggregate quality tests in accordance with the requirements of appropriate Referenced Standard for such 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 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 right-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 Engineer. Employ dust control when, where and in a manner required by 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. Provide the protective means (i.e.: cap the end of pipe) to prevent water and debris from washing into the pipe.
- 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 right-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 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. 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. 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.



## 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 ten 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.
- 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.
    - b. For piping having a diameter of 24 inches and larger 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 AASHTO No. 8 Coarse Aggregate.
    - b. For piping having a diameter of 24 inches and larger use AASHTO No. 57 Coarse Aggregate.
- E. Fine Aggregate (Sand): Conforming to PDT Section 703.1, for Type A sand. Sand made for slag aggregates is not allowed.
- F. Concrete Cradle and Encasement: Conforming to requirements of Section 03300 for Class A (4,000 psi.) Concrete.
  - 1. Provide Class B (3,000 psi.) Concrete for all other applications in trench excavation and backfilling work.
- G. Foundation Backfill: AASHTO No. 3 Coarse Aggregate conforming to PDT Section 703.2. Slag aggregates are not allowed.
- H. Underground Warning Tape:
  - 1. Metallic Utility Lines: Printed 4-mil polyethylene non-detectable tape, six inches minimum width, color coded with black ink on APWA (American Public Works Association) approved colors, one inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types.

2. Non-Metallic Utility Lines: Printed 5-mil polyethylene aluminum backed, detectable tape, six inches minimum width, color coded with black ink on APWA (American Public Works Association) approved colors, one inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types.
3. Provide underground warning tape for the following pipe lines and utilities as installed or encountered in the work:
  - a. Caution Buried Sewer Line Below - Green.
  - b. Caution Buried Water Line Below - Blue.
  - c. Caution Buried Gas Line Below - Yellow.
  - d. Caution Buried Electric Line Below - Red.
  - e. Caution Buried CATV Line Below - Orange.
  - f. Caution Buried Communication Line Below - Orange.
  - g. Caution Buried Fuel Line Below - Yellow.
  - h. Caution Buried Fiber Optic Cable Below - Orange.
  - i. Caution Buried High Voltage Line Below - Red.
4. Acceptable Manufacturers:
  - j. Seton Identification Products.
  - k. Or Approved Equal.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Trench Line and Grade: Maintain trench line and grade for sewers and pipe lines as follows:
  1. DEP Requirements: Sewer grades shall conform to the requirements of the Pennsylvania Department of Environmental Protection (DEP). The minimum grade of terminal sewer runs shall be 0.60 percent. Where practical, however, a grade of at least 1.00 percent is preferred for terminal sewer runs.
  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: If a laser beam instrument is used, perform field checks of the beam position every fifty feet of installed pipe line. Use survey or other approved method to perform the beam position check.
  4. Optional Methods for Maintaining Line and Grade: As rough excavation is completed set grade stakes or batter boards of rough lumber across the trench opposite

the control points. Securely set up and support each batter board to prevent accidental displacement and to ensure each board being leveled equidistant above the pipeline invert.

- a. Run a taut string-line between the batter boards directly over the proposed pipeline centerline. Use the string-line as a control for maintaining pipeline grade and horizontal alignment.
- b. To check the vertical distance from string-line to pipe invert, use a grade stake or pole, with a true right-angled offset designed to rest on the pipe invert.
- c. Use a plumb line from the string-line to the center of pipe to maintain horizontal alignment.

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.
3. Dispose of removed tree and permanent plantings debris in a lawful manner off site.
4. Where embankment is to be placed, clear and grub the area to a depth of not less than six inches below existing ground.

### 3.02 EMBANKMENT CONSTRUCTION

A. Construction Requirements: Construct embankments in accordance with the following paragraphs:

1. Embankment Foundation: Remove existing embankment foundation material when determined unsatisfactory by the Engineer. Refill such areas to original elevation in the same manner specified for formation of embankment.
  - a. Scarify embankment foundation surface where embankment three feet or more in height is to be placed. Scarify or otherwise loosen embankment foundation surface to a depth of six inches where embankment less than three feet in height is to be placed.
  - b. Existing embankment foundations having a slope steeper than four to one shall be plowed to provide embankment binding when required by the Engineer. On steeper slopes the Engineer may require the foundation to be cut into steps or berms.

- c. Fill existing natural depressions or such other depressions resulting from the site work to the level of adjacent ground elevation in the same manner specified for formation of embankment prior to starting initial embankment layer.
- 2. Formation of Embankment: Use On-Site Backfill material placed in nine inch layers and each compacted separately using equipment meeting with Engineer's approval. Carry the whole embankment up evenly the required elevation without breaks or irregularities in material distribution or in the formation of layers. Trim embankment slopes and leave in a neat and acceptable condition.
  - a. Add water to On-Site Backfill material which does not contain a sufficient amount of moisture to obtain the required compaction. On-Site Backfill material containing moisture in excess of the amount required to obtain the necessary compaction density may not, without written approval, be incorporated in the embankment until allowed to dry to a moisture content not greater than two percentage points above optimum for that particular material.
  - c. When pipe is to be laid in fill, bring embankment height to at least four feet above the top of the pipe before the trench is excavated.
  - d. Compact embankment material to a minimum final density of not less than 90 percent of the maximum dry weight density at its optimum moisture content.
- B. Borrow Material Requirements: Borrow materials required for embankment shall meet the specified requirements of On-Site Backfill material.
  - 1. During the excavation operation, keep the borrow area graded to insure free water drainage. Following completion of work in the borrow area; grade the area to present a uniformly trim appearance merging into the surrounding terrain and to prevent serious erosion.

### 3.03 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. Salvaged Topsoil: In open areas of rights-of-way (not in streets) strip turf and topsoil to the depth of suitable topsoil material and stock pile for subsequent topsoil placement operations.
- 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 right-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. 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

	Minimum Trench Width (Outside Diameter of <u>Pipe at the Barrel Plus</u> )	Maximum Trench Width (Outside Diameter of <u>Pipe at the Barrel Plus</u> )
<u>Diameter of Pipe</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.. Right-of-way or Easement Restrictions: Where pipe lines 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 as can be carried on without damage to adjoining property.
- 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, provide concrete cradle or encasement for 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 or construct timber foundation as required by the Engineer.
  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.
- L. Tunneling and Jacking: The tunneling and jacking of this paragraph is not to be considered the same as the work of tunneling and jacking under a highway or railroad. The work described in this paragraph is intended to be an optional method for installing the pipe to clear certain features in close proximity to the pipeline route.
  1. Make tunnels for laying pipe lines of sufficient size to allow the proper joining of pipes and the proper compacting of refill around them. Methods of tunneling or jacking used as may affect the workmanship or quality of completed work or product shall be changed as work progresses, in the judgment of the Engineer, conditions so require. Methods of tunneling and jacking with respect to responsibility and liability for safety to persons and property rests solely with the Contractor.
  2. Where rock is encountered in tunnel work, take rock out fully to the lines prescribed by the Engineer.

3. Timber tunnels to such extent as may be necessary. Where ordinary timber lining is used, completely fill the space between such timber and the outer surface of the pipeline with On-Site Select Earth Backfill or other approved material, rammed solidly between the pipeline and the timber lining, or fill same space with Concrete Encasement material if ordered by the Engineer.

### 3.04 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.
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 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 recompacting settled material. Exercise care to carry backfill up evenly within the trenches.

1. Initial Backfill: Following pipe bedding and piping and 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:
    - 1) Paved Areas: Conforming to the requirements of the Pennsylvania Department of Transportation.
    - 2) Unpaved Areas: Conforming to the requirements of the Pennsylvania Department of Transportation.
  - b. All other paved surfaces (including roadways, shoulders, driveways and parking areas): Aggregate Backfill compacted in six inch layers to the bottom of temporary or permanent pavement. On-Site Backfill may not be used in place of Aggregate Backfill.
4. Remainder of Backfill in Sidewalks: On-Site Backfill compacted in six inch layers to a point eight inches below the adjacent existing surface. Backfill the remaining eight inches with compacted Aggregate Backfill 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 make tests at various locations or depths of trenches, to determine whether the Contractor's compaction operations are meeting specified requirements. Compact trench backfill as follows:
1. Solidly tamp each layer of Initial Backfill around the pipeline with proper tamping tools made specially 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 in trench refill operations to produce a density of backfill at the bottom of each layer of not less than 95 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 right-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.

### 3.05 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 Connections: Excavate depth of cut to invert predetermined by Engineer. Where required by Engineer, excavate entire length of service connection trench before laying pipe.
1. Rock Excavation: If rock is encountered within ten feet of buildings, remove by drilling and wedging or some other method other than blasting. Remove rock to one foot beyond end of service connection.
  2. Curb and Sidewalk Restoration: If curbs and sidewalks are disturbed during service

- connection work, restore such curbs and sidewalks to as new condition.
3. Markers: Do not backfill upper free end of service connection 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 service connection. Cut top of marker 1 foot above finished grade.
  4. Backfilling and compacting as specified previously.
- C. 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.
- D. 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 trenches. Install in accordance with printed recommendations of the tape manufacturer, and as specified herein:
1. Bury tape at a depth of 12-inches below existing grade. In pavements measure 12-inches from subgrade of pavement.
  2. Provide warning tape in trenches for utilities specified previously.
- E. 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, replant 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.
- F. Maintenance: The Contractor is solely responsible for injury or damage resulting from lack of trench maintenance during the guarantee period.

END OF SECTION

## SECTION 02270

### EROSION AND SEDIMENT POLLUTION CONTROL

#### PART 1 GENERAL

##### 1.01 REQUIREMENTS OF REGULATORY AGENCIES

- A. 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 the most recent version of the DEP Erosion and Sediment Pollution Control Program Manual
- B. Site Review: When required, arrange and conduct an on-site review of potential soil erosion problems with personnel of the Lebanon County Conservation District (717-272-3908)
  - 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.
- D. All building materials and wastes shall be removed from the site and recycled or disposed of in accordance with the DEP's solid waste management regulations at 25 Pa. Code 260.1 et seq., 271.1 and 287.1 et. Seq. No building material or wastes or unused building materials shall be burned, buried, dumped, or discharged at the site.
- E. The Contractor shall be responsible for ensuring that any material brought on site is clean fill. DEP Form FP-001 must be retained by the property owner for any fill material affected by a spill or release of regulated substance but qualifying as clean fill due to analytical testing.

##### 1.02 SUBMITTALS

- A. Erosion and Sediment Pollution Control Plan: Prior to earth moving activities furnish two

copies of plan approved by regulatory agency having jurisdiction.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Materials for erosion control work are as described in the approved plan prepared by the Contractor.

## PART 3 EXECUTION

### 3.01 INSTALLATION

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

END OF SECTION

## SECTION 02300

### TUNNELING, BORING AND JACKING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section Includes: This Section includes the tunneling, boring and jacking work to pass pipe lines under public transportation rights-of-way.
  - 1. The Contractor shall have the option to perform the pipeline highway and railroad crossing work of this Section by any of the above stated methods. A combination of the methods will not be allowed.
- B. Related Sections:
  - 1. Shoring: Section 02151.
  - 2. Trenching, Backfilling and Compacting: Section 02221.
  - 3. Piped Wastewater Sewers: Section 02722.
  - 5. Cast-In-Place Concrete: Section 03300.

##### 1.02 REFERENCES

- A. American Association of State Highway and Transportation Officials (H-20): (AASHTO) Loading for Conduits Installed Under Streets, Road, or Highways.
- B. American Railway Engineering Association (A.R.E.A.) (Cooper E-80).
- C. American Society for Testing and Materials:
  - 1. ASTM A 53, Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless.
  - 2. ASTM A 123, Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip.
  - 3. ASTM A 139, Electric-Fusion (Arc) Welded Steel Pipe (NPS 4 in. and over).
  - 4. ASTM A 307, Carbon Steel Externally and Internally Threaded Standard Fasteners.
  - 5. ASTM A 569, Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
  - 6. ASTM A 615, (S1), Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, including Supplementary Requirement.
  - 7. ASTM C 32, Sewer and Manhole Brick (Made from Clay or Shale), Spec. for.
  - 8. ASTM C 33, Concrete Aggregates.
  - 9. ASTM C 144, Aggregate for Masonry Mortar.

10. ASTM C 150, Portland Cement.
11. ASTM C 207, Hydrated Lime for Masonry Purposes.
12. ASTM C 270, Mortar for Unit Masonry.
13. ASTM F 467, Nonferrous Nuts for General Use.
14. ASTM F 468, Nonferrous Bolts, Hex Cap Screws and Studs for General Use.

D. American Welding Society: AWS D1.1 Structural Welding Code.

E. Commonwealth of Pennsylvania Department of Transportation (PDT), Specifications Publication 408, as supplemented.

1. PDT Section 703.3 Select Granular Material.
2. PDT Section 703.2 Coarse Aggregate.

F. CE-8 Specifications for Pipeline Occupancy of Consolidated Rail Corporation Property.

G. Requirements and Specifications for Pipeline Occupancy, National Railroad Passenger Corporation, Northeast Corridor (Control No. OCE-0110).

#### 1.03 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.

1. The shop drawings shall show the cross section dimensions, diameter and thickness gauge of the liner plate.
2. Submittal drawings and computations shall bear the seal of a Registered Professional Engineer.

B. Furnish PennDOT and the railroad company (as applicable) for approval, detail drawings, accompanied by design calculations, for the following:

1. Tunneling shield, tunneling pits, including sheeting and bracing therefor, tunnel liner plate and tunneling procedure and grouting method.
2. Boring and jacking pits including sheeting and bracing therefor, steel pipe and boring or jacking procedure and grouting method.

C. Certificates: Certified records or reports of results of laboratory tests, such records or reports to contain a sworn statement that laboratory tests have been made as specified.

#### 1.04 QUALITY ASSURANCE

A. Workmen Qualifications: Use only personnel thoroughly trained and experienced in the skills required.

1. 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. State Highway Requirements: 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, 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.
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.
  2. Inspection, insurance or other charges demanded by the Commonwealth of Pennsylvania Department of Transportation, or other authority having jurisdiction shall be paid for by the Owner.
- C. Railroad Requirements: Materials and methods of construction used on railroad company property shall be subject to the approval of the railroad company and the Contractor shall at all times conduct his work and operations fully within the railroad company's rules, regulations and requirements. Ascertain from the railroad company, its rules, regulations and requirements, and what, if any, delays may be encountered. If required by the railroad company, submit for approval an outline of the methods and means proposed for prosecuting the work.
1. Design Criteria for Under Railroads: Encasing conduit under railroad tracks shall be of sufficient strength to support all superimposed loads, including a Cooper E 80 Loading with 50 percent added for impact.
  2. Railroad Standards: Perform work within the railroad company's property in accordance with the requirements of the current edition of the Consolidated Rail Corporation's "CE-8 Specifications for Pipeline Occupancy of Consolidated Rail Corporation Property".
    - a. If required by the railroad company, materials for track supporting structures shall be furnished by the Contractor for installation and removal by personnel of the railroad company.
    - b. The railroad company has the right to provide inspection and signaling and to support, re-ballast, or realign their tracks or perform other work by their own forces. The cost of such items are the responsibility of the Contractor.
    - c. Record and have on file details pertaining to railroad company inspections. Include as a minimum the dates of inspections, number of railroad company personnel and number of hours spent on inspection by railroad company personnel.
    - d. If the thickness of the encasing conduit must be increased to meet the railroad company requirement, furnish and install such at no additional cost over the price bid for the Railroad Crossing.
    - e. Furnish and erect crossing signs on both sides of the tracks. The actual location where each sign is to be erected will be established by the Engineer in the field.

D. Source Quality Control:

1. Laboratory Tests: The Engineer reserves the right to require that laboratory tests be conducted on materials. 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.
2. 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>
Steel Pipe	API 5L	As specified in API 5L
Steel Pipe	ASTM A 139 or ASTM A 53	As specified in ASTM A 139 or ASTM A 53, as applicable

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: No consideration will be given to the nature of materials encountered in tunneling, boring or jacking operations. Remove rock whenever encountered during the tunneling, boring or jacking operations.
- B. Scheduling:
  1. Highway Crossing Schedule: Perform highway crossing operations continuously on a 24-hour basis if required by PennDOT.
  2. Railroad Crossing Schedule: The railroad company will designate the acceptable time for constructing the railroad crossing. It is a requirement of the railroad company that tunneling must be conducted continuously on a 24-hour basis.
- 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. Temporary track supports shall be provided if required, and shall be in accordance with the railroad company temporary track support methods when the pipeline crossing work is being performed.

3. Structure Supports: As specified in Section 02221.
4. Accommodation of Traffic: As specified in Section 02221.
5. Explosives and Blasting: Not permitted in performance of work of this Section.
6. Excavation Conditions: As specified in Section 02221.
7. Excess Materials: As specified in Section 02221.
8. Borrow Material: As specified in Section 02221.

## PART 2 PRODUCTS

### 2.01 ENCASING CONDUIT

- A. Steel Tunnel Liner Plate: Cold formed, steel, four flanged liner plates of minimum inside neutral axis diameter as indicated on the Drawings, or as indicated by the Engineer.
  1. Material: Structural quality hot rolled carbon steel conforming to ASTM A 569, and hot-dipped galvanized conforming to ASTM A 123.
    - a. Minimum Thickness: U.S. Standard Gauge 8, marked on each liner plate by manufacturer.
  2. Grout Holes: Provide tapped grout holes and plugs, minimum 1 ½-inch diameter, in every third plate.
  3. Nuts and Bolts: Minimum ½-inch diameter, coarse thread, conforming to ASTM A 307, Grade A.
  4. Coating: Factory coated inside and outside with asphaltic material to a minimum thickness of 0.05 inch.
  5. Acceptable Manufacturers:
    - a. Armco Drainage and Metal Products, Inc.
    - b. Republic Steel Corp.
    - c. Commercial Shearing and Stamping Company.
    - d. Or equal.
- B. Steel Pipe for Highway Crossing: Conforming to ASTM A 139, Grade B or ASTM A 53, Grade B, and of minimum diameter as indicated on the Drawings.
  1. Minimum Wall Thickness: 0.500-inch, or as required by the individual site design criteria.
- C. Steel Pipe for Railroad Crossing: Conforming to API 5L Grade B, seamless steel and of minimum diameter as indicated on the Drawings.
  1. Minimum Wall Thickness: 0.562-inch.

### 2.02 SEWER PIPE AND FITTINGS

- A. Ductile Iron Pipe (DIP): As specified in Section 02722.
  1. Use mechanical joint pipe.
- B. Reinforced Concrete Pipe (RCP): As specified in Section 02722 .

- C. Prestressed Concrete Cylinder Pipe (PCCP): As specified in Section 02722.
- 2.03 MISCELLANEOUS MATERIAL

- A. Aggregate Backfill: Aggregate material conforming to the following and the choice of material being as required according to the Engineer's direction in the field.
1. AASHTO No. 8 Coarse Aggregate conforming to PDT Section 703.2.
  2. Select Granular Material conforming to PDT Section 703.3.
- B. Brick: Commercially manufactured brick made from clay or shale and burned, meeting requirements of ASTM C 32, Grade MS.
- C. Waterproofed Mortar: Conforming to requirements of ASTM C 270 for Type M, 2500 psi (Parts by volume include: One part cement, 1/4 part lime, and sand at not less than 2-1/4 nor more than three times the sum of the volumes of cement and lime used and of the following materials:
1. Waterproofing Agent: Medusa Waterproofing Powder by Medusa Portland Cement Co.; Hydratite by Grace Construction Materials; or Hydrolox by Chem-Master Corp. Add the Medusa product in the ratio of two pounds per bag of cement; add the other products per manufacturer's recommendations.
  2. Portland Cement: Conforming to ASTM C 150, Type I.
  3. Hydrated Lime: Conforming to ASTM C 207, Type S.
  4. Sand: Conforming to ASTM C 144.
  5. Water: Clean and free from deleterious amounts of acids, alkalis, and organic materials.
- D. Concrete: Class B (3000 psi.), as specified in Section 03300.
- E. Lean Concrete: Plant mixed concrete of 2000 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: Lean concrete shall contain aggregate with particle size not less than 1/8-inch or more than 1/2-inch in any dimension and a maximum of five percent of particles passing a No. 8 sieve.
- F. Grout: Sand/Cement grout composed of the following materials:
1. Portland Cement: Conforming to ASTM C 150 Type II.
  2. Sand: Conforming to ASTM C 33, fine aggregate.
  3. Water: Potable.
  4. Grout Mixture: Mixture of one part Portland Cement, three parts fine aggregate and water.
- G. Sand: Conforming to ASTM C 33, fine aggregate.
- H. Hold Down Rod: Reinforcement bar conforming to ASTM A 615, Grade 60, deformed.
1. Field coat hold down rods with a coal tar product such as No. 46-465 H.B. Tnemecol

as manufactured by Themec Company, Inc., or equal.

- I. Pipe Support System (Casing spacers for pipe support in Encasing Conduit): Provide casing spacers to prevent direct contact between the carrier pipe and steel encasing conduit. Casing spacers may be either of the following types except that a mixture of the two types is not acceptable.
  1. Banded Wood Skid/Blocking (Pipe Support in Conduit): Composed of stainless steel band strapping and preservative treated wood blocking. Material composition as follows:
    - a. Wood Skid/Blocks: Wood species of the allowable types under recognized 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.
    - b. Steel Bands: Use one inch wide (minimum) 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.
  2. Casing Spacer System (Pipe Support in Conduit): Composed of coated steel band with plastic block/runners or skids. Material composition as follows:
    - a. Plastic Skid/Blocks: Glass reinforced molded plastic runner blocks having a compression strength of 18,000 psi according to ASTM D 695, and a tensile strength of 17,600 psi according to ASTM D 638.
    - b. Steel Band: 14 gauge steel, hot rolled and pickled. Two piece design through 36-inch carrier pipe size. Bands shall have deep embossed flanges and corner cut angles greater than 90 degrees.
      - 1) Bands shall contain an integral polyvinyl chloride (PVC) isolation liner of 0.90-inch thickness and Durometer hardness of A85-90.
      - 2) Bands provided with installation connection hardware consisting of cadmium plated 5/16-inch studs with hex nuts and washers; minimum of six studs on an 8-inch wide band.
      - 3) Bands factory finished in 10 to 16 mils thick fusion bonded PVC coating.
    - c. Acceptable Manufacturers:
      - 1) PSI Pipeline Seal and Insulator, Inc.
      - 2) Cascade Waterworks Mfg. Co.
      - 3) APS Advance Products and Systems, Inc.
- J. Railroad Crossing Sign: Provide sign of dimensions and lettering as illustrated on the Drawings and of the following construction:
  1. Sign Plate: Mill finish aluminum alloy 6061-T6, minimum 0.080 inch thick.
  2. Steel Pipe Post: Conforming to ASTM A 53 with schedule 40 wall thickness and galvanized finish.
  3. Hardware: Aluminum U-bolts, nuts and washers conforming to ASTM F 467 and

ASTM F 468.

5. Painting: Prior to painting, thoroughly clean the sign plate surfaces with the products for surface preparation as recommended by the paint material manufacturer. Perform painting using the following products or equal.
  - b. Apply one coat of Sherwin-Williams Zinc Chromate Primer No. B50Y1, which when thoroughly dry shall be followed by two coats of Sherwin-Williams Metalastic Enamel (White).
  - c. When the second coat of enamel has thoroughly dried, have a professional sign painter perform the required lettering to the satisfaction of the Engineer, using a grade of exterior black paint as recommended by the sign painting profession.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Field Inspection: Inspect the specified Products before installation 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.

### 3.02 PREPARATION

- A. Excavation Work: As specified in Sections 02221 and such added requirements as specified herein:
  1. Over Excavation: Should the Contractor in constructing an Access Pit excavate below the subgrade for the proposed crossing, he will be required to backfill the area excavated below the subgrade with Aggregate Backfill or with Class B concrete as required by the Engineer and at no increase in Contract Price.
  2. Tunneling Pit: Construct tunneling pits as illustrated on the Sewer Detail Drawing entitled: Tunnel Work Pit and Tunnel Liner Plate.
  3. Access Pit for Boring or Jacking: Preliminary work shall consist of excavating and shoring an acceptable shaft on the downstream side of the crossing and the installation of a backstop and guide timbers.
    - a. Bracing and Backstop Design for Jacking: The bracing and backstops shall be so designed, and jacks of sufficient rating shall be used, so that the jacking can be progressed without stoppage except for adding lengths of pipe. Accurately place guide timbers on line and grade.
- B. Shoring: As specified in Section 02151. Follow OSHA requirements for excavation shoring as applicable to prevent excavation wall collapse.

### 3.03 CONSTRUCTION

- A. Construction Options: The Contractor shall have the option to construct the pipeline

crossing encasing conduit by tunneling methods, or by boring or jacking methods. A combination of the methods will not be allowed.

- B. Tunneling Operations: Tunneling shall conform to the applicable requirements of Section 02221 and the applicable requirements of the appropriate referenced regulatory agencies.
1. Liner Plate Installation: Install the Steel Tunnel Liner Plate to the limits indicated on the Drawings or required by the Engineer or the regulatory agencies.
    - a. Exercise care in trimming the surface of the excavated section in order that the steel liner plates fit snugly against undisturbed material wherever possible.
    - b. Do not advance excavation ahead of the previous installed liner plates any more than is necessary for the installation of the succeeding liner plate.
    - c. Support the vertical face of the excavation as necessary to prevent sloughing. Completely bulkhead the heading at any interruption of the tunneling operation.
  2. Painting: Field paint the bolt heads and nuts of the installed tunnel liner plate.
  3. Grouting Operations: Completely fill the voids behind the liner plate or encasing conduit (as applicable) by placing a uniform mixture of grout under pressure.
    - a. Provide grout holes tapped for no smaller than 1 ½-inch pipe, spaced at approximately three feet around the circumference of the tunnel liner plates in every third ring.
    - b. Start grouting at the lowest hole in each grout panel and proceed upwards simultaneously on both sides of the tunnel.
    - c. Install threaded plug in each grout hole as the grouting is completed at that hole.
    - d. Proceed with grouting as required by the Engineer, but in no event shall more than six linear feet of tunnel be progressed beyond the grouting.
- C. Boring Operations: Boring shall conform to the applicable requirements of the appropriate referenced regulatory agency and 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 agency.
  2. 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.
  3. Over-cut by the cutting head shall not exceed the outside diameter of the encasing conduit by more than one-half inch.
  4. The use of water or other liquids to facilitate casing placement and spoil removal is prohibited.
  5. If voids develop, or if bored hole diameter is more than one inch greater than the outside diameter of the encasing conduit, place Grout to fill the voids.
  6. Check conduit alignment in a manner and at times required by Engineer. Check alignment and grade at least once each working shift as the work progresses.
  7. Completely bulkhead the heading at interruptions in boring operation.
  8. Completely weld joints around the circumference between sections of steel pipe encasing conduit.

- D. Jacking Operations: Jacking shall conform to the applicable requirements of the regulatory agencies and additional requirements specified herein. This operation shall be conducted without hand mining ahead of the pipe and without the use of any type of boring, augering, 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. Support the vertical face of the excavation as necessary to prevent sloughing.
  3. Use poling boards and bulkheads as required if subgrade conditions in the heading are unstable.
  4. Jacking and excavation within the pipe shall proceed simultaneously with the ground being cut no more than two inches outside the pipe at the top and sides and not less than two inches above subgrade at the bottom.
  5. The use of water or other liquids to facilitate casing placement and spoil removal is prohibited.
  6. If voids develop, or if jacked hole diameter is more than one inch greater than the outside diameter of the encasing conduit, place grout to fill voids in manner approved by the regulatory agencies.
  7. Check conduit alignment in a manner and at times required by Engineer. Check alignment and grade at least once per shift as the work progresses.
  8. Completely bulkhead heading at interruptions in jacking operation.
  9. Completely weld joints around the circumference between sections of steel pipe encasing conduit.
- E. Laying and Supporting Pipe: Lay the pipeline in the encasing conduit as specified in 02722, as applicable, and such added requirements included herein:
1. Support and maintain the alignment and grade of the pipeline until the concrete cradle is poured and the hold down rods are set.
  2. Provide concrete cradle as indicated on Detail Drawings. Concrete construction as specified in Section 03300.
  3. Support and maintain the alignment and grade of the pipeline 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.
- F. Tunnel or Encasing Conduit Filling and Closing: After the pipeline has been installed in the tunnel or encasing conduit, and the pipeline has been tested, fill the encasing conduit with Sand or Lean Concrete as required by the regulatory agency.
1. The end of the casing shall be encased with either brick and mortar or synthetic rubber end seals with stainless steel bands. If using brick and mortar, close one end of encasing conduit with brick and mortar before filling encasing conduit. Close other end of the tunnel or encasing conduit with Brick and Waterproofed Mortar after filling the tunnel or encasing conduit, or as the filling operation dictates. If using a synthetic rubber end seal, use model AC Pull on End Seal by Advanced Products & Systems, Inc.



G. Railroad Crossing Sign: Erect Railroad Crossing Signs on both sides of the tracks at railroad crossings, in locations indicated on the Drawings or as established by the Engineer in the field.

H. Cleanup: As specified in Section 02221.

#### 3.04 FIELD QUALITY CONTROL

A. Testing: After laying pipe in encasing conduit is completed, and before filling the encasing conduit, perform pipe line acceptance testing as specified in Section 02722 as applicable.

END OF SECTION

## SECTION 02500

### PAVING AND SURFACING

#### PART 1 GENERAL

##### 1.01 REQUIREMENTS OF REGULATORY AGENCIES

###### A. State Highway Regulatory Requirements:

1. Removal, protection and replacement of paving on State Highways is subject to inspection by Commonwealth of Pennsylvania Department of Transportation representatives. Perform work in accordance with requirements of Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 459, Occupancy of Highways by Utilities, July, 1989.
2. Pavement removal and replacement requirements on State Highways specified in this Section are requirements of Highway Occupancy Permit obtained by Township and supersede similar requirements of Title 67, Chapter 459, regulations. However, requirements of Highway Occupancy Permit are subject to change by Pennsylvania Department of Transportation.
3. Inspection, insurance or other charges demanded by Commonwealth of Pennsylvania Department of Transportation, or other authority having jurisdiction will be paid for by the Contractor whether billed to Owner or Contractor.

###### B. Township Streets:

1. Perform removal, protection and replacement of paving on township streets in accordance with requirements of the Street Cut Permit as issued to the Contractor by the North Cornwall Township Code Enforcement Officer.

#### PART 2 PRODUCTS

##### 2.01 MATERIALS

- ###### A.
1. Use paving and surfacing materials as required by the particular regulatory agency having jurisdiction.

#### PART 3 EXECUTION

##### 3.01 CONSTRUCTION

- ###### A.
1. Perform the paving and surfacing construction work in accordance with the requirements of the particular regulatory agency having jurisdiction.

END OF SECTION

## SECTION 02531

### PRESSURE WASTEWATER 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 appurtenance.
- B. Related Sections:
  - 1. Trenching: Section 02221.
  - 2. Manholes: Section 02601.
  - 3. Piped Wastewater Sewer: Section 02722.
  - 4. 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 B2.1, USAS-Pipe Threads (except Dryseal).
  - 9. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
  - 10. ANSI B16.21, Nonmetallic Gaskets for Pipe Flanges.
  - 11. ANSI B18.2.1, Square and Hex Bolts and Screws, Including Askew head Bolts, Hex Cap Screws, and Lag Screws.
  - 12. ANSI B18.2.2, Square and Hex Nuts.
- B. American Society for Testing and Materials.
  - 1. ASTM A36; Specification for Structural Steel.
  - 2. ASTM A47, Specification for Ferritic Malleable Iron Castings.
  - 3. ASTM A48, Specification for Gray Iron Castings.
  - 4. ASTM A123, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 5. ASTM A126; Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

6. ASTM A167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
7. ASTM A183, Specification for Carbon Steel Track Bolts and Nuts.
8. ASTM A240, Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
9. ASTM A283, Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
10. ASTM A307; Specification for Carbon Steel Externally Threaded Standard Fasteners.
11. ASTM A320, Specification for Alloy Steel Bolting Materials for Low-Temperature Service.
12. ASTM A536, Specification for Ductile Iron Castings.
13. ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
14. ASTM B140 Specification for Copper-Zinc-Lead (Leaded Red Brass or Hardware Bronze) Rod, Bar, and Shapes.
15. ASTM B371, Specification for Copper-Zinc-Silicon Alloy Rod.
16. ASTM B584, Specification for Copper Alloy Sand Castings for General Applications.
17. ASTM C534, Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
18. ASTM D1599, Standard Test Method for Short-Term Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.
19. ASTM D1784, Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
20. ASTM D1785, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80 and 120.
21. ASTM D2000, Standard Classification System for Rubber Products in Automotive Applications.
22. ASTM D2241, Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR-Series).
23. ASTM D2466, Specification for Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
24. ASTM D2564, Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
25. ASTM D2774, Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.
26. ASTM D3139, Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
27. ASTM E84, Test Method for Surface Burning Characteristics of Building Materials.
28. ASTM F477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
29. ASTM SB800.

C. American Water Works Association:

1. AWWA C104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

2. AWWA C151, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
3. AWWA C600, Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances.
4. AWWA C800, 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. Valves.
  5. Air Release and Cleanout 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 stating that the 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 of class of pipe in any continuous sewer between structures, unless otherwise indicated on the Drawings.
  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: As a condition of the Contract, factory tests of pipe materials listed in the following, shall have been performed. 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>
a. Polyvinyl Chloride Pipe	ASTM D2241	As specified in ASTM D2241.
b. Polyvinyl Chloride Pipe	ASTM D1785	As specified in ASTM D1785.
c. Ductile Iron Pipe	ANSI A21.51	As specified in ANSI A21.51.

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 Proposal Form from the fund stipulated for the purpose.

#### 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, if any, 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, for pipe laying work.

### PART 2 PRODUCTS

#### 2.01 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) 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 D2241, SDR-21 for 200 psi pressure. PVC material shall conform to ASTM D1784 requirements for Cell Classification 12454B.
1. Pipe Joints: Push-on or compression type, rubber gasket, conforming to ASTM D3139 and ASTM F477 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 D1784 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 D1599 requirements.
  - c. Bells shall be gasketed joint conforming to ASTM D3139 with gaskets conforming to ASTM F477 requirements.
  - d. Acceptable Manufacturer: The Harrington Corporation or equal.
  - 3. Retainers for PVC Pipe: Manufactured from 60-42-10 ductile iron conforming to ASTM A536 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 A536 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. Polyvinyl Chloride (PVC) SCH-40 Pipe and Fittings, Exposed 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 D1785 Schedule 40, pressure Class 160, and manufactured from Class 1245-B Rigid PVC Compounds with a hydrostatic design stress of 13.8 MPa (2000 psi) designated as PVC 1120.
- 1. Socket-Type Joints: Socket-Type conforming to ASTM D2564. Solvent cement for joint making shall conform ASTM D2564.
  - 2. Flanges: PVC Schedule 40 150-lb. flanges manufactured from Rigid PVC Compounds conforming to ASTM D1784.
    - a. Gaskets: Soft rubber full face flat type.
    - b. Bolts: Steel conforming to ASTM A307.
  - 3. Socket Type Fittings: ASTM D2466 manufactured from Class 1245-B Rigid PVC Compound.
  - 4. Provide adapters, nipples, caps, etc., as required.
  - 5. Wall Thickness Class, Buried Pipe: As indicated on Drawings.
  - 6. Wall Thickness Class, Exposed Pipe: Class 53 except as noted otherwise on Drawings.
  - 7. Fittings: Gray iron or ductile iron conforming to ANSI A21.10 requirements, rated for 250 psi working pressure.
  - 8. 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.

9. 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.
  10. 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.
  11. 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 A536. Gland dimensions shall match ANSI A21.11 and ANSI 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.
  12. Pipe and Fitting Lining: Manufacturer's standard cement-mortar lining in accordance with AWWA C104, single thickness. Lining shall include an asphaltic seal coat to prevent moisture loss in cement-mortar curing sequence.
  13. 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.
  14. Pipe and Fittings Coating (Special Coating): Ductile iron pipe factory coated inside and out with Bitu-Chem No. 32-B-4 Pennox-Tar by Pennsburg Coating Corporation. Prepare pipe surfaces per coating manufacturer's instructions and coat to 20 mils minimum dry mil thickness.
- 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.
  - d. Or equal.

## 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 E84. Insulation manufactured to meet requirements of ASTM C534. 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.
    - d. Or equal.
- C. Curb Stop and Box: Designed to conform to Standard AWWA 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 A283, (Grade A) requirements, fabricated in a true circular section and free of surface defect.

2. Follower Rings or Flanges: Steel construction conforming to ASTM A47 (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 A183 requirements, double radius head or button head 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.
- E. Stainless Steel Pipe Supports: Fabricate pipe supports and pipe straps for exposed piping using AISI Type 304 stainless steel conforming to ASTM A167. 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 AISI Type 303 or Type 304 stainless and nut and washer of AISI Type 316 stainless.
  2. Standard Bolts, Nuts and Washers: AISI Type 304 stainless steel conforming to ASTM A320.
- F. 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 D2000 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.
- G. Cast-In-Place Concrete Products: As specified in Section 03300.
1. Use Class B (3,000 psi.) quality concrete, unless indicated otherwise on the Drawings.

## 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 A48, 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 SB800 requirements.
  8. Mechanism Lever Pins and Float: High strength stainless steel, conforming to ASTM A240 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. Or equal.
- 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 A48, Class 35 requirements.
  2. Inlet Size: 2-inches.
  3. Discharge Orifice: 2-inches.
  4. Float Stem and Guide: Bronze, conforming to ASTM B584 requirements.
  5. Floats: Stainless Steel, conforming to ASTM A240 requirements.
  6. Orifice Seat: Buna-N, Nitrile Rubber, conforming to ASTM SB800 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. Or equal.
- 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 A48, 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 SB800 requirements.
9. Air Release Valve Mechanism Lever Pins and Float: High strength stainless steel, conforming to ASTM A240 requirements.
10. Air and Vacuum Valve Float Stem and Guide: Bronze, conforming to ASTM B584 requirements.
11. Air and Vacuum Valve Floats: Stainless Steel, conforming to ASTM A240 requirements.
12. Air and Vacuum Valve Orifice Seat: Buna-N, Nitrile Rubber, conforming to ASTM SB800 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. Or equal.

D. Valve Support work: Provide steel support as indicated on the Standard Details.

1. Miscellaneous Metals: Steel conforming to requirements of ASTM A36 and galvanize finished according to ASTM A123.
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 A320.

## 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 allows 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.
  - a. Physical properties of brass pressure containing parts shall conform to ASTM B62.
  - b. Stems fabricated of Alloy A (rolled silicon brass) conforming to ASTM B371, or Copper Alloy No. 876 (silicon bronze + silicon brass) conforming to ASTM B584, 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.
    - 3) Or equal.

C. Plug Valves (Straightway Type): 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 A126 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.
  - e. Or equal.

- D. Bronze Ball Valves: Valve body of solid bronze material conforming to ASTM B584, 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 B140.
  - 5. Acceptable Manufacturers:
    - a. Crane Co.
    - b. Or equal.
- 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 D1784 with sealing O-rings of Viton.
  - 3. Acceptable Manufacturers:
    - a. NIBCO Inc.; True-Union Ball Check.
    - b. Or equal.

## 2.05 PRECAST CONCRETE CHAMBERS

- A. Terminal Cleanout Chambers, In-Line Chambers, Junction Cleanout Chambers, and Air Release Chambers: In general, the materials and construction shall conform 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 A48.
- B. Piping in Chambers: Provide ductile iron pipe and ductile iron or cast iron fittings within 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 pipe from the Project site and replace with new Products at no increase in Contract Price.
  - 1. Pipe 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 keeps 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

### 3.03 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, 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.
- 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 D2774.
  - 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.
  - c. Joint Restraints: Install joint restraints at changes in direction of pipe runs and at terminal ends of pipe runs in accordance with the following table:

**PVC PIPE RESTRAINED JOINT DIMENSIONS**  
(In feet of straight pipe for each leg)

<u>Fitting</u>	<u>1 1/2 in. through 4 in. Dia. Pipe</u>
Plug	25
Tee	25
Lateral	25
90 deg.	25
45 deg.	15
22 1/2 deg.	15
11 1/4 deg.	15

5. Laying/Joining Ductile Iron Pipe: Installation and joint assembly according to AWWA C600, 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.
6. Flanged Joints: To make ductile iron pipe flanged joint, face flanges true and fit with gaskets, and draw flanges up square and tight to insure full gasket flow and satisfactory seal.
  - a. 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. 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

(In feet of straight pipe for each leg)

	6 Inch Dia.	8 Inch Dia.
<u>Fitting Type</u>	<u>Pipe</u>	<u>Pipe</u>
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.
- B. Flexible 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 completion of backfilling the trenches, for his own purposes. However, the leakage tests of 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. Testing Equipment: Use testing apparatus equipped with a control panel with necessary piping, control valves and gauges to control pressure within piping test section and to monitor pressures throughout the test.
  - 1. To prevent accidental overloading of piping test section, provide testing apparatus with an approved pressure relief device set to relieve at ten psig.
  - 2. Provide an extra pressure gauge of known accuracy to frequently check test equipment and apparatus.
  - 3. Testing equipment and associated testing apparatus subject to Engineer's approval.
- 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 the pressure wastewater sewers, 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. Consider pressure wastewater sewers acceptable when measured leakage does not exceed ten gallons per day per mile per inch of pipe diameter.
- E. 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.
- F. Owner's Tests: The Owner reserves the right to retest, at his expense, 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 02601

### MANHOLES

#### PART 1 GENERAL

##### 1.01 DESCRIPTION

- A. This section specifies construction of the various types and sizes of manholes required.

##### 1.02 SUBMITTALS

- A. Precast concrete manholes
- B. Manhole steps.
- C. Gaskets, adapters, and other appurtenances
- D. Manhole castings
- E. Design mixtures: For each precast concrete mixture, include compressive strength and water-absorption tests.
- F. Manholes installed within PennDOT Right-of-Way shall be PennDOT Certified products.
- G. Manhole corrosion protection liner submittals, if required.

##### 1.03 QUALITY ASSURANCE

- A. Source Quality Control:
  - 1. Maintain uniform quality of products and component compatibility by using the products of one manufacturer for precast reinforced concrete
  - 2. Obtain certificate of construction compliance with ASTM C 478 from the precast reinforced concrete manhole manufacturer. Submit this certificate as part of required submittals.
  - 3. Obtain certificate 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.
  - 4. The Engineer reserves the right to accept certified test records or reports of previously conducted tests

## 1.04 PRODUCT 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. 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. Exercise such particular care in storage of the specified appurtenant products as recommended by their respective manufacturers.
- C. Manholes and all related materials will be thoroughly inspected for defects prior to their being installed. Any defective, damaged, or unsound material shall be repaired or replaced as directed.

## PART 2 PRODUCTS

### 2.01 PRECAST CONCRETE MANHOLE COMPONENTS

- A. Materials and Fabrication: Conforming to requirements specified in ASTM C 478 except as follows:
  - 1. Concrete: Composition and compressive strength conforming to ASTM C 478 except use Type II or Type III cement in manhole components and increase compressive strength to 4500 psi (at 28 days) in precast bases.
  - 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, prealigned vertically, spaced on equal centers, and located minimum distance from ends of risers and top sections as indicated on Construction Drawings. Steps shall be aluminum or reinforced plastic.
  - 4. Manhole Component Seals: Manhole component joints factory formed for self-centering concrete to concrete bearing employing a preformed plastic sealing compound.
  - 5. Lifting Holes and Lugs: Through-wall lifting keys or lugs not permitted in manhole component construction. Factory-install lifting keys or lugs integrally in manhole components.
- B. Precast Concrete Manhole Bases, Top and Riser Sections
  - 1. Manholes shall be 48" diameter unless otherwise noted.
  - 2. All manholes shall be eccentric cone top sections unless noted otherwise.
  - 3. Base sections shall be monolithically cast and shall consist of a manhole bottom and a wall which shall extend a minimum of 10 inches above the top of the highest influent sewer.
  - 4. Pipe openings shall be preformed during manufacturing in each base and riser

section requiring a pipe opening. Pipe opening seals shall be integrally cast with holes for pipe. Seals shall be all-rubber composition, flexible, pliable and provide up to 15 degrees lateral, diagonal or vertical pipe deflection. When steel clamps are used to connect the pipe into the seal, two clamps shall be used. Gaskets shall meet or exceed rubber quality standards of ASTM C-443.

5. Precast riser sections shall be construction as specified previously under materials and fabrication.
6. Precast top sections shall be as required by the Construction Drawings, and of materials and construction as specified herein, except differing requirements as follows:
  - a. Hold Down Bolt Inserts: Factory cast the inserts in the top section with no fewer than ¾-inch threaded inserts or slotted inserts to accommodate manhole frame hold down bolts. Provide threaded inserts of three inches depth and designed for 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.
  - b. Eccentric Cone Tops: Provide precast tops of the same minimum wall thickness and same area of circumferential steel reinforcement as riser sections.
7. The following manufacturers are approved for precast concrete manufacturers:
  - a. Monarch Products, Co. Inc.
  - b. Terre Hill Concrete Products
  - c. Approved equal

C. Manhole Frame and Cover Castings:

1. Castings shall be heavy duty cast iron 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 Construction Drawings.
2. Bearing surfaces shall be machined to prevent rocking and rattling under traffic.
3. Cast the word "SEWER" integrally on cover in two inch raised letters.
4. Cover gasket shall be one piece O-ring gasket factory installed in a machined rectangular or dovetail groove in the cover bearing surface.
5. Where manhole frame and covers are to be replaced on manholes that are not to be replaced, it is the Contractor's responsibility to measure existing manhole casting and determine if listed models below will work for this application.
6. The following manufacturers and models are approved for manhole frame and cover castings:
  - a. NEENAH Foundry Company, Model 1642 381-1 or Model 16422018 for low profile applications.
  - b. East Jordan Iron Works, Inc.

D. Grade Adjustments: Contractor shall have the option of using precast grade rings or poured in place adjustments for manhole frame and cover. In either case, the grade

adjustment shall not exceed six (6) inches. For poured in placed grade adjustments, on-site mixing of concrete is not permitted. Precast grade rings, if used, shall be manufactured in compliance with the requirements of the Specifications for Precast Reinforced Concrete Manhole Sections, and ASTM Designation C 478. Split grade rings or broken/cracked grade rings are unacceptable. Contractor shall be responsible for providing a grade adjustment that is watertight. Leveling rings are not permitted on new construction.

- E. Cement Grout: grouts shall be non-shrink, non-metallic. Use Type II cement where grout is in contact with sewage.
- F. Waterproofing Mortar: Use material conforming to requirements of ASTM C 270 for Type M with waterproofing admixture included. Apply in accordance with manufacturer's instructions. Acceptable manufacturers include:
  - 1. Medusa Waterproofing Paste by Medusa Portland Cement Co.
  - 2. Hydratite by Grace Construction Materials.
  - 3. Hydrolox by Chem Master Corporation.
- G. Preformed Plastic Gasket: A flexible plastic gasket-type sealant for manhole joints shall be butyl rubber (plastic) sealant that meets the requirements of the Federal Specification SS-S-210A (3.4 Adhesion & Hydrostatic Pressure) and shall conform with the applicable requirements specified in Section 5.7 of ASTM C 361.
- H. Drop Manholes: Construct inside drop manhole connections whenever the difference between the invert in and invert out in a manhole is greater than 24 inches. Inside drop shall be constructed using a PVC bowl and hood with stainless steel expansion anchors installed every 24". The incoming pipe shall be trimmed so that 2" maximum protrudes into the manhole. A V-shaped notch shall be cut into the bottom edge of the incoming pipe. A PVC drop pipe with 90 degree PVC bend flush with the channel shall be installed. If necessary, the channel shall be formed to accept the flow from the inside drop connection. Installations with the drop pipe discharging onto the bench will not be accepted. The Duran Inc. Reliner system shall be installed.
- I. Intermediate Platforms: Install intermediate platforms on all manholes with a depth greater than 20 feet. The intermediate platforms must be constructed of concrete or stainless steel and must be an integral part of the manhole structure. In instances where intermediate platforms are required, manholes must be a minimum of 5 foot in diameter.
- J. Corrosion Protection Lining: Proposed or existing manholes which receive discharge of wastewater from a pump station force main must be sprayed with a corrosion protection lining material after installation. The lining material must be installed from the invert to the manhole frame including all donuts and manhole bases. Manhole steps shall be covered during the lining and liner must be sprayed around the steps. Dry finish thickness of the liner shall be a minimum of 250 mils for existing manholes and 150 mils for new manholes. The lining system shall be SprayRoq SprayWall.

## PART 3 EXECUTION

### 3.01 EXAMINATION

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

### 3.02 PREPARATION

- A. Perform earthwork for manhole installation as specified in Section 312333.

### 3.03 MANHOLE CONSTRUCTION METHODS

- A. Precast Concrete Manhole Bases: Install bases on a 6-inch deep compacted layer of aggregate as shown on the Construction Drawings. Cast-in-Place concrete manhole bases or doghouse manholes are not permitted.
- B. Length of Pipe Connection; Use pipes no longer than five feet in length when connecting mainline into manholes.
- C. Manhole frame and cover castings shall be set to be flush with grade in streets once they are overlaid. Set manhole frame and cover to conform to roadway grade and crown.
- D. When a manhole is located outside a paved area, the finished elevation of the top of frame and cover shall be set to 18 inches above finished grade.
- E. A minimum drop of 0.10 feet in manhole between invert in and invert out is required for 8 inch diameter pipe.
- F. Factory formed channels are acceptable if the channel is poured properly to the satisfaction of the Engineer. Use Class B (3000 psi) concrete as specified in Section 03300. Where manholes have more than one influent line, the channels shall be properly formed as to direct the flow into the main channel and downstream. All channels shall be molded of proper size, cross section, and to the require grade. All bends in channels shall be built with the maximum possible radius. Channels shall be finished smooth in a neat and workmanlike manner with trowels. The pipe invert shall match the invert of the channel.
- G. Where required, on-site mixing of concrete for channel construction or poured grade adjustment risers is not permitted.



- H. Precast reinforced concrete risers and top sections necessary to build a completed manhole shall be furnished, and the different sections shall fit together readily to permit effective jointing.
- I. Preformed plastic sealing compound joints between adjacent sections shall be carefully made in accordance with the written instructions of the manufacturer. After the joints have been made, the preformed plastic sealing compound shall be cut or troweled smooth across the joint on the inside of the manhole wall.
- J. Sections shall be joined in a manner that provides the steps to be set in a straight line on the side of the manhole and spaced out as set forth on the Construction Drawings. The top manhole step shall be a maximum of 9" from the top of the manhole cone section.
- K. New connections into existing manholes must be core-drilled. Core drilling is not acceptable under manhole steps or at joint sections.

#### 3.04 MANHOLE FRAMES AND COVERS

- A. Where required, final adjustment of frames to elevation shall be made by poured concrete adjustment risers or precast concrete rings. In either case, elevation adjustments shall not be permitted to exceed six (6) inches. Leveling rings are not acceptable in new construction.
- B. The joint between the bottom of the frame and the top of the manhole section or the top of the grade adjustment riser as applicable, shall be made with preformed plastic sealing compound and shall be sealed on the outside surface using non-shrink grout.
- C. Frames must be bolted to the manhole section regardless of its location. Bolt frames through grade adjustments so that bolts are securely fastened to the top of manhole section.

#### 3.05 MANHOLE REHABILITATION AT CONNECTION POINTS

- A. The Owner and/or Engineer will inspect the condition of all existing manholes to which connection will be made as part of the sewer extension. If necessary, the Owner will require rehabilitation or complete replacement of the manhole.
- B. The Contractor will be required to remove all brick and existing concrete and other riser materials and replace with new poured concrete adjustment risers. If the total riser exceeds six-inches the cone section is to be removed and a larger cone section and/or intermediate barrel section shall be installed. Contractor is responsible for verifying shiplap prior to ordering any materials.
- C. Manhole frames and covers will be inspected and could require replacement if they are in poor condition or do not meet current specifications.

- D. Installation of a corrosion protection lining could be considered in place of full replacement. In all cases, lining (as specified herein) shall be installed after all connections are made and shall be required to pass a vacuum test. Manhole preparation shall be in accordance with the manufacturer's specifications for installation.

### 3.06 ADDITIONS AND ALTERATIONS TO EXISTING MANHOLES

- A. Examination/Verification: Prior to manhole frame and cover adjustment to the proposed new grades, the Contractor shall verify the required height adjustment for the existing manhole frame and cover and determine the additional manhole components required.
  - 1. The determination of whether grade rings or a short wall section will be required is dependent on compliance with OSHA regarding entry to the first manhole step distance limitations.
- B. Earthwork: Perform the required excavation necessary to conduct the manhole additions and alterations work. Perform the excavation by such means and methods as will not damage the existing materials.
  - 1. Salvage the existing topsoil within the excavation limits and stockpile for subsequent replacement following the completed work.
  - 2. Upon completion of the additions and alterations work, backfill the manhole using the as-excavated material placing the material in six inch compacted layers. Perform the final layer of material placement using as-excavated topsoil.
- C. Salvage/Preparation: Carefully remove the existing manhole frames and covers, and also the reusable precast concrete components, and stockpile for subsequent reinstallation in the manhole frame and cover raising operations.
  - 1. Perform cleaning operations on the salvaged materials to remove mortar and concrete residues and to promote bonding with the fresh materials upon reinstallation.
  - 2. Remove and dispose of brick and mortar where such materials were used for manhole frame and cover adjustment-to-grade.
  - 3. Core bore holes in the existing manhole top sections where required for new manhole frame and cover anchor bolts installations.
- D. Installations: In general, the means and methods of performing manhole additions and alterations operations are the sole responsibility of the Contractor, but subject to the limitations as follows:
  - 1. Keep the manhole interior free of debris as the additions and alterations work is being performed.
  - 2. Perform cleaning and surface preparation of the existing manhole components, which are not being removed, to promote proper bonding of both reinstalled and newly installed material.
  - 3. Dispose of cleaning and construction debris and other materials in a lawful manner off site.

4. Raising/Setting Manhole Frames and Covers: To make manhole frame and cover adjustments to meet the new grades, comply with the following:
  - a. Where conditions require a new short wall section unit under the existing tapered section, install such new section as previously specified under Manhole Construction Methods, Manhole Wall Erection.
  - b. Where conditions require the use of additional new precast concrete grade rings and waterproofed mortar, set grade rings as specified previously for Frame and Cover Installation.
  - c. Leveling rings may be permitted at the approval of the Township Engineer. All leveling rings must be welded to the frame assembly.
  - d. Following the manhole additions and alterations work as specified above, reinstall the prepared cast iron manhole frame and cover as specified previously for Frame and Cover Installation. Apply anti-seize lubricant to cover tightening bolts.

### 3.07 ACCEPTANCE TESTING

- A. General Requirements: New manholes that are installed as part of the sewer extension must be tested using the procedure herein. Additionally, any manholes to which a connection is made will need to be vacuum tested. The Contractor is encouraged to perform a pre-construction vacuum test prior to connecting into existing manholes. If a pre-construction vacuum test is not performed, the Contractor will be responsible for determining the source of leaks in the existing manhole and repairing the leaks. Pre-construction vacuum testing must be performed in the presence of the Engineer.
- B. Conduct tests in the presence of, and to the complete satisfaction of the Engineer.
- C. Contractor shall provide all tools, materials, equipment and instruments necessary to conduct the manhole testing specified herein.
- D. Vacuum testing equipment: Use vacuum apparatus equipment with necessary piping, control valves and gauges to control air removal rate from the manhole and to monitor vacuum. Pressure gauge must be oil filled and read in inches of mercury, not in PSI. Vacuum testing apparatus are subject to Engineer's approval.
- E. Testing shall be performed with frames installed. Include the joint between the manhole and the manhole frame in the test.
- F. Testing shall be performed for acceptance purposes only after the manhole has been backfilled.

- G. Testing Procedure:
1. Prior to testing, clean manholes thoroughly and seal openings, both to complete satisfaction of the Engineer. Seal openings with properly sized plugs.
  2. Draw a vacuum of ten inches of mercury and close the valves.
  3. Consider manhole acceptance when vacuum does not drop below nine inches of mercury for the following manhole sizes and times:
    - a. Four foot diameter manhole: 60 seconds.
    - b. Five foot diameter manhole: 75 seconds.
    - c. Six foot diameter manhole: 90 seconds.
    - d. Eight foot diameter manhole: 120 seconds.
- H. If manhole fails vacuum testing, Contractor shall determine the source or sources of leaks. The manhole shall be retested or replaced and tested at the Contractors expense.
- I. If manholes are adjusted to accommodate final paving, the manhole shall be retested.
- J. Manholes provided with a corrosion protection lining shall be vacuum tested a minimum of 24-hours after the installation of the liner material.

END OF SECTION

## SECTION 02722

### PIPED WASTEWATER SEWER

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section Includes: This Section specifies construction of the various types and sizes of piped wastewater sewers and appurtenances.
- 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 151, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
3. AWWA C 301, Prestressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids.
4. AWWA C 302, Reinforced-Concrete Water Pipe-Noncylinder Type, Not Prestressed.
5. 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. Sewer 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: In addition to the design requirements of the Pennsylvania Department of Environmental Protection (DEP), comply with the following:
1. Use one type and class of pipe in continuous line of sewer between structures, unless otherwise indicated on the Drawings.
  2. Use 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, protect the pipe with concrete encasement or by some other means acceptable to the Engineer.
  4. Whenever concrete encasement of the sewer is required, the entire length of sewer between manholes shall be Ductile Iron pipe.
- B. Source Quality Control:
1. Shop Tests: In accordance with Article 1.06 of the General Instructions, factory tests of pipe materials listed in the following, 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>
Ductile Iron Pipe	ANSI A 21.51	As specified in ANSI A 21.51.
Polyvinyl Chloride PVC Pipe	ASTM D 3034 or F 789 (ASTM F 679 or F 794) as applicable.	As specified in ASTM D 3034 or F 789 (ASTM F 679 or F 794) as applicable.
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.
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 SEWER 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. 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 Polyvinyl Chloride (PVC) Pipe: Provide pipe which is permanently marked with manufacturer's trademark, size and ASTM conformance designation.
1. Pipe, 18 through 48 Inch Diameters: Manufactured to have a smooth interior with a solid cross-sectional ribbed exterior with the ribs perpendicular to the axis of the pipe, and conforming to ASTM F 794 requirements.
  2. PVC Compounds: Complying with the requirements for a cell classification of 12454-B, 12454-C, or 13364-B as defined by ASTM D 1784.
  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.
- E. Ductile Iron Pipe (DIP): Conforming to ANSI A21.50 and ANSI A 21.51 requirements and 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: All pipe and fittings must be provided with Protecto 401 Ceramic Epoxy lining on the interior surface.
- F. 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.
- G. Prestressed Concrete Cylinder Pipe (PCCP): Provide pipe manufactured of Type II Portland Cement conforming to ASTM C 150, and calcereous 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 ½ 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. Pipe opening seals in Manholes shall be all-rubber composition, flexible, pliable and provide up to 15 degrees lateral, diagonal or vertical pipe deflection. Gaskets shall meet or exceed rubber quality standards of ASTM C-443. Gaskets shall be Z-Lok as manufactured by A-LOK PRODUCTS, Inc. or approved equal. PVC waterstops are not acceptable for manhole connections.
- B. Connections into existing manholes shall be accomplished by core drilling and installation of a Kor-N-Seal adapter as manufactured by NPC Systems, Inc.
- C. Flexible Pipe Couplings: Provide flexible pipe couplings designed for differing pipe material connection; and for transition/reducing conditions of differing pipe material connections. **Flexible pipe couplings are not permitted for pipe size over 6" in diameter.**
  - 1. Coupling Construction: Virgin PVC material which meets the requirements of Commercial Standard Specifications CS 226-59. Couplings shall be provided with pre-assembled, type 305 stainless steel bands.
  - 2. Acceptable Manufacturers:
    - a. FERNCO Inc., Distributed by the General Engineering Company.
    - b. Or approved equal.
- D. Mechanical Pipe Couplings: Solid sleeve mechanical couplers will be required for connection of new PVC to existing pipe material greater than or equal to 8 inches in diameter.
  - 1. Gasket material shall be virgin styrene butadiene rubber or ethylene propylene diene monomer rubber compounded for sewer service. Nuts and bolts shall be AISI 304 Stainless Steel.
  - 2. All cast parts shall be coated with fusion bonded epoxy for corrosion resistance.
  - 3. Acceptable Manufacturers:
    - a. Hymax Couplings by Krausz USA
    - b. Romac Industries, Inc.
    - c. Ford Meter Box
    - d. Or Approved equal

## 2.03 LATERAL PIPE AND FITTINGS

- A. Solid Wall Polyvinyl Chloride (PVC) Pipe: As specified under Sewer Pipe and Fittings; six inch diameter. Lateral pipe must be SDR-35. Schedule 40 PVC is permitted for building sewer pipe.
- B. Observation Tee: The Contractor shall install a 6"x 6"x 6" double sweeping tee with a 6" riser pipes to the surface as indicated on the detail drawings. Riser pipe shall be one piece of pipe (no joints) unless the depth exceeds 13 feet. Double sweep tee shall be fabricated from SDR 26 PVC material. Acceptable manufactures include:
  - 1. GPK Product Inc.
  - 2. Multi Fittings Corp
- C. Cleanout Protection Casting: A cleanout protection casting shall be installed as depicted on the detail drawings. Castings shall be gray iron casting conforming to ASTM A48, Class No. 35, designed for AASHTO highway loading class HS-20. Acceptable manufacturers include:
  - 1. Neenah Foundry Company, Model No. NF-1975 479
  - 2. East Jordan Works Inc. Model No. 1565
- D. Use straight tee fittings in the mainline for connection of lateral sewer to mainline. Wye fittings will be accepted in cul-de-sacs or other areas where a tee connection is not feasible. Saddle connections into existing mainline sewers will only be considered when a connection is made into a sewer that was previously lined. Coordination with the Engineer will be necessary for this type of connection.
- E. Pipe Plugs: Designed for permanent installation and removable. Obtain plugs for various types of pipe used from the respective pipe manufacturer.
- F. Repairs: Reconnection of existing building sewer to new lateral shall be as follows:
  - 1. If existing building sewer is cast iron, VCP, ACP or DIP, use a fernco flexible coupling with stainless steel shear bands to connect existing building sewer to new sewer lateral.
  - 2. If existing building sewer is Schedule 40, use a Schedule 40 to SDR-35 adapter to connect existing building sewer to new sewer lateral (GPK Part No. G330-0004)
  - 3. If existing building sewer is SDR-35, use a standard repair coupling to connect existing building sewer to new sewer lateral.

## 2.04 CONTRACTOR OPTIONS IN PRODUCTS

- A. Sewer Pipe and Fitting Options: Unless indicated otherwise on the Drawings, provide one type of pipe in the Project for a particular pipe size range listed herein. However, use only the one type of pipe, as selected, to construct the pipe sewer mains for which pipe material options are allowed.
1. 6-inch Through 15-inch Diameter Sewer:
    - a. Polyvinyl Chloride pipe (PVC), SDR-35 or PS-46.
    - b. Ductile Iron pipe (DIP). 16-inch diameter allowed where 15-inch diameter is indicated on Drawings.
  2. 18-inch Through 27-inch Diameter Sewer:
    - a. Polyvinyl Chloride pipe (PVC): Solid Wall, or PS-46
    - b. Ductile Iron pipe (DIP) 20-inch diameter DIP allowed where 21-inch diameter pipe is indicated on Drawings.
    - c. Reinforced Concrete pipe (RCP), rubber and steel joint.
    - d. Prestressed Concrete Cylinder pipe (PCCP); 20-inch diameter PCCP allowed where 21-inch diameter pipe is indicated on Drawings.
  3. 21-inch Through 48-inch Diameter Sewer:
    - a. Polyvinyl Chloride pipe (PVC): Solid Wall, PS-46 or Closed Profile.
    - b. Ductile Iron pipe (DIP) 20-inch diameter DIP allowed where 21-inch diameter pipe is indicated on Drawings.
    - c. Reinforced Concrete pipe (RCP), rubber and steel joint.
    - d. Prestressed Concrete Cylinder pipe (PCCP); 20-inch diameter PCCP allowed where 21-inch diameter pipe is indicated on Drawings.
  4. Required Pipe Material Exception: Where DIP is indicated on the Drawings no option is permitted because of prevailing site conditions, or DIP is required by utility companies or local governmental bodies.
- B. Pipe Connections to Existing Manholes or Structures Options: Cut the required pipe opening in the manhole by core drilling methods only. Make the pipe opening no more than 2-inches above the bench. The pipe opening seal shall be a Kor-N-Seal as manufactured by NPC Systems, Inc.

## 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 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 blasting, if blasting is allowed in the Project.

### 3.03 SEWER 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. 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. 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. 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. 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.
  - 4. Laying/Joining Specified Types of Plastic Pipe: Installation and joint assembly

according to ASTM D 2321 requirements and for Class I bedding material as included therein.

5. Laying/Joining Reinforced Concrete Pipe: In addition to previously specified reference standard specification requirements, the Rejection requirements of ASTM C 76 govern acceptance of RCP prior to and following installation. Make-up Rubber and Steel joints as follows:
  - a. Joint Make-up: During joint make-up check the gasket position using the pipe manufacturer provided feeler gauge, or similar procedure as recommended by the pipe manufacturer. If the gasket is not in place, open the joint and re-make the joint using a new gasket.
  - b. Finishing the Joint: Position the inverted factory installed grouting diaper properly over the entire joint in accordance with the manufacturer's instructions. Pour the flowable grout mixture into the opening at the top of the diaper so that it completely fills the external joint recess. Rod or puddle the grout to ensure complete filling of the joint recess. Apply a stiff grout mix over the diaper opening to form a grout seal.
6. Laying/Joining Prestressed Concrete Cylinder Pipe: In addition to previously specified reference standard specification requirements, the Rejection requirements of AWWA C 301 govern acceptance of PCCP prior to and following installation.
  - a. Joint Make-up: During joint make-up check the gasket position using the pipe manufacturer provided feeler gauge, or similar procedure as recommended by the pipe manufacturer. If the gasket is not in place, open the joint and re-make the joint using a new gasket.
  - b. Finishing the Joint: Position the inverted factory installed grouting diaper properly over the entire joint in accordance with the manufacturer's instructions. Pour the flowable grout mixture into the opening at the top of the diaper so that it completely fills the external joint recess. Rod or puddle the grout to ensure complete filling of the joint recess. Apply a stiff grout mix over the diaper opening to form a grout seal.

C. Lateral Connection Fittings:

1. Tees: Make connections to sewer using straight tee fittings of same material and joint configuration as the sewer at planned point of branch connection.
  - a. Use commercially manufactured tee fittings and one-eighth bends.
  - b. Set tee branches at proper vertical angles as required to bring service connections to the proper depth.
  - c. Fittings locations determined by the Engineer with respect to service connections to existing house or building location.
2. Plugs: Close free ends of branches and service connections with a carefully fitted plug. Type of plug used and method of installation to Engineer's approval. Installed plugs shall successfully pass Line Acceptance Tests.

D. Drop Connections: Make drop connections where indicated on the Drawings, where drop

in invert is two feet or more or as required by the Engineer. Use same pipe material used to construct the main from which the drop connection is made. Construct drop connection in accordance with design shown on Detail Drawing. Inside drop connections shall be constructed using a PVC bowl and hood with stainless steel expansion anchors installed every two feet. The Duran Inc. Reliner system shall be installed for inside drop connections. Outside drop connections are not preferred by the Township and will only be approved on a case by case basis. If an outside drop connection is proposed by a Developer, the piping for the drop must be ductile iron lined with Protecto 401.

- E. Connections to Existing Manholes or Structures: Make pipe connections to existing manholes or structures in accordance with the appropriate requirements as follows:
  - 1. Core-Drilled Opening Utilizing Pipe Seal: Use this method of connection as the Township'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 Kor-N-Seal adapter.
  - 2. New Invert Channel: 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 to the existing mainline.
- F. Reconnection of Existing Service Connections: Cut in new PVC tee fittings for connection to the existing sewer main. Use pipe as specified previously. Make connection to existing piping with mechanical pipe couplings.
  - 1. Service connection fittings as specified previously.
  - 2. Use commercially manufactured tee fittings and one-eighth bends.
  - 3. Set tee branches at proper vertical angles as required to bring service connections to the proper depth.
  - 4. Fittings locations determined by the Engineer with respect to existing service connection location.
  - 5. Pipe material shall be PVC unless existing main pipe material is DIP. If existing main pipe material is DIP, a DIP tee fitting and pipe shall be used.



G. Stream Crossing: Construct stream crossing in accordance with the requirements of Section 02221 and the following:

1. Pipe: Construct stream crossing using only Ductile Iron Pipe, concrete encased as specified in Section 02221.

### 3.04 BUILDING SEWER CONSTRUCTION

A. General Requirements: Construct building sewers to such points indicated on Drawings, or to such other points designated by the Engineer. . Lay and join building sewers in every respect as specified for Sewer Construction Methods except as follows:

1. Line and Grade: Lay service connections true to line and grade furnished by Engineer, and unless otherwise required by Engineer, at a 90 degree angle to curb line.
2. Test Tees: Test tees which are buried are strictly prohibited.
3. Deep Sewer Service Connection: 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 shown on Drawings for Service Connection-Deep Sewer. Construct of same material used for service connections.
4. Where RCP or PCCP is used for pipe sewer mains use PVC pipe for service connection piping. Provide suitable adaptor.
5. Where DIP is used for pipe sewer mains use DIP and fittings for the service connection piping.

### 3.05 FIELD QUALITY CONTROL

A. General Requirements: Conduct tests specified herein so that each pipe line installed in the Project is tested to the Engineer's satisfaction.

1. Provide tools, materials (including water), apparatus and instruments necessary for pipe line testing as performed by the Contractor.
2. Conduct tests in the presence of and to the satisfaction of the Engineer.

B. Tests by Contractor: Perform the following as work and tests by the Contractor:

1. Cleaning prior to Tests.
2. Initial Section Test.
3. Deflection Test.
4. Infiltration Test.
5. Repair and Retest.

C. Testing Equipment: The Contractor shall provide the following testing equipment:

1. 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.
  2. Provide all other equipment, materials, and labor necessary to conduct Contractor required tests.
- D. 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.
- E. 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.
- F. 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 Standards listed therein:
  1. Plug free ends of laterals at the observation tee. The testing must be performed so that the double sweep tee and the riser pipe are included in the test. Sand bags should be placed on top of the riser pipe. Building sewers shall be tested separately at the time of connection to the sewer extension.
  2. Seal Sewer piping at upstream and downstream manholes with pneumatic type plugs. Test plug seal before actual use by testing plugs outside the trench in one length of pipe pressurized to maximum anticipated testing pressure. Plugs to hold without bracing and show no movement.
  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. DIP, RCP, PCCP: Test according to [ASTM C 924](#).
    - b. PVC Pipe, Solid Wall: Test according to [UNI-B-6](#).
    - c. PVC Pipe, Profile Wall: Test according to [UNI-B-6](#).
    - d. VCP Pipe: Test according to [ASTM C 828](#).
  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 packer that is capable of
    - b. After entering each pipeline segment with the test equipment, position the packer on a section of sound sewer pipe between joints and perform a test. The equipment shall hold a 7-10 psi test pressure for a period of 15 seconds with a pressure drop less than 1 psi. In the event of a failed test, repair any defective equipment and re-test to verify proper operation of all equipment.
    - c. Joint testing pressure shall be equal to 0.5 psi per vertical foot of pipe depth plus 2 psi. However, joint testing pressure shall not exceed 10 psi.
    - d. Upon completing the testing of each individual joint, the packer shall be deflated with the void pressure meter continuing to display void pressure. Should the void pressure meter drop to 0.0 +/- 0.5 psi, clean the test equipment of residual grout material or make the necessary equipment repairs to provide for an accurate void pressure reading.
- G. 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.
  4. Deflection testing of rigid piping materials (ductile iron, RCP, etc) is not required or recommended.

- H. 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.
- I. Closed Circuit Television (CCTV) Inspection: Following the successful completion of line acceptance testing and deflection testing, the sewer mains shall be flushed and a final CCTV inspection will be required. The following procedure shall be required:
1. Closed Circuit Television Equipment: Provide a complete closed circuit television system specifically designed and constructed for internal television inspection of sewer piping. The closed circuit television equipment shall be capable of producing picture quality to the satisfaction of the Engineer. System shall include, but not be limited to, the following items:
    - a. A color pan and tilt (270 degrees) camera specifically designed and constructed for sewer inspection. The camera shall be operative in 100 percent humidity and shall be able to pause, pan, and visually inspect all service connections, pipe ends, and maintenance or structure defects.
    - b. Adequate lighting for the pan and tilt camera to provide a clear picture of the entire periphery of the existing sewer.
    - c. Distance meter with monitor screen readout, indicating the location of the television camera at all times.
    - d. A television monitor within a mobile television studio large enough to accommodate up to three people for the purpose of viewing the picture transmitted by the camera.
  2. The video shall include the following minimum site data with the opening text and accompanying voice narrative:
    - a. City
    - b. Street and/or easement location
    - c. Start manhole
    - d. End manhole
    - e. Date of inspection
    - f. Direction of flow
    - g. Pipe diameter
    - h. Pipe material
  3. Access to Municipal Water Supplies: The Contractor shall be responsible for obtaining water required for Work of this Section. The local water supply is owned by the City of Lebanon Authority (717-273-2506). The Contractor shall contact the City of Lebanon Authority to determine availability of water.
  4. The video inspection speed shall generally not exceed 30 feet per minute. The camera should stop at each observation for a reasonable amount of time for observation. Recordings shall clearly show observations in addition to obvious

features such as laterals and joints. The location of observations shall be reported as distance from reference manhole and clock-hour location on pipe circumference.

5. Distance Meter: Accuracy of the distance meter used to determine the locations of the television camera shall be checked by use of a walking meter, roll-a-tap, or other suitable device, and the accuracy of the distance meter shall be with-in +/- two (2) feet of the measured footage between manholes along the existing sewer centerline from the start of the pipe to end of the pipe. The meter shall be calibrated daily.
6. Video Recordings: CCTV inspections will be delivered entirely in electronic format encoded in .WMV, .MPG, .AVI or .MP4 format. The video recording shall include visual identification of each sewer run being televised using the Owner's upstream and downstream manhole nomenclature. Each sewer run shall be a separate file. If the video and/or audio quality is not adequate for post-inspection coding, the Developer shall be required to repeat the survey at the Developer's expense.
7. Inspection Reports: Furnish to the Owner one (1) complete printed copy and an electronic copy of the television inspection reports, logging each section of the sewer main piping televised and providing specific details noting defects and observations encountered during the inspection. All Owner and NASSCO Pipeline Assessment Certification Program (PACP) required header information specified in this Section must be fully and accurately entered on all CCTV reports. Work not following these specifications may be rejected.
8. Still Photographs: Provide digital photographs showing inspection image whenever an observation is recorded. The footage shall be clear and visible on the photograph.
9. Inspection Summary: Furnish to the Owner one (1) printed copy and an electronic Microsoft Excel file of a spreadsheet summarizing the work completed.

END OF SECTION

## SECTION 03100

### CONCRETE FORMWORK

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section Includes: This Section specifies 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 effect 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 p.s.i. 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: This Section specifies 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 INSPECTION

- 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: This Section specifies 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 Sections of this Project Manual. 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

- 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 ½-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. Maximum-size coarse aggregate, inches: | Air content per cent by volume: |
| 1-1/2                                     | 5 plus/minus 1                  |
| 3/4 or 1                                  | 6 plus/minus 1                  |
| 3/8 or 1/2                                | 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 water tightness.
    - a. Hold end joints to a minimum.
    - b. Make water tightness 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.

4. 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 ½-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 manufacturer's 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 less than 12 in.	For sections with least dimension 12 in. or greater
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 troweling 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: This Section specifies the grouts for the individual grouting requirements stated in other Sections of the Specifications and where indicated on the Drawings.
- 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. Parson RPM
    - c. 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



## **NORTH CORNWALL TOWNSHIP**

### **PROCEDURES FOR DEVELOPER SEWER EXTENSIONS**

#### **1.) Introduction:**

This document has been prepared by North Cornwall Township (Township) to minimize conflicts and confusion that may occur from time to time during the Planning, Design, Agreement, Construction, and Guarantee phases of sewer extension projects (projects) undertaken by individuals, corporations, partnerships, etc. (Developers). The following pages illustrate the various procedures and processes involved in the development and completion of such projects. Members of the public are always welcome to attend the Township's regularly scheduled meetings, which are held on the second Tuesday of each month at the Township Building at 7:00 p.m.

#### **2.) Planning Phase:**

During this phase, Developers formally express their intent to construct extensions to the Township's Wastewater Collection System. Consideration must be given to the following items before proceeding to the next phase of the procedures contained herein. The activities outlined below should be concurrent to those outlined in the North Cornwall Township Subdivision and Land Development Ordinance (SALDO).

- Submit project initiation fee of \$2,000.00 to the Township. These funds are required to cover the review phase, capacity requests, planning modules or exemptions, connection options, etc.
- Submit a written request to the Township inquiring as to available capacity to serve the project. Provide the location of the project, the type of development proposed, and the proposed daily sewage flow. The Township will respond as to its available capacity as soon as possible after technical review and discussion.
- Submit a Pennsylvania Department of Environmental Protection (DEP) Planning Module or Postcard to the Township. Because the Township submits future sewage planning information to the DEP annually through its Chapter 94 Reporting procedures, it is recommended that a Postcard be submitted in lieu of a complete Planning Module. If, through consultation with the Township and its engineering consultant, it is determined that a complete Planning Module is required, then one must be submitted. DEP Planning approval is required for all projects and will be reviewed and discussed at the Township's meeting.
- Obtain a copy of the Township's "Standard Construction and Material Specifications for Sanitary Sewer System Extensions" (Specifications). All requirements discussed in the sections that follow are included in the Specifications. No formal engineering submission for a project should be developed without a comprehensive understanding of the information contained in the Specifications. Copies of the Specifications can be downloaded at <http://www.nctown.org/departments-services/sewer> or a hard copy can be purchased at the Township Building for \$50.00. Specifications may be inspected at the Township Building during regular business hours. Payment must be made in the form of a check payable to the Township.

## **NORTH CORNWALL TOWNSHIP**

### **PROCEDURES FOR DEVELOPER SEWER EXTENSIONS**

- Contact the Township's Engineer, ACT ONE & Associates at 717-236-7500. The Developer and his Engineer are encouraged to meet with the Township's Engineer prior to making formal plan submissions. The Township's Engineer will provide guidance on the procedures contained herein as well as site-specific design recommendations based on the Township's design standard requirements as required under the Specifications.

### **3.) Design Phase:**

During this phase, Developers submit documents for review to the Township for the project. Depending on the nature of the project, some, several or all of the submission items listed below may apply. The activities outlined below should be concurrent to those outlined in the most recent version of the Township's SALDO.

- Establish an Escrow Account with the Township by providing a \$5,000.00 payment to the Township and identifying the project. These funds are required to pay both engineering review and legal fees incurred. For larger projects, the initial deposit may not be adequate and may be increased. The Township will send notification to the Developer when the Escrow Account approaches the minimum balance of \$1,500.00. Requests for additional funds are typically in increments of \$3,000.00, unless the project has been approved by the Engineer without condition. In the event that the Escrow Account reaches the minimum balance of \$1,500.00, engineering review work on the project will cease until the Developer's Escrow Account is replenished. The engineering review work will resume within a reasonable amount of time depending on workload of the Township's Engineer. In order to prevent delays in engineering reviews, the Developer can opt to deposit any sum of money into the Escrow Account in order to maintain the balance. Any money remaining in Escrow after the project is completed will be returned to the Developer.
- Submit Drawings for review. The Drawings will be reviewed by the Township's Engineer. If any revisions are required, comments will be provided. Upon approval, five (5) copies of the final Drawings will be requested.
- Submit sewer Right-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. The plats and legal descriptions will be reviewed by the Township's Engineer. If any revisions are required, comments will be provided. Upon approval, five (5) copies of the final plats and legal descriptions will be requested. The plats and legal descriptions will then be forwarded to the Township's Solicitor for preparation of Deeds of Easement. The Deeds will be forwarded to the property owner(s) for execution, and then forwarded to the Township for recording.

## **NORTH CORNWALL TOWNSHIP**

### **PROCEDURES FOR DEVELOPER SEWER EXTENSIONS**

- If the project involves construction activities within a PennDOT Right-of-Way, a Highway Occupancy Permit (HOP) must be prepared by the Developer or his Engineer and submitted to the Township for execution. All HOPs must be prepared with the Township as the permittee. Upon execution by the Township at its meeting, the HOP will be forwarded to PennDOT.

Once the Drawings are approved, the Developer will be notified as such and be provided an itemized listing of remaining items required prior to being issued Notice to Proceed (NTP) with construction of the project. (See 4.) and 5.) below)

#### **4.) Agreement Phase:**

During this phase, the Sewer Extension Agreement (Agreement) is developed, approved and executed and the NTP is prepared. Several pieces of information that are required from the Developer are vital to the development and eventual execution of the Agreement.

Although the Township's Engineer may not require all items for all projects, generally, the items discussed below must be received in acceptable format no less than fourteen (14) days prior to the next scheduled regular meeting of the Township in order to allow adequate time for development and execution of the Agreement.

- Submit the Contractor's Construction Cost Estimate. The Township's Engineer will check the material quantities and costs and make adjustments as required to determine an acceptable construction cost. This value (including 10% contingency) will be provided to the Developer for use in obtaining Financial Security for the construction phase of the project.
- Submit the Contractor's Estimated Level of Effort for Construction and Testing in man-days. The level of effort must be categorized by man-days necessary for mainline construction, lateral construction (extending to the right-of-way line), mainline deflection testing, manhole vacuum testing, and CCTV work. This level of effort will be used to determine the amount of on-site inspection time required for the project.
- Indicate the desired form of Financial Security. The most common forms of Financial Security are Performance and Payment Bonds or Letters of Credit. Standard surety bond forms or AIA forms may be used if found to be acceptable by the Township Solicitor. All Letters of Credit shall contain an "Evergreen" clause, which will cause the Letter of Credit to automatically renew for successive one (1) year period(s) if the issuing financial institution does not request its release at least sixty (60) days prior to its expiration date.
- Submit Developer Contact information for inclusion in the Agreement, unless submitted during a previous phase of the project.

## **NORTH CORNWALL TOWNSHIP PROCEDURES FOR DEVELOPER SEWER EXTENSIONS**

Upon receipt of the above information, the Township's Engineer will estimate the amount of funds required for deposit into the Escrow Account to accommodate the subsequent Construction and Guarantee Phases of the project. The Township's Engineer will also develop the Agreement and forward five (5) copies to the Developer for execution. The Agreements must be executed and returned to the Township's Engineer. The Agreements will be presented to the Township during the next scheduled Township meeting for approval and execution.

The following items must be submitted to the Township's Sewer Engineer in acceptable format prior to the NTP being issued:

- Submit four (4) copies of the Contractor's Insurance Certificate. Limits of liability are outlined in the Specifications. The Township and its Engineer must be included on the Policy as additional insureds. If any additional information is required, the Township's Engineer will request it from the issuing Insurance Agency.
- Submit five (5) copies of Shop Drawings for sewer construction materials. If Shop Drawings are submitted in an electronic format, they will be returned in an electronic format.
- Submit the required number of copies of the Financial Security documents for the dollar amount specified in the Agreement. Submit one (1) original Letter of Credit, and four (4) original Performance and Payment Bonds.
- A deposit of the required amount of funds into the Escrow Account with the Township for construction phase activities as specified in the Agreement. The Developer must deposit the required amount into the Escrow Account prior to being issued NTP with construction. On occasion, situations develop during construction proceedings that will prolong inspection and document review time beyond the Township's Engineer's estimate. In such cases, the amount of funds requested for the construction phase escrow deposit may not be adequate. The Township will send notification to the Developer if the Escrow Account balance is in jeopardy of being exhausted.

### **5.) Construction Phase:**

During the construction phase, the Developer's Contractor installs the sewer extension in accordance with the approved Drawings and Specifications. The Township's Engineer or other qualified inspector conducts inspection of the installation process to assure that the materials used and methods employed are in conformance with the Specifications. Upon completion, all acceptance testing of the new sewers is completed per the requirements of the Specifications. The following describes the sequence of events during the construction-phase activities of a project.

## **NORTH CORNWALL TOWNSHIP**

### **PROCEDURES FOR DEVELOPER SEWER EXTENSIONS**

- The Developer is issued written NTP with sewer construction by the Township's Engineer. The NTP letter is normally provided with copies of the following attachments:
  1. Executed Agreement
  2. Executed Financial Security papers (Letter of Credit or Bonds)
  3. Contractor's Liability Insurance Certificate
  4. Approved Shop Drawings
  5. Approved Construction Drawings
- The Developer's Contractor schedules a construction start date with the Township's designated inspector for inspection services. At least one week notice of the initiation of sewer construction must be provided to set up a meeting on site and coordinate construction inspection activities.
- A Pre-Construction Job conference is held during which the Township's designated inspector explains the procedures required to remain in conformance with the Specifications. Construction and inspection proceeds. The Developer's Contractor and/or Engineer collect information on the sewers as they are constructed to record the installed depth and length of the sewer mains and service laterals. This information is required for the generation of Record Drawings, as required during the Guarantee Phase.
- Construction occurs and after the Contractor indicates that construction is complete, the Township's designated inspector provides a Punch List of remaining tasks to be performed.
- Upon completion of the Punch List items, the Township's designated inspector witnesses a Mandrel Test of the new sewers to determine if any of the lines has a sub-standard alignment. Sub-standard lines must be repaired or replaced.
- Following the successful completion of line acceptance testing and deflection testing, the sewer mains shall be flushed and a final CCTV inspection will be required.

#### **6.) Guarantee Phase:**

During this Phase, the Developer submits documents required to dedicate the sewers to the Township. Record Drawings, plats and legal descriptions, and Guarantee-phase Financial Security are provided to dedicate the sewers to the Township. Promptly upon completion of the construction phase items above, but no longer than sixty (60) days after completion of construction of the extension, the developer shall:

- Submit Record Drawings for review. The Record Drawings will be reviewed by the Township's Engineer. If any revisions are required, comments will be provided.

## **NORTH CORNWALL TOWNSHIP**

### **PROCEDURES FOR DEVELOPER SEWER EXTENSIONS**

- After the Record Drawings are approved by the Township Engineer, submit two (2) sets of prints and one (1) electronic data file on CD or DVD. The electronic data file must be in a format that can be integrated into Geographical Information System (GIS) software. Generally, Record Drawings developed in AutoCAD or any GIS software application is acceptable for an electronic data file. Adobe PDF files do not meet the requirements of an electronic data file.
- Submit plats and legal descriptions for sewer dedication for review. The plats and legal descriptions must be for the alignment of all new sewer lines and manholes. The plats and legal descriptions will be reviewed by the Township's Engineer. If any revisions are required, comments will be provided. Upon approval by the Township's Engineer, five (5) copies of the final plats and legal descriptions will be requested. The plats and legal descriptions will then be forwarded to the Township's Solicitor for preparation of Deed(s) of Dedication. The Deeds will be forwarded to the Developer for execution and return for Township approval and recording.
- Submit Guarantee-phase Financial Security. The required amount for the Guarantee phase is equal to fifteen percent (15%) of the original Construction Cost Estimate. The Guarantee-phase Financial Security must remain in effect for a period of eighteen (18) months, or longer if required by a permitting agency, from the date that the Township receives the executed Deed(s) of Dedication from the Developer. Documents must be submitted to the Township's Engineer for review and approval.

Once the preceding items have been completed the Township will issue Connection Permits allowing service connections to be made to the new lines.

As stated above, the Guarantee-phase Financial Security will expire eighteen (18) months or longer from the Township's receipt of the executed Deed(s) of Dedication. The Township's Letter of Credit contains an "Evergreen" clause, which will cause the Letter of Credit to automatically renew for successive one (1) year period(s) if the issuing financial institution does not request its release at least sixty (60) days prior to its expiration date. The Developer's should be aware of this requirement and assume the responsibility of informing the issuing financial institution within the prescribed time frame. At which time the Guarantee-phase Financial Security expires, the Township's Engineer will recommend that the Township "close out" the Developer's Escrow Account and return any remaining balance to the Developer.

#### **Early Connection Requirements:**

Sewer extensions, to which connections are going to be made prior to dedication to the Township, must pass all applicable acceptance tests outlined in the Township's Specifications. Applicable field quality control testing includes line acceptance testing and deflection testing for piped wastewater sewer, and vacuum testing for wastewater manholes.

## **NORTH CORNWALL TOWNSHIP**

### **PROCEDURES FOR DEVELOPER SEWER EXTENSIONS**

The developer agrees to maintain the sewers until final dedication to the Township. Maintenance activities include but are not limited to clearing clogs, repairing defects, responding to all customer requests and complaints and addressing sources of inflow and infiltration.

Prior to final dedication of sewers to the Township, all sewers previously tested and all sewer facilities for the development to and including the connection to the Township's existing sewer system must pass all applicable acceptance tests. Additionally, internal television inspection of the sewer lines must be completed. Video logs and DVD recordings of the inspection must be provided to the Township for review by its Engineer.

**NORTH CORNWALL TOWNSHIP  
SEWER EXTENSION AGREEMENT**

Project: \_\_\_\_\_

Project No: \_\_\_\_\_

Phase No: \_\_\_\_\_ (if phased) \_

Planned EDU's: \_\_\_\_\_

THIS SEWER EXTENSION AGREEMENT made and executed on this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_, between the NORTH CORNWALL TOWNSHIP, a body corporate and politic existing by virtue of the laws of the Commonwealth of Pennsylvania, with its principal office at 320 S. 18<sup>th</sup> Street, Lebanon, PA 17042 (hereinafter referred to as TOWNSHIP),

and

\_\_\_\_\_  
\_\_\_\_\_  
(Name and address of DEVELOPER - provide photo identification along with verification of entity, whether corporation, partnership or individual)

\_\_\_\_\_  
Phone Number  
(Developer's Contact Person)

\_\_\_\_\_  
Contact Person/Title

WITNESSETH:

WHEREAS, the DEVELOPER intends and is about to develop for residential or other purposes a certain tract of land situate within the sewer franchise areas of the TOWNSHIP, which tract, the location and dimensions of the streets and the existing structures and those intended to be erected thereon, together with the planned number of E.D.U.'s, are generally designated and described on Exhibit "A" attached hereto and made a part thereof;

WHEREAS, the DEVELOPER has made application to the TOWNSHIP for permission to construct, at its own cost and expense and by its own contractors, a sanitary sewer system within the above designated and described tract (Exhibit "A") and to connect the same when completed into the existing sewage collection system of the TOWNSHIP. The DEVELOPER acknowledges that such application was made after having received information from officials of the TOWNSHIP as to the relative costs and expenses thereof.



NOW, THEREFORE, in consideration of the payments and promises hereinafter made, both parties intending to be legally bound do mutually agree as follows:

1. General Items

- a. A document of the TOWNSHIP entitled "Standard Construction and Material Specifications for Sanitary Sewer System Extensions" (hereinafter referred to as "Specifications"), shall be a part of this SEWER EXTENSION AGREEMENT (hereinafter referred to as the "SEA") by reference as though fully set forth herein. Should any provisions of this "SEA" be inconsistent with the provisions of the aforesaid "Specifications", the provisions of the latter, according to their latest amendments, shall prevail.
  - b. The DEVELOPER, at its own cost and expense, will cause to be prepared, by qualified professional engineering personnel, all detailed plans, permit applications and planning modules, hereinafter collectively referred to as "permit documents", for the proposed extension to the sewage collection system of the TOWNSHIP.
  - c. Such plans shall be prepared in compliance with the "Specifications".
  - d. All such "permit documents" shall be supplied to the TOWNSHIP as detailed in the "Specifications".
  - e. Promptly upon receipt of such "permit documents", the TOWNSHIP shall cause same to be submitted to the consulting engineers (herein referred to as the "Engineer"), then representing the TOWNSHIP with relation to this sewer project. Such "permit documents" shall be revised or amended by the DEVELOPER, if necessary, until they are reviewed by the TOWNSHIP'S Engineer and approved by the TOWNSHIP as providing for an extension of a type and nature so planned and to be constructed as to readily become an integral part of the collection system of the TOWNSHIP.
  - f. The approved "permit documents" shall be submitted by the TOWNSHIP, as detailed in the "Specifications" to the Department of Environmental Protection of the Commonwealth of Pennsylvania or the Pennsylvania Department of Transportation. Upon receipt of all required approvals of such regulatory agencies as are required by law and upon compliance by the DEVELOPER with all applicable local ordinances and regulations, the TOWNSHIP will notify the DEVELOPER that work may be started on the project.
  - g. Depending on the nature of the development, it may be necessary to require an additional supplemental agreement to this SEA. The DEVELOPER, in addition to the terms and conditions set forth in this SEA, shall be bound by the requirements set forth in any supplemental agreement.
2. The DEVELOPER shall hire and employ and pay his own contractor, contractors or sub-contractors to construct the extension according to the aforesaid approved plans, and the TOWNSHIP shall have no responsibility or liability for payment of any part of the costs of expenses arising out of or relating to said construction or the labor, materials, and equipment used therein or thereon. The DEVELOPER may also be required to hire a third-party testing

agency to perform tests related to backfill compaction and moisture content. If the TOWNSHIP requests this testing and the DEVELOPER does not satisfy the request, the TOWNSHIP will hire the third-party testing agency and reimburse any expense out of the DEVELOPER'S escrow.

3. The DEVELOPER shall indemnify and save harmless the TOWNSHIP and Engineer and all their officers, agents and employees, from all claims, liabilities, suits, judgments, verdicts, actions or proceedings at law or equity of any kind whatsoever arising out of, connected with or caused by any operation or matter in, of or related to the sewer extension which is the subject of this "SEA", including among other things, injury to property, and injury to and sickness and death of each and every person or persons whatsoever, including without limitation, members of the public and officers, agents and employees of the DEVELOPER, the DEVELOPER's contractor, contractors, or sub-contractors, and the DEVELOPER shall, if required by the TOWNSHIP or Engineer, produce evidence of settlement of any such claims, suits, liabilities, judgments, verdicts, actions or proceedings. The DEVELOPER shall defend or cause to be defended all such above described claims, liabilities, judgments, verdicts, suits, actions or proceedings, groundless or not, which may be commenced against the TOWNSHIP or Engineer or their officers, agents and employees, and the DEVELOPER shall pay or cause to be paid any and all judgments which may be secured in any such actions, claims, liabilities, judgments, verdicts, proceedings or suits, and the DEVELOPER shall defray or cause to be defrayed any and all expenses, including costs and attorney's fees, which may be incurred in or by reason of such actions, claims, liabilities, judgments, verdicts, proceedings or suits. Therefore such defense and indemnification shall be provided by DEVELOPER, including the TOWNSHIP and Engineer and all of their officers, agents and employees as additional insured's under the policies of the DEVELOPER, his contractors and subcontractors that pertain to this project. The DEVELOPER and its contractor shall be solely responsible for construction site safety, safety practices, supervision, direction of personnel, use of equipment and the means, methods and manner of construction employed by the contractor.

The DEVELOPER shall be required to include the above paragraph 3 in all "SEA"s or contracts with his contractor, contractors, or sub-contractors.

4. During the course of the construction, all materials, workmanship, and compliance with the approved plans shall be subject to the inspection of the Engineer for the TOWNSHIP.

The TOWNSHIP and 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 or method of construction employed by the contractors, their sub-contractors, agents, servants or employees; nor will the TOWNSHIP or the Engineer be liable for any matters or claims arising therefrom. The TOWNSHIP and Engineer shall be under no obligation or liability arising from the work of or injuries to the contractors, their subcontractors, agents, servants or employees on said Project.

In the event the materials and/or workmanship are found by the Engineer of the TOWNSHIP to be in noncompliance with the previously described "Specifications", the TOWNSHIP will revoke its approval to proceed with construction. The DEVELOPER hereby agrees to immediately cease construction operations and replace and/or correct the noncompliant materials and/or workmanship. The approval to proceed with construction will be reissued only

upon receipt of written procedures from the DEVELOPER to prevent future noncompliant occurrences. The DEVELOPER shall also be responsible for compliance with inspection requirements of applicable governmental agencies, utility companies and property owners in connection with the construction. Upon completion of the construction of the extension and prior to individual connections thereto, the Engineer for the TOWNSHIP will certify the satisfactory completion thereof to the TOWNSHIP. The TOWNSHIP'S Engineer or other qualified inspector will witness all acceptance testing of the sewer extension per the requirements of the Specifications. Acceptance testing includes air testing of the pipes, vacuum testing of the manholes, deflection testing of the mainline and a final CCTV inspection.

- a. Requirements for Early Sanitary Sewer Connections: Generally, dedication must occur prior to individual connections to the new sewer extension. Sewer extensions, to which connections are going to be made prior to dedication to the Township, must pass all applicable acceptance tests outlined in the TOWNSHIP'S Specifications. Additionally, the developer agrees to maintain the sewers until final dedication to the TOWNSHIP. Maintenance activities include but are not limited to clearing clogs, repairing defects, responding to all customer requests and complaints and addressing sources of inflow and infiltration. Prior to final dedication of sewers to the TOWNSHIP, all sewers previously tested and all sewer facilities for the development to and including the connection to the TOWNSHIP'S existing sewer system must pass all applicable acceptance tests. Additionally, internal television inspection of the sewer lines must be completed. Video logs and DVD recordings of the inspection must be provided to the TOWNSHIP for review by its Engineer.
5. Promptly upon completion of the extension, but not longer than sixty (60) days after completion, the DEVELOPER shall:
  - a. Cause to be prepared and furnished to the TOWNSHIP, and its engineer or other representative, at the expense of DEVELOPER, "Record" drawings of the completed extension project as detailed in the "Specifications" and other drawings, documentation or other material necessary to complete the analysis of the proposed addition to the TOWNSHIP'S sewer system.
  - b. Cause to be executed, acknowledged and delivered to the TOWNSHIP ready for recording, at the sole expense of the DEVELOPER, the Deed of Dedication, which will be prepared by the TOWNSHIP Solicitor at the DEVELOPER'S expense, for the said entire extension project, its pipes, manholes, and all of its appurtenances, as well as all rights, liberties, and privileges appurtenant thereto including rights-of-way over the streets and other thoroughfares and private lands necessary for the existence and future maintenance thereof. The DEVELOPER shall prepare the plat and legal description for the sewers to be dedicated to the TOWNSHIP.
  - c. Deliver to the TOWNSHIP the additional financial security described in Paragraph #11 hereof.
6. Upon receipt and recording of said Deed of Dedication, the extension project and all parts and appurtenances thereof as above described shall be, become, and remain the sole, absolute, and permanent property of the TOWNSHIP or its assigns free and clear of any lien, obligation,

other liability in favor of the DEVELOPER, its successors or assigns, its contractor or contractors, its and their laborers and material men and any of their creditors, or in favor of any other person or corporation, to the same end and effect as if the TOWNSHIP had constructed the extension project with its own labor and at its own expense; and thereafter the TOWNSHIP shall maintain, repair, rebuild and other wise act toward said extension as its own property and at its own cost and expense and the DEVELOPER shall have no further obligation or responsibility thereto except as hereinafter provided. Nothing herein shall be construed to discharge or dilute the contractual obligations of the contractor, contractors, or sub-contractors of the DEVELOPER to guarantee their workmanship and to maintain their ditches and paving for such periods of time following completion as may have been agreed upon by contractors and the DEVELOPER. The DEVELOPER shall and does hereby, for a period of eighteen (18) months or longer if required by the "Specifications" or a permitting agency following payment of all escrows, fees, costs and security required by the TOWNSHIP, the delivery of said Deed of Dedication, and acceptance by the TOWNSHIP, guarantee the said sewer system as to workmanship and materials.

7. Upon or prior to the date of this "SEA", the DEVELOPER has deposited with the TOWNSHIP, the receipt whereof is hereby acknowledged, the sum of \_\_\_\_\_ (\$\_\_\_\_\_), and, which sum shall be held in escrow by the TOWNSHIP, without interest, for the application by the TOWNSHIP to defray the following fees and costs chargeable to the TOWNSHIP in the performance of this "SEA":
  - a. The charges of its Engineer for examination, analysis, studies, reports, letters in connection with its review of the project and review of any and all drawings, documents, inspections, including but not limited to the "permit documents" as referred to in Paragraph #1 (e) hereof.
  - b. The charges incurred in filing the "permit documents" and in securing the approvals thereof as referred to in Paragraph #1 (f) hereof, exclusive of any permit fees. Such permit fees shall be paid by the DEVELOPER as outlined in the "Specifications".
8. Prior to the TOWNSHIP notifying the DEVELOPER that work may be started on the project as referred to in Paragraph #1 (f) hereof, the DEVELOPER shall deposit with the TOWNSHIP the sum of \_\_\_\_\_ (\$\_\_\_\_\_), which shall also be held by the TOWNSHIP, without interest, for application by the TOWNSHIP to or toward the following costs chargeable to it in the performance of this "SEA":
  - a. All charges of its Engineer for conducting further analyses, studies, tests, on-site inspection, shop drawing review and other project and construction related activities as referred to in Paragraph #4 hereof; and
  - b. Legal and administrative expenses incurred by the TOWNSHIP with respect to the Project.

Should the total funds deposited 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 issue a stop work order on the project until said deficiency or expected deficiency has been paid to the TOWNSHIP upon demand by the DEVELOPER and the DEVELOPER shall maintain a balance of at least Two Thousand Dollars (\$2,000.00) in escrow until the acceptance of the Deed of Dedication for the project or later as the TOWNSHIP deems necessary. Upon such demand the TOWNSHIP shall issue a stop work order on the project until said deficiency or expected deficiency has been paid to the TOWNSHIP by the DEVELOPER.

9. Prior to the TOWNSHIP notifying the DEVELOPER that work can begin on the project as referred to in Paragraph #1 (f) hereof, the DEVELOPER shall deliver to the TOWNSHIP, either:
  - a. A "Performance Bond" covering faithful and satisfactory performance of the work herein described, in an amount not less than one hundred ten (110) percent of the construction costs; and a "Payment Bond" in an amount not less than one hundred ten (110) percent of the construction costs covering payment in full for all services rendered (including reasonable rentals of equipment for certain periods), materials furnished, and labor supplied or performed. The same Surety must execute both Bonds. The AUTHORITY will determine the bond form based on the size and cost of the project. Standard surety bond forms or AIA forms may be used if found to be acceptable by the TOWNSHIP's solicitor. The amounts of the Performance Bond and Payment Bond required by this Extension "SEA" shall be (\$\_\_\_\_\_ ) each; OR
  - b. Financial security may be in the form of cash, certified check, or irrevocable letter of credit or restrictive or escrow account in a Federal or Commonwealth chartered lending institution authorized to conduct such business within the Commonwealth of Pennsylvania. Such financial security for this project shall be in an amount of one hundred ten (110) percent of the construction costs or (\$\_\_\_\_\_ ) and shall be used to reimburse the TOWNSHIP for all costs and expenses incurred by it (as evidenced by itemized bills therefore), in completion of the project in the event that:
    - i. DEVELOPER becomes insolvent before completing the construction of the project; or
    - ii. DEVELOPER does not complete the project within \_\_\_\_\_ days after the TOWNSHIP notifies the DEVELOPER that work can begin on the project as referred to in Paragraph #1 (f) hereof.
10. As the project proceeds, the DEVELOPER may request the TOWNSHIP to release or authorize the release, from time to time, such portions of the financial security necessary for payment to the contractor, contractors, or sub-contractors performing the work. Any such request shall be in writing addressed to the TOWNSHIP, shall be in an amount no less than ten percent (10%) of project cost, and the TOWNSHIP shall have forty-five (45) days, from receipt of such request, within which to allow the TOWNSHIP's Engineer, or other Engineer acceptable to the TOWNSHIP, to certify, in writing, to the TOWNSHIP that such portion of the work upon the project has been completed in accordance with this "SEA". Upon such certification, the TOWNSHIP shall release or authorize release by the lending institution of an amount as estimated by the TOWNSHIP's Engineer, or other Engineer acceptable to the TOWNSHIP, that fairly represents the value of the project completed. The TOWNSHIP may, prior to final

release at the time of completion and certification by the Engineer, require retention of 10% of the estimated cost of the aforesaid project.

11. With the Deed of Dedication described in Paragraph #5 (b) hereof, the DEVELOPER shall deliver to the TOWNSHIP additional financial security to secure structural integrity of the project, as well as the functioning of the project in accordance with this "SEA" for a period of eighteen (18) months or longer if required by the "Specifications" or a permitting agency following payment of all escrows, fees, costs and security required by the TOWNSHIP, the delivery of said Deed of Dedication, and acceptance by the TOWNSHIP of the Deed of Dedication. Such financial security shall be in the form of a "Maintenance Bond" or of the same type set forth in Paragraph #9 (b) hereof. This financial security shall be in the amount of 15% of the construction costs or\_\_\_\_\_. The financial security listed in Paragraph #9 hereof will be released upon receipt of this additional financial security when requested by the Developer.
12. Tapping fees shall be due and payable to the TOWNSHIP in full prior to issuance of a building permit in accordance with the requirements of the TOWNSHIP. Capacity fees shall be due and payable to the TOWNSHIP in full prior to approval of the final plans.
13. GOVERNING LAW. This "SEA" shall be interpreted and shall be governed by the laws of the Commonwealth of Pennsylvania, without regard to conflict of law principles.
14. ENTIRE "SEA". All prior oral and written "SEA's" between the parties are merged within this "SEA", which alone fully and completely sets forth the understanding of the parties, and any and all representations by any of the parties or their agents or representatives made prior to or concurrent with execution of the "SEA" which are not specifically contained herein shall not be binding upon any of the parties hereto. This "SEA" may not be changed orally or in any other matter other than by an "SEA" in writing and signing by the party against whom enforcement of the change is sought.
15. BINDING EFFECT. This "SEA", and all of the provisions hereof, shall be binding upon and inure to the benefit of the parties hereto and their respective heirs, personal representatives, successors and assigns.
16. SEVERABILITY. The provisions of this "SEA" are severable. If any provision or part hereof is declared invalid or unenforceable, or is set aside for any other reason by a court of competent jurisdiction, then the remainder of this "SEA" shall remain in full force and effect between the parties.
17. COUNTERPARTS. This "SEA" may be executed in counterparts.

IN WITNESS WHEREOF, the TOWNSHIP has caused the within "SEA" to be executed in this corporate name over the signature of its Chairman, and its corporate seal to be hereunto affixed, duly attested by its Secretary; and the DEVELOPER has caused same to be executed by its duly authorized representatives; all on the day and date first above written.

BOARD OF SUPERVISORS  
NORTH CORNWALL TOWNSHIP  
Lebanon County, Pennsylvania

ATTEST:

By: \_\_\_\_\_  
Chairman

\_\_\_\_\_  
Secretary

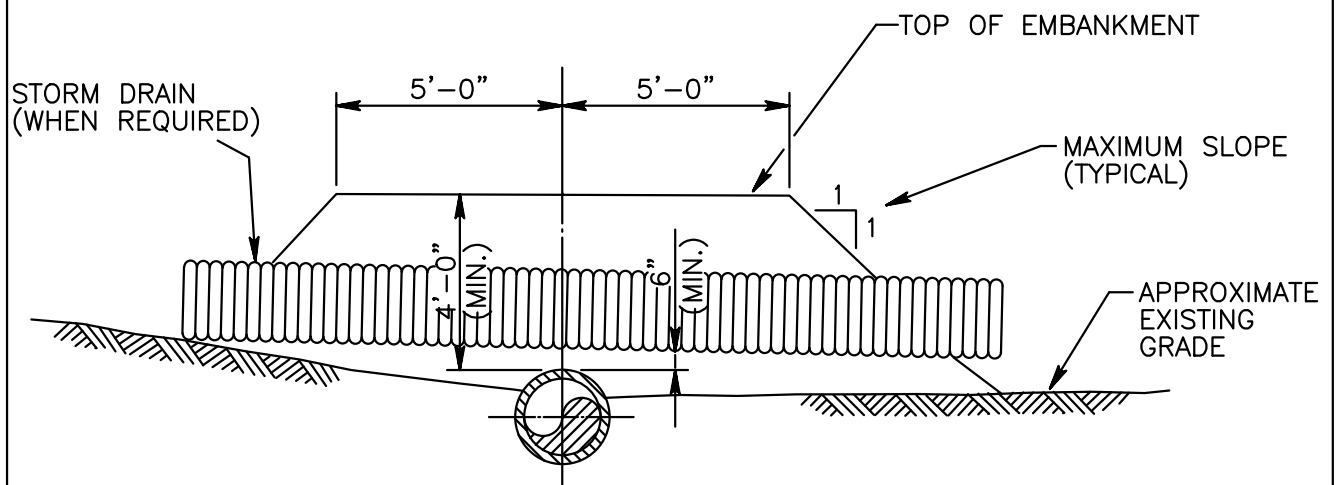
(SEAL)

\_\_\_\_\_  
DEVELOPER NAME

WITNESSES:

By: \_\_\_\_\_  
Authorized Signature and Title

\_\_\_\_\_  
\_\_\_\_\_

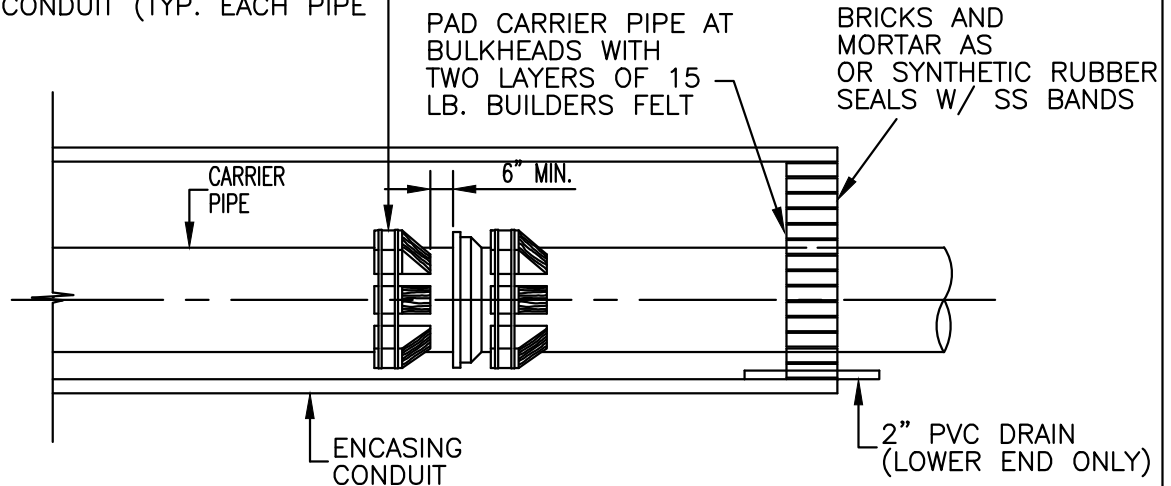


SECTIONAL ELEVATION

EMBANKMENT (EM)



PRESSURE TREATED LUMBER SKIDS  
OF PROPER WIDTH AND LENGTH TO  
ACCOMMODATE TWO GALVANIZED STEEL  
STRAPS AND MAINTAIN ADEQUATE  
CLEARANCE BETWEEN PIPE BELL AND  
ENCASING CONDUIT (TYP. EACH PIPE  
SECTION)



SIDE ELEVATION

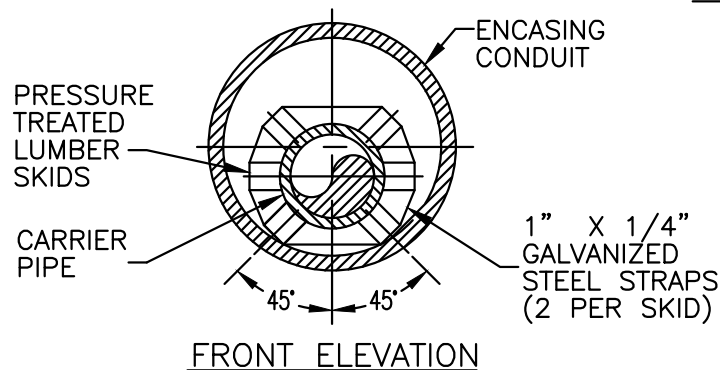
#### ENCASING CONDUIT NOTES

1. SKIDS TO BE LUBRICATED WITH GREASE TO FACILITATE INSTALLATION OF CARRIER PIPE.
2. UPON COMPLETION THE VOID SPACE BETWEEN THE ENCASING CONDUIT AND THE CARRIER PIPE MUST BE FILLED WITH LIMESTONE CHIPS.

2-1" WIDE NOTCHES  
FOR STEEL STRAPPING

SIDE ELEVATION

SKID

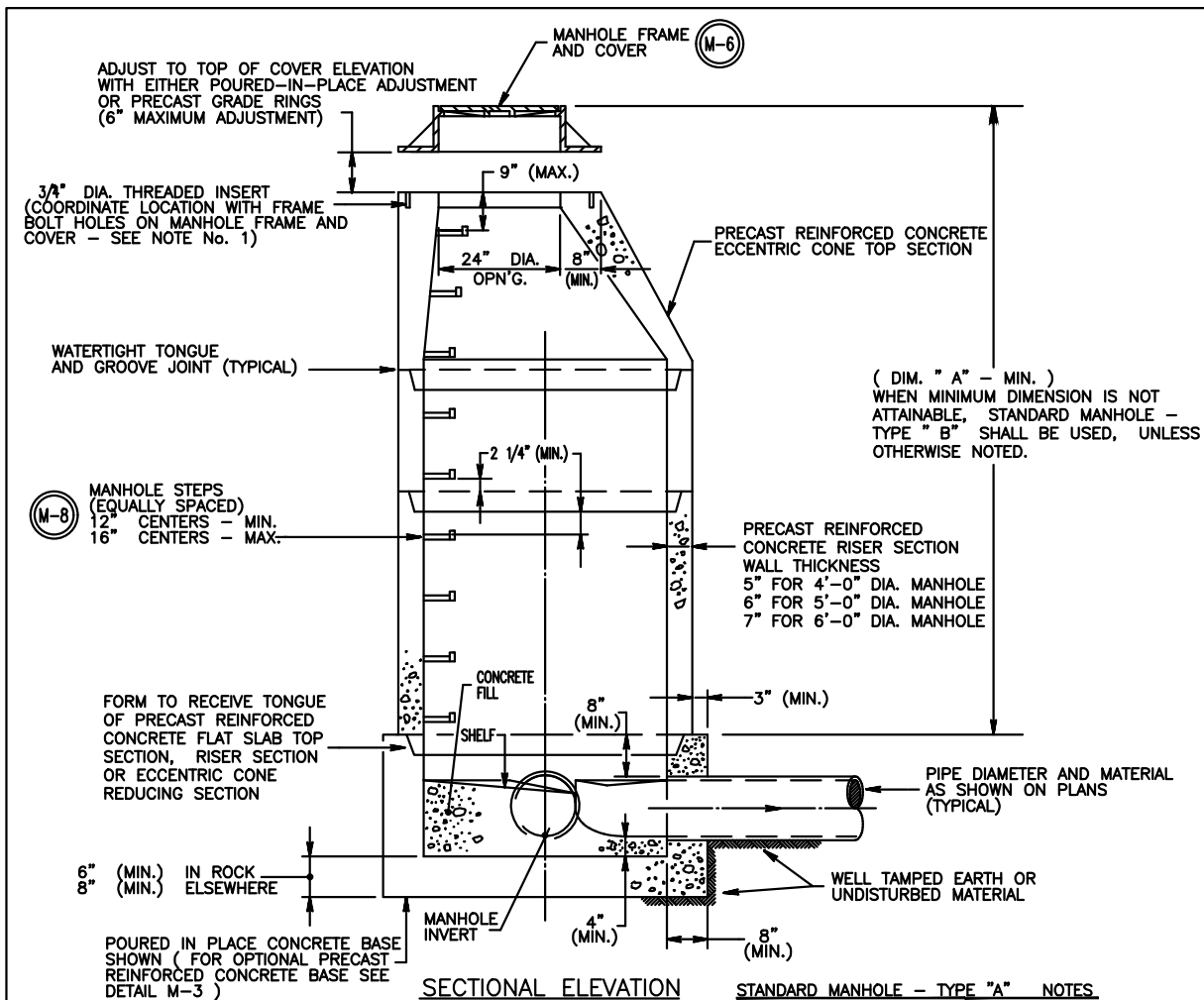


FRONT ELEVATION

#### ENCASING CONDUIT

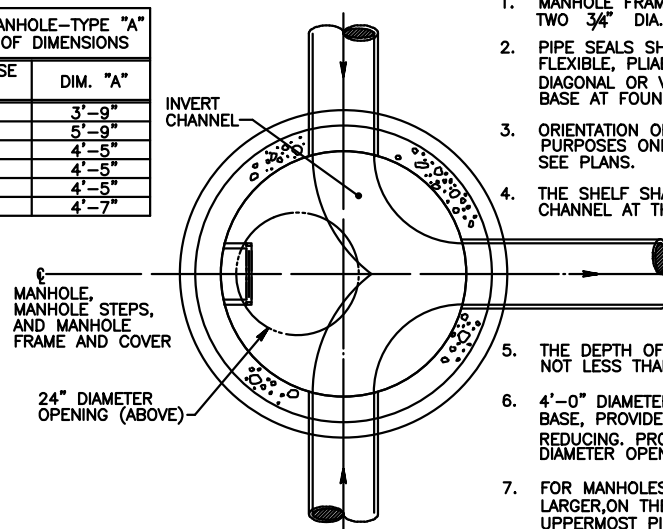
(REMOVABLE CARRIER PIPE)





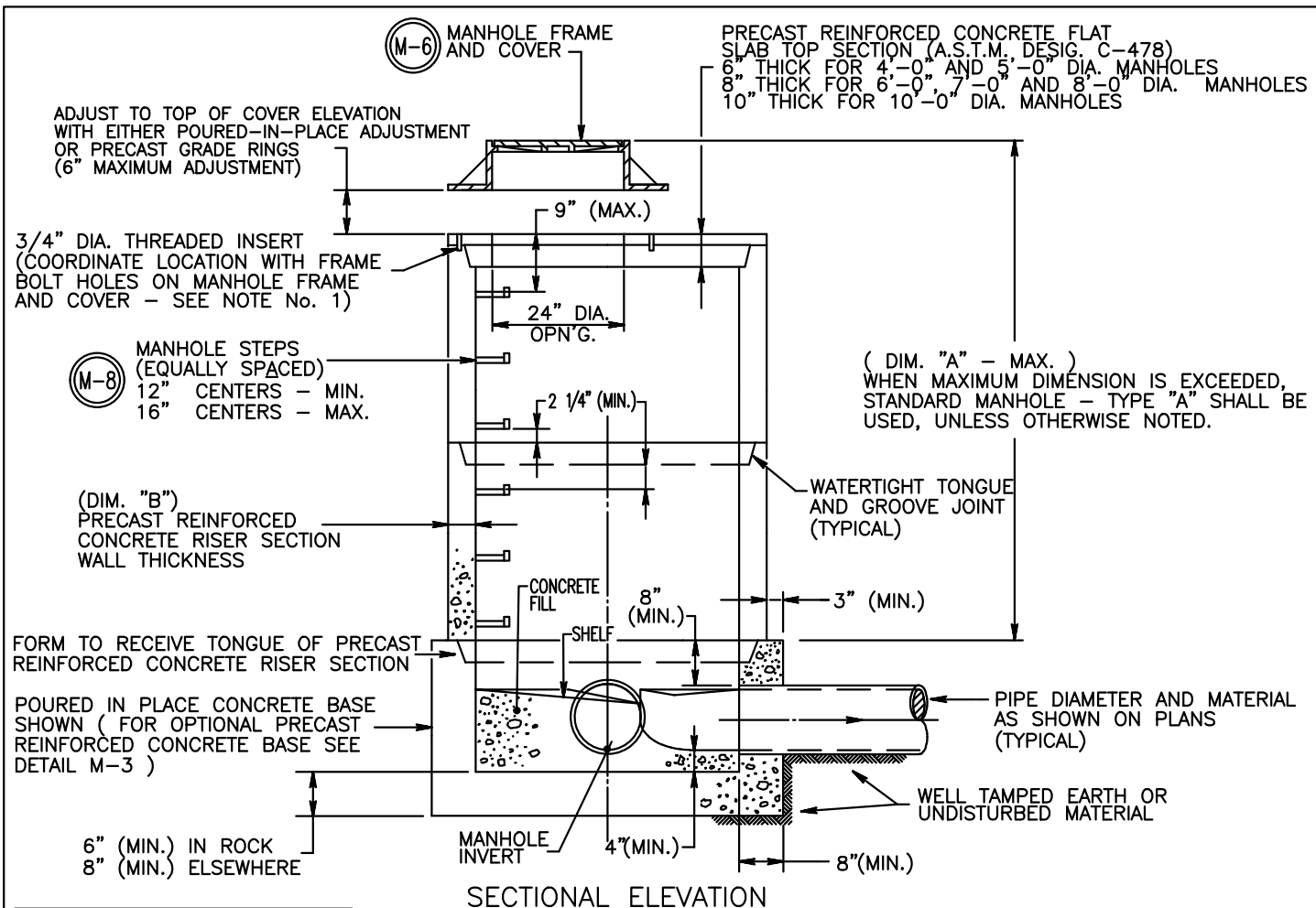
#### STANDARD MANHOLE - TYPE "A" NOTES

MANHOLE BASE DIAMETER	DIM. "A"
4'-0"	3'-9"
5'-0"	5'-9"
6'-0"	4'-5"
7'-0"	4'-5"
8'-0"	4'-5"
10'-0"	4'-7"



- MANHOLE FRAME TO BE BOLTED IN PLACE WITH TWO 3/4" DIA. BOLTS AND FLAT WASHERS.
- PIPE SEALS SHALL BE ALL-RUBBER COMPOSITION FLEXIBLE, PLIABLE AND PROVIDE 15 DEGREES LATERAL DIAGONAL OR VERTICAL PIPE DEFLECTION (CAST INTO BASE AT FOUNDRY)
- ORIENTATION OF PIPES SHOWN FOR ILLUSTRATION PURPOSES ONLY. FOR ACTUAL LOCATIONS SEE PLANS.
- THE SHELF SHALL SLOPE TOWARD THE INVERT CHANNEL AT THE RATE OF 1" PER FOOT (MINIMUM).
- THE DEPTH OF THE INVERT CHANNEL SHALL BE NOT LESS THAN 3/4 OF THE DIAMETER OF THE PIPE.
- 4'-0" DIAMETER BASE SHOWN. FOR 5'-0" DIAMETER BASE, PROVIDE A 5'-0" TO 4'-0" ECCENTRIC CONE REDUCING. PROVIDE A FLAT SLAB TOP, WITH A 4'-0" DIAMETER OPENING, PIPE CONNECTION TO WALL.
- FOR MANHOLES HAVING A 6'-0" DIAMETER BASE OR LARGER, ON THE BASE AT THE FIRST JOINT ABOVE THE UPPERMOST PIPE CONNECTION TO WALL FOR INSTALLATION OF THE 4'-0" DIAMETER PRECAST REINFORCED CONCRETE RISER SECTION OR ECCENTRIC CONE TOP SECTION.
- FOR LENGTH OF PIPE CONNECTIONS TO MANHOLES, SEE MANHOLE SECTION OF THE PROJECT MANUAL.
- FINISHED GRADE SHALL BE FLUSH WITH TOP OF COVER ON MANHOLE FRAME AND COVER, UNLESS OTHERWISE NOTED.
- PROPOSED OR EXISTING MANHOLES WHICH RECEIVE DISCHARGE OF WASTEWATER FROM A PUMP STATION FORCE MAIN MUST BE SPRAYED WITH A CORROSION PROTECTIVE LINING AS REQUIRED BY SECTION 02601
- DOGHOUSE TYPE MANHOLES ARE STRICTLY PROHIBITED

#### STANDARD MANHOLE - TYPE "A" (M-1)

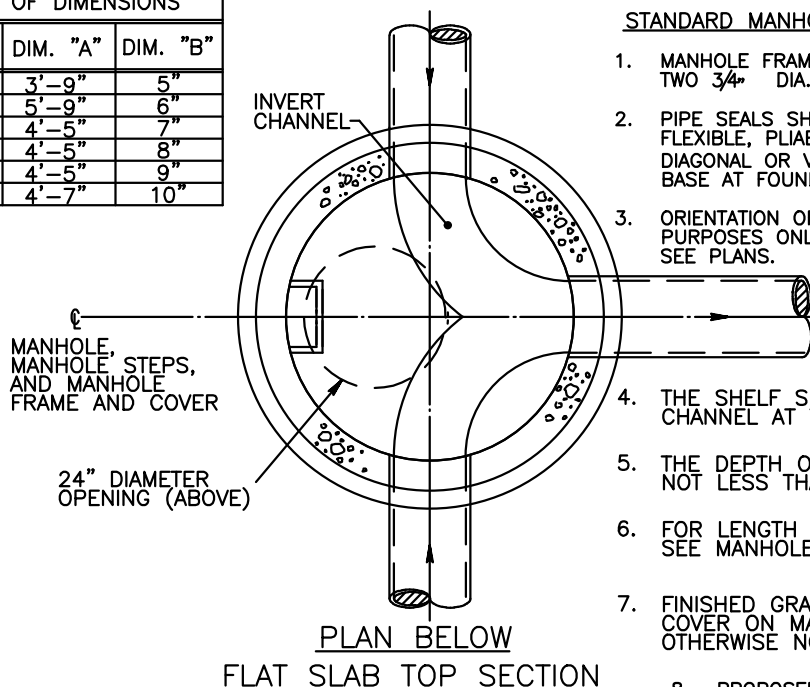


STANDARD MANHOLE - TYPE "B"  
SCHEDULE OF DIMENSIONS

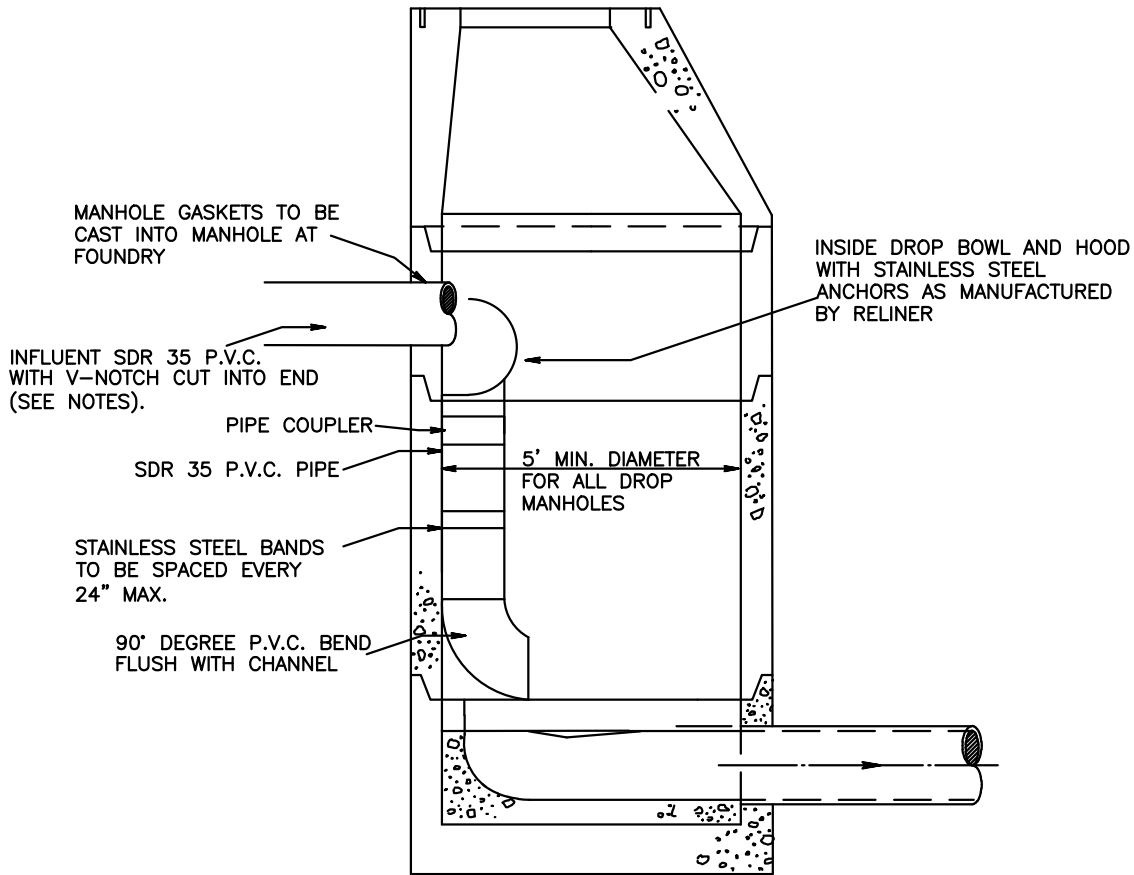
MANHOLE DIAMETER	DIM. "A"	DIM. "B"
4'-0"	3'-9"	5"
5'-0"	5'-9"	6"
6'-0"	4'-5"	7"
7'-0"	4'-5"	8"
8'-0"	4'-5"	9"
10'-0"	4'-7"	10"

STANDARD MANHOLE - TYPE "B" NOTES

1. MANHOLE FRAME TO BE BOLTED IN PLACE WITH TWO 3/4" DIA. BOLTS AND FLAT WASHERS.
2. PIPE SEALS SHALL BE ALL-RUBBER COMPOSITION FLEXIBLE, PLIABLE AND PROVIDE 15 DEGREES LATERAL DIAGONAL OR VERTICAL PIPE DEFLECTION (CAST INTO BASE AT FOUNDRY)
3. ORIENTATION OF PIPES SHOWN FOR ILLUSTRATION PURPOSES ONLY. FOR ACTUAL LOCATIONS SEE PLANS.
4. THE SHELF SHALL SLOPE TOWARD THE INVERT CHANNEL AT THE RATE OF 1" PER FOOT (MINIMUM).
5. THE DEPTH OF THE INVERT CHANNEL SHALL BE NOT LESS THAN 3/4 OF THE DIAMETER OF THE PIPE.
6. FOR LENGTH OF PIPE CONNECTIONS TO MANHOLES, SEE MANHOLE SECTION OF THE PROJECT MANUAL.
7. FINISHED GRADE SHALL BE FLUSH WITH TOP OF COVER ON MANHOLE FRAME AND COVER, UNLESS OTHERWISE NOTED.
8. PROPOSED OR EXISTING MANHOLES WHICH RECEIVE DISCHARGE OF WASTEWATER FROM A PUMP STATION FORCE MAIN MUST BE SPRAYED WITH A CORROSION PROTECTIVE LINING AS REQUIRED BY SECTION 02601
9. DOGHOUSE TYPE MANHOLES ARE STRICTLY PROHIBITED



STANDARD MANHOLE - TYPE "B" (M-2)



SECTIONAL ELEVATION

DROP MANHOLE NOTES

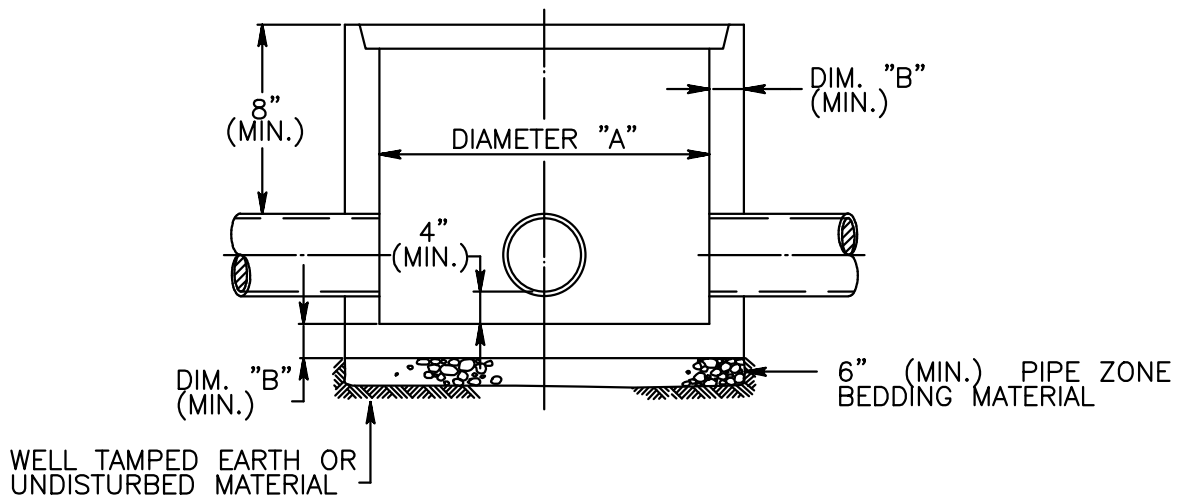
1. THE PURPOSE OF THIS DETAIL IS TO DEMONSTRATE THE REQUIREMENTS FOR A DROP MANHOLE. SEE DETAIL M-1 AND M-2 FOR INFORMATION REGARDING STANDARD MANHOLE REQUIREMENTS AND DIMENSIONS THAT ALSO APPLY TO A DROP MANHOLE.
2. A STANDARD MANHOLE SHALL BE USED TO THE MAXIMUM EXTENT FEASIBLE. IF A DROP MANHOLE IS NECESSARY, AN INSIDE DROP MANHOLE WILL BE REQUIRED USING A DROP BOWL AND HOOD SYSTEM AS MANUFACTURED BY RELINER/DURAN INC.
3. A MINIMUM OF A FIVE FOOT DIAMETER MANHOLE IS REQUIRED WHEN A DROP MANHOLE IS PROPOSED.
4. CONTRACTOR SHALL TRIM PIPE SO THAT A MAXIMUM OF TWO INCHES PROTRUDES INTO THE MANHOLE. A V-NOTCH SHALL BE CUT INTO THE BOTTOM EDGE OF THE PIPE AS PER PIPE MANUFACTURER'S RECOMMENDATION.
5. CONTRACTOR SHALL ENSURE THAT A FLOW CHANNEL IS CONSTRUCTED FROM THE DROP CONNECTION. UNDER NO CIRCUMSTANCES SHALL A DROP CONNECTION DISCHARGE DIRECTLY ONTO THE BENCH.
6. DOGHOUSE TYPE MANHOLES ARE STRICTLY PROHIBITED.
7. WHEN MANHOLE STEPS WILL INTERFERE WITH INSIDE DROP MOVE MANHOLE STEPS TO PREVENT OVERLAP.

INSIDE DROP MANHOLE (M-3)

PRECAST REINFORCED CONCRETE  
MANHOLE BASE NOTES

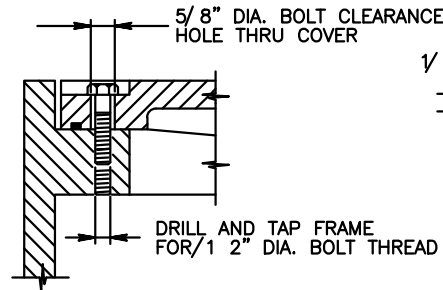
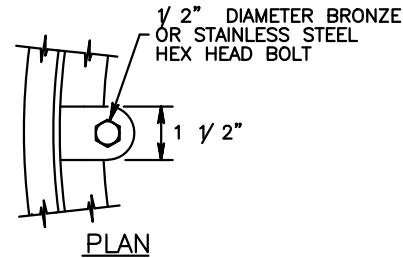
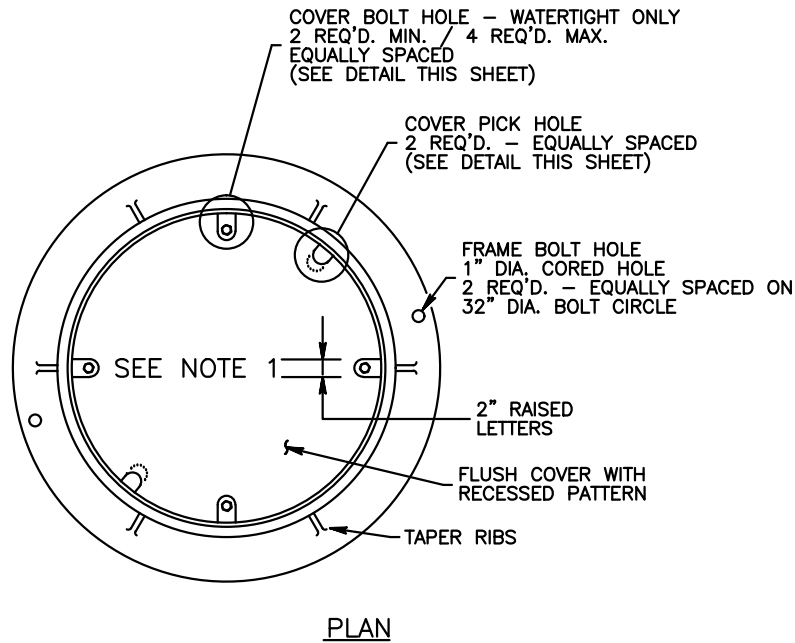
PRECAST REINFORCED CONCRETE MANHOLE BASE SCHEDULE OF DIMENSIONS	
DIA. "A"	DIM. "B"
4'-0"	5"
5'-0"	6"
6'-0"	7"
7'-0"	8"
8'-0"	9"
10'-0"	10"

1. PIPE SEALS SHALL BE ALL-RUBBER COMPOSITION FLEXIBLE, PLIABLE AND PROVIDE 15 DEGREES LATERAL, DIAGONAL OR VERTICAL PIPE DEFLECTION (CAST INTO BASE AT FOUNDRY).
2. ORIENTATION AND DIAMETER OF PIPE OPENINGS SHOWN FOR ILLUSTRATION PURPOSES ONLY. SEE PLANS FOR LOCATION AND DIAMETER.
3. PRECAST REINFORCED CONCRETE MANHOLE BASE TO CONFORM TO ASTM SPECIFICATION C-478.
4. REINFORCING STEEL TO CONFORM TO ASTM SPECIFICATION A-185.



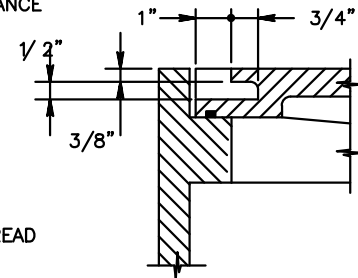
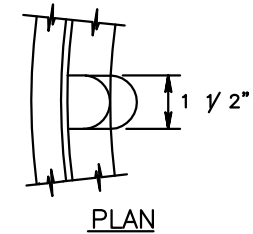
SECTIONAL ELEVATION

PRECAST REINFORCED CONCRETE MANHOLE BASES (M-4)

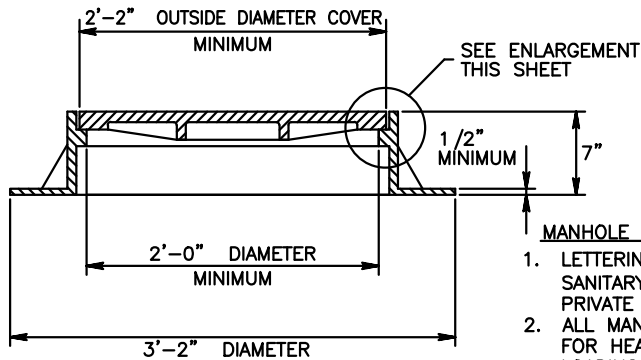


SECTIONAL ELEVATION  
COVER BOLT HOLE

REQUIRED ONLY ON MANHOLES DESIGNATED TO HAVE "WATERTIGHT" COVERS



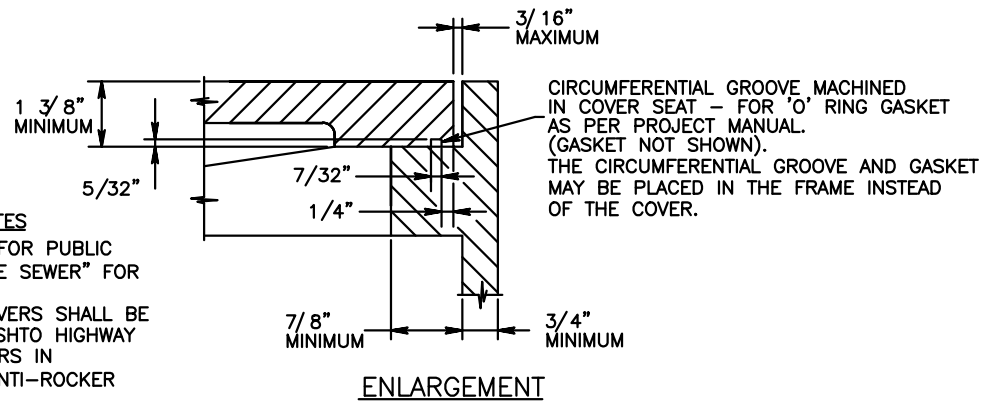
SECTIONAL ELEVATION  
COVER PICK HOLE



SECTIONAL ELEVATION

MANHOLE FRAME AND COVER NOTES

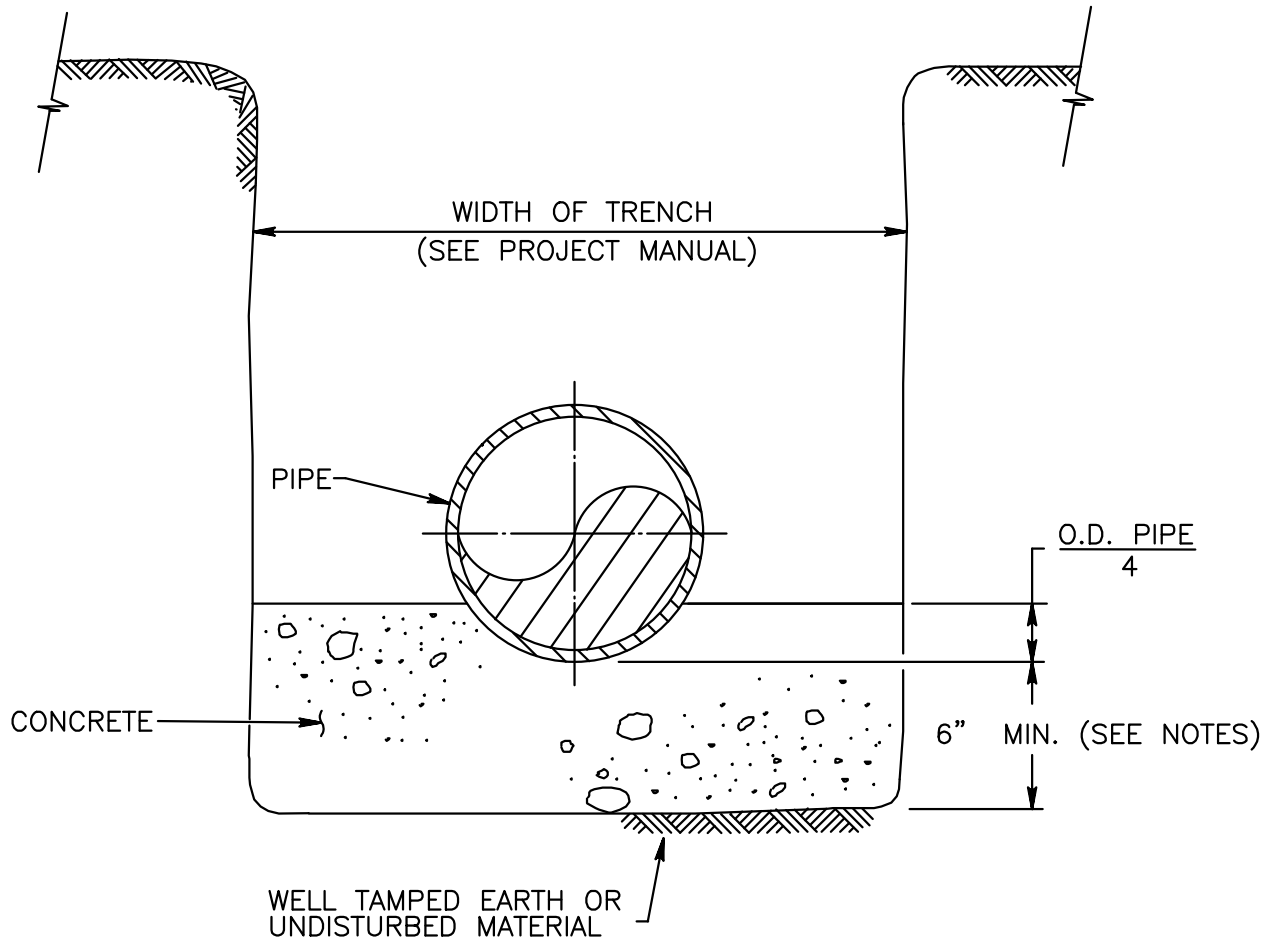
1. LETTERING SHALL BE "SEWER" FOR PUBLIC SANITARY SEWER AND "PRIVATE SEWER" FOR PRIVATE SANITARY SEWER.
2. ALL MANHOLE FRAMES AND COVERS SHALL BE FOR HEAVY DUTY TRAFFIC, AASHTO HIGHWAY LOADING CLASS HS-20. SEWERS IN STREETS/ROADS SHALL HAVE ANTI-ROCKER BARS.
3. APPLY LUBRICANT TO ANY COVER BOLTS. APPLY ANTI-SEEZE TO ALL THREADED SURFACES.
4. WATERTIGHT FRAME AND COVER TO BE USED IN ALL AREAS OF PAVEMENT OR AS DIRECTED BY OWNER.
5. MANUFACTURER SHALL BE NEENAH FOUNDRY OR EAST JORDAN WORKS. MODELS AS REQUIRED BY SPECIFICATIONS.



ENLARGEMENT

STANDARD AND WATERTIGHT  
MANHOLE FRAME AND COVER





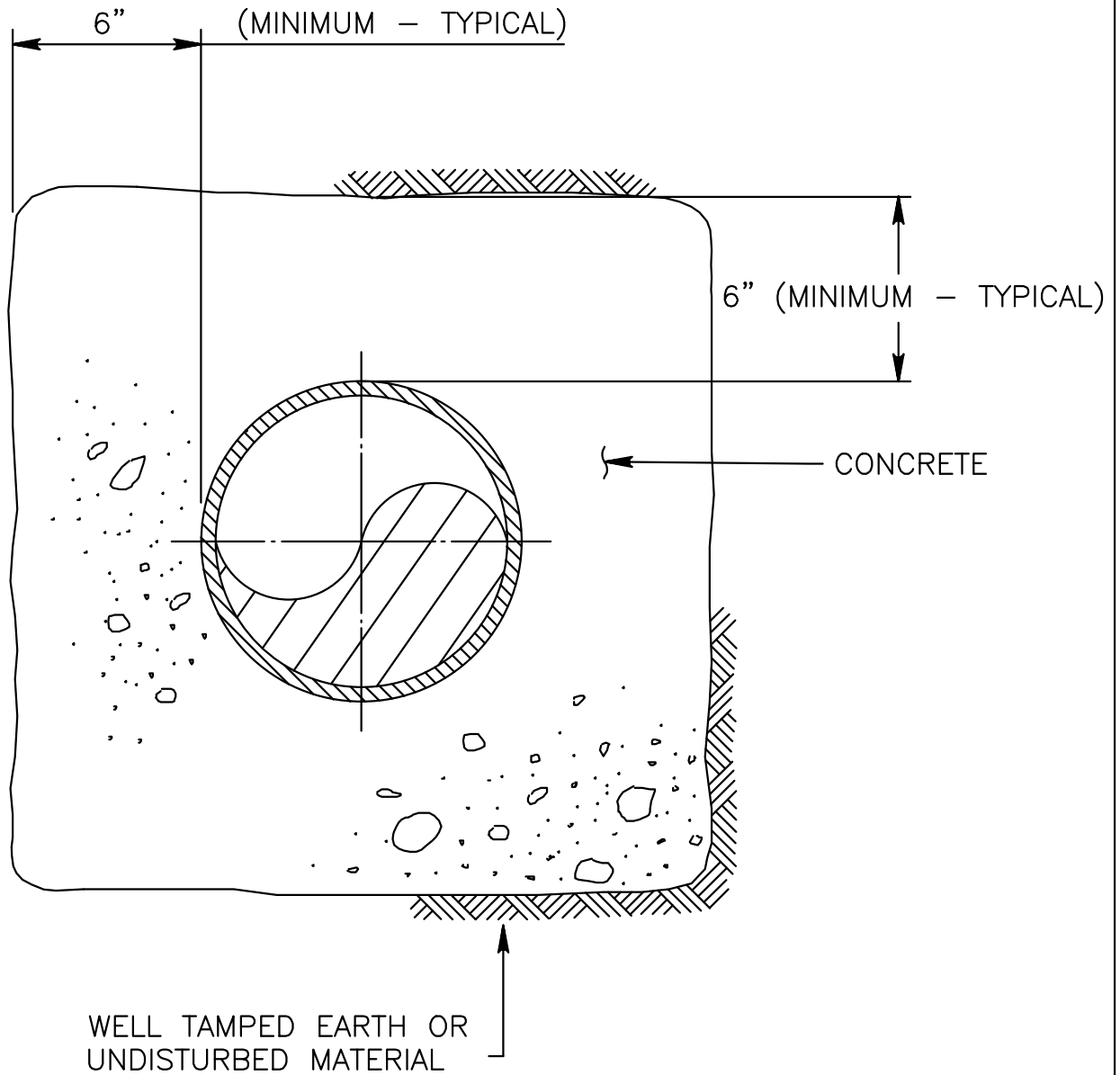
SECTIONAL ELEVATION

NOTES

1. WHEN THE INSIDE DIAMETER OF PIPE IS LESS THAN OR EQUAL TO 24," BEDDING BELOW THE BOTTOM OF PIPE WILL BE A MINIMUM OF 6."
2. WHEN THE OUTSIDE DIAMETER OF PIPE IS GREATER THAN 24," BEDDING BELOW THE BOTTOM OF THE PIPE WILL BE A MINIMUM OF THE OUTSIDE DIAMETER OF PIPE DIVIDED BY 4.

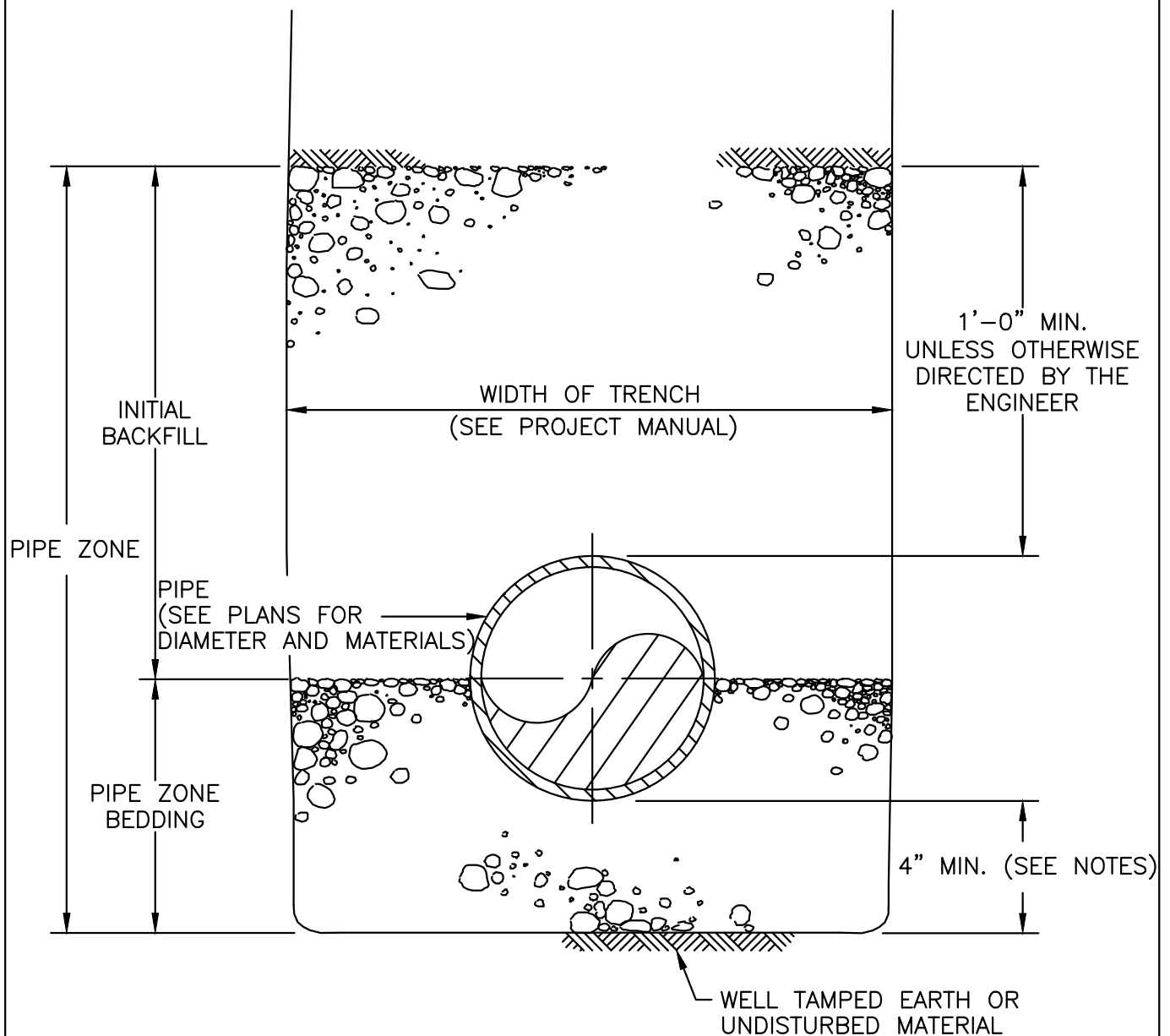
CONCRETE CRADLE (P-1)  
PIPE BEDDING





SECTIONAL ELEVATION

CONCRETE ENCASEMENT (P-2)

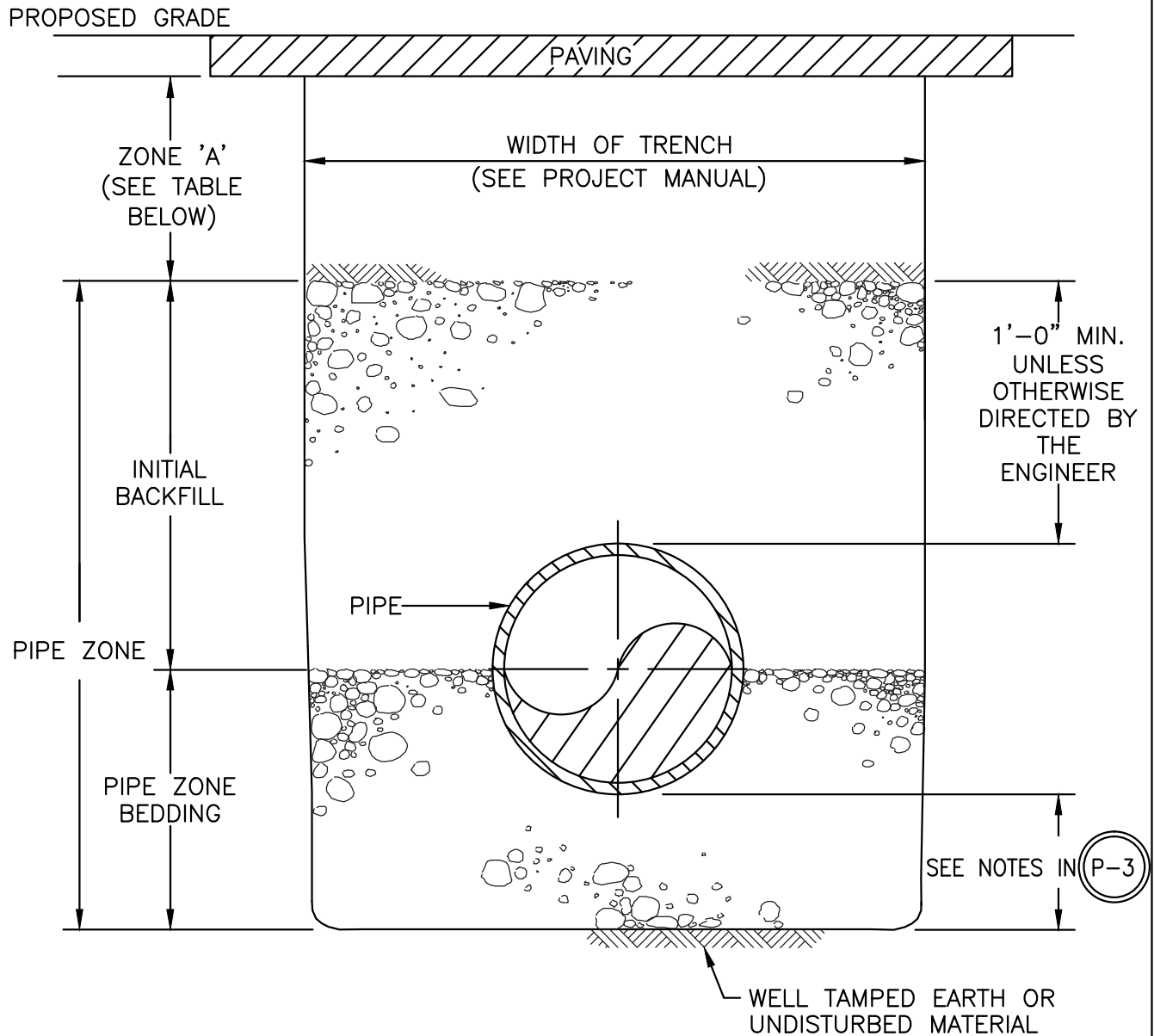


### SECTIONAL ELEVATION

#### PIPE ZONE BEDDING NOTES

1. WHEN THE OUTSIDE DIAMETER OF PIPE IS LESS THAN OR EQUAL TO 16" BEDDING BELOW THE BOTTOM OF PIPE WILL BE A MINIMUM OF 4".
2. WHEN THE OUTSIDE DIAMETER OF PIPE IS GREATER THAN 16" BEDDING BELOW THE BOTTOM OF THE PIPE WILL BE A MINIMUM OF THE OUTSIDE DIAMETER OF THE PIPE DIVIDED BY 4.

## PIPE ZONE BEDDING AND INITIAL BACKFILL (P-3)



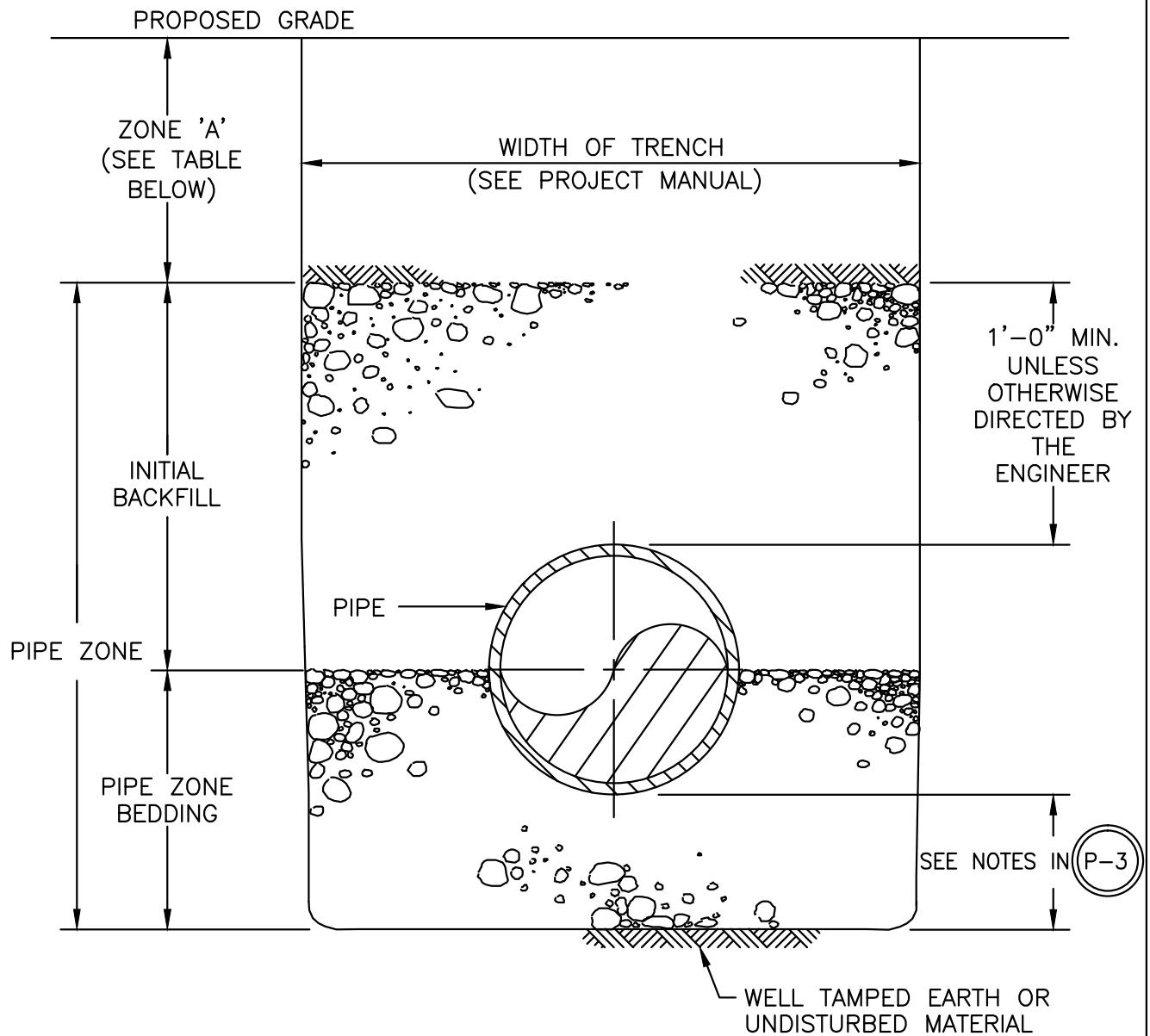
SCHEDULE OF BACKFILLING REQUIREMENTS FOR ZONES 'A'

DESCRIPTION OF PAVED AREA	ZONE 'A'
PAVED AREAS WITHIN THE R/W LIMITS OF STATE HIGHWAYS	CONFORMING TO THE REQUIREMENTS OF PENNDOT
PAVED ROADWAYS AND SHOULDERS OF PROPOSED AND EXISTING STREETS OTHER THAN STATE HIGHWAYS	AGGREGATE BACKFILL COMPACTED IN 6 INCH LAYERS
BITUMINOUS DRIVEWAYS AND SIDEWALKS	COMPACTED AGGGREGATE BACKFILL

NOTE: THE USE OF ON-SITE BACKFILL IS PROHIBITED IN PAVED AREAS AS DESCRIBED ABOVE

## BACKFILLING IN PAVED AREAS

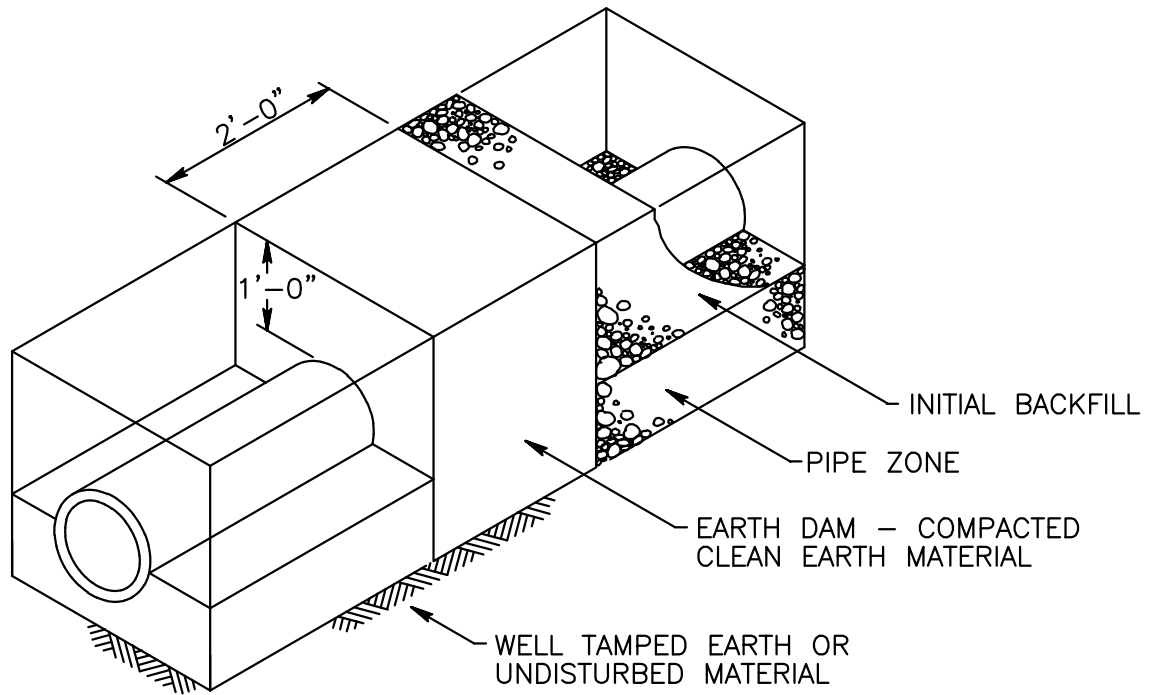




SCHEDULE OF BACKFILLING REQUIREMENTS FOR ZONE 'A'

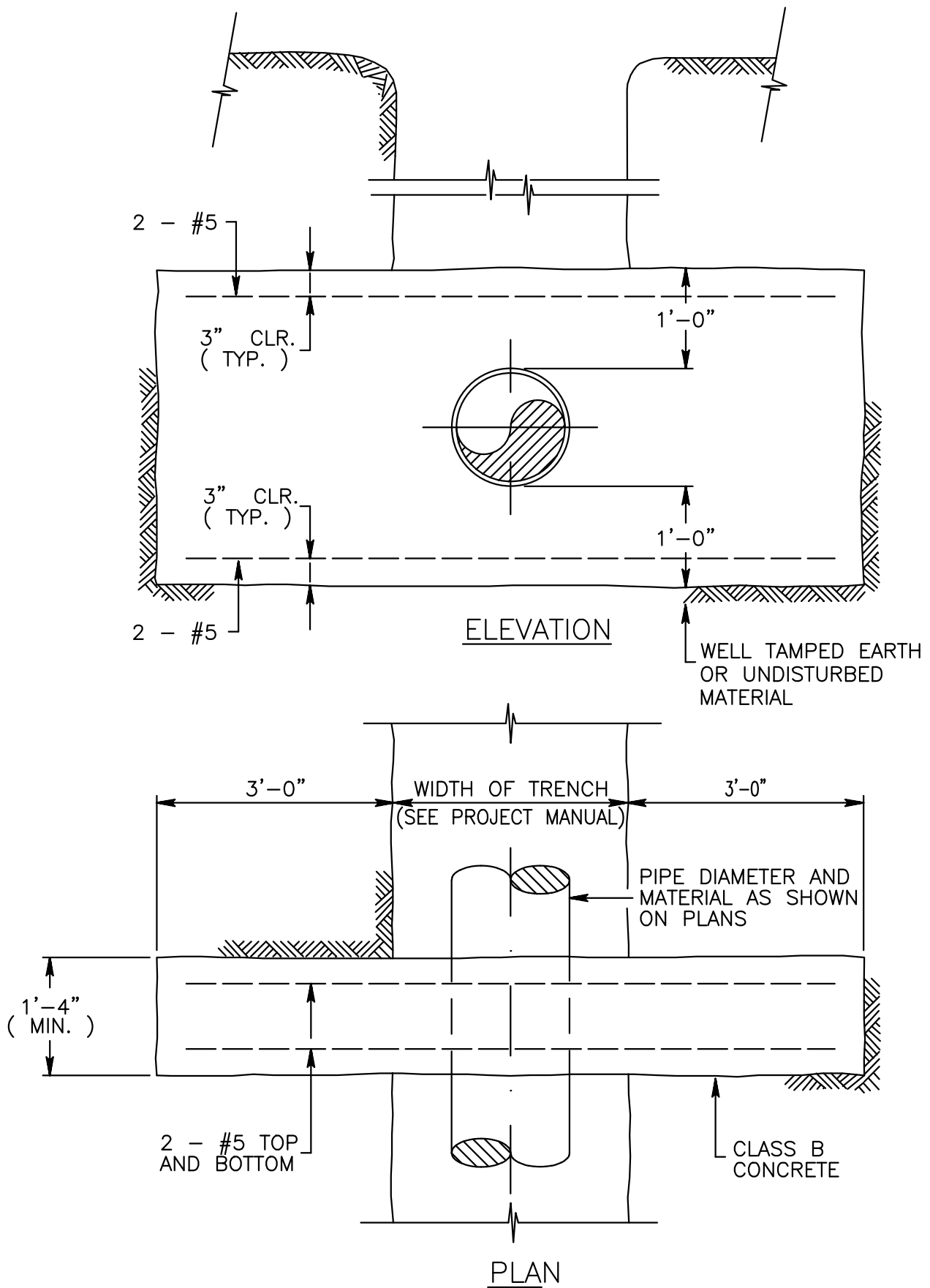
DESCRIPTION OF UNPAVED AREA	ZONE 'A'
UNPAVED AREAS OUTSIDE ROADWAYS	ON-SITE BACKFILL COMPACTED IN 6" LAYERS TO BOTTOM OF TOPSOIL. REPLACE TOPSOIL TO APPROXIMATE DEPTH OF EXISTING AND CROWN TO SUCH HEIGHT AS REQUIRED BY THE ENGINEER.
UNPAVED AREAS WITHIN R/W LIMITS OF STATE HIGHWAYS	CONFORMING TO THE REQUIREMENTS OF PENNDOT
UNPAVED SHOULDERS OF PROPOSED AND EXISTING STREETS OTHER THAN STATE HIGHWAYS	AGGREGATE BACKFILL COMPACTED IN 6 INCH LAYERS
STONE DRIVEWAYS AND PARKING AREAS	AGGREGATE BACKFILL COMPACTED IN 6 INCH LAYERS
UNIMPROVED STREETS	AGGREGATE BACKFILL COMPACTED IN 6 INCH LAYERS

## BACKFILLING IN UNPAVED AREAS BUP

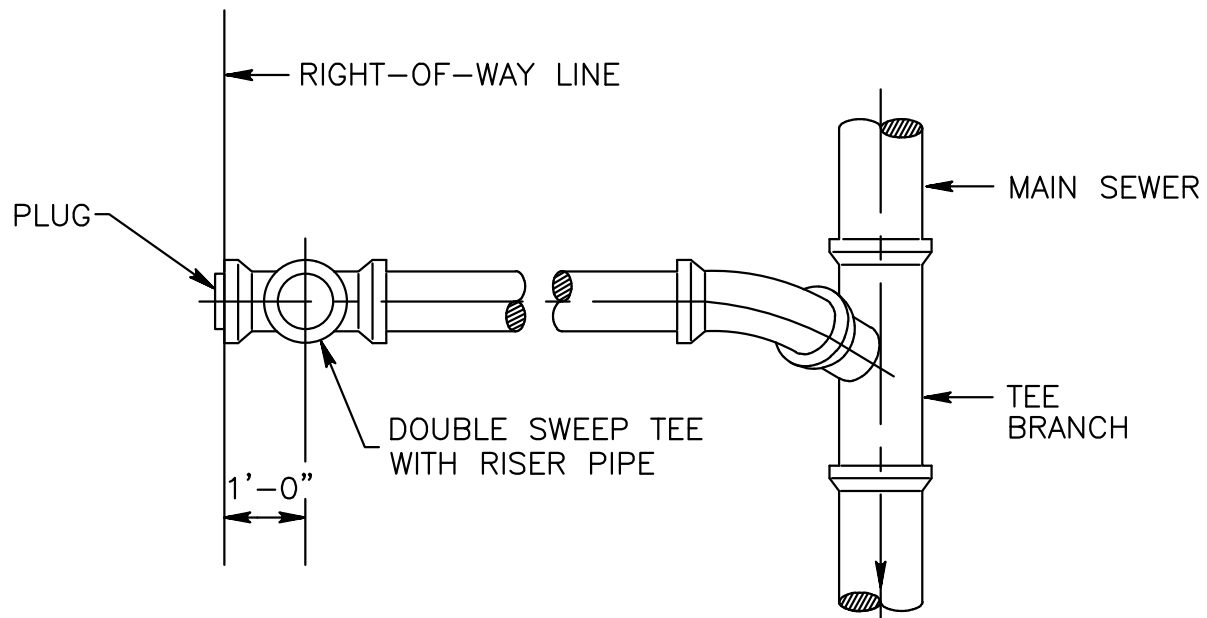


ISOMETRIC VIEW

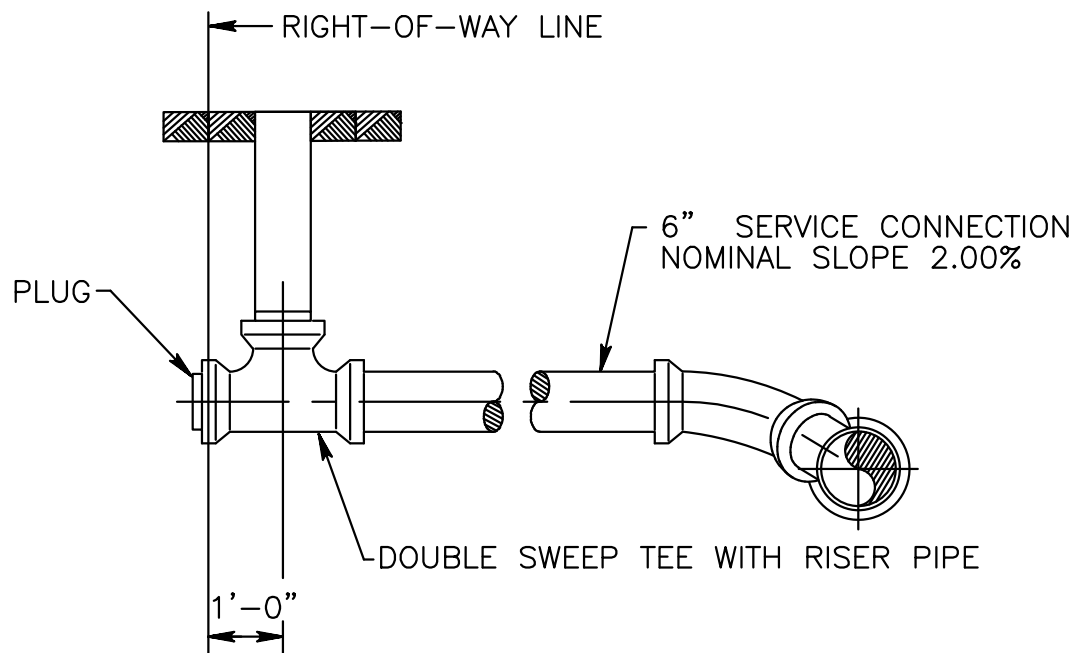
EARTH DAM (ED)



CONCRETE ANCHOR (CA)



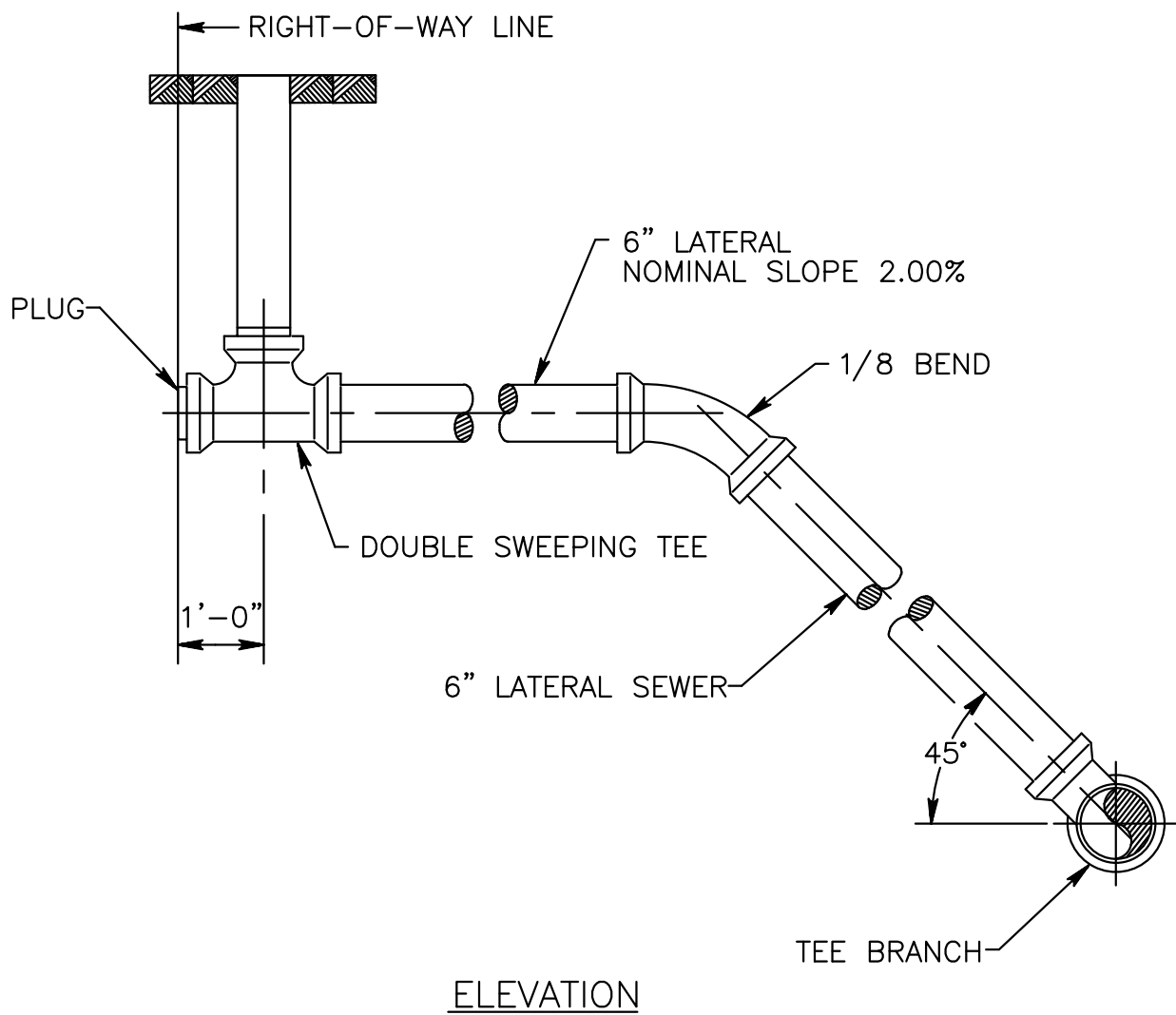
PLAN



ELEVATION

SERVICE CONNECTION  
SHALLOW SEWER

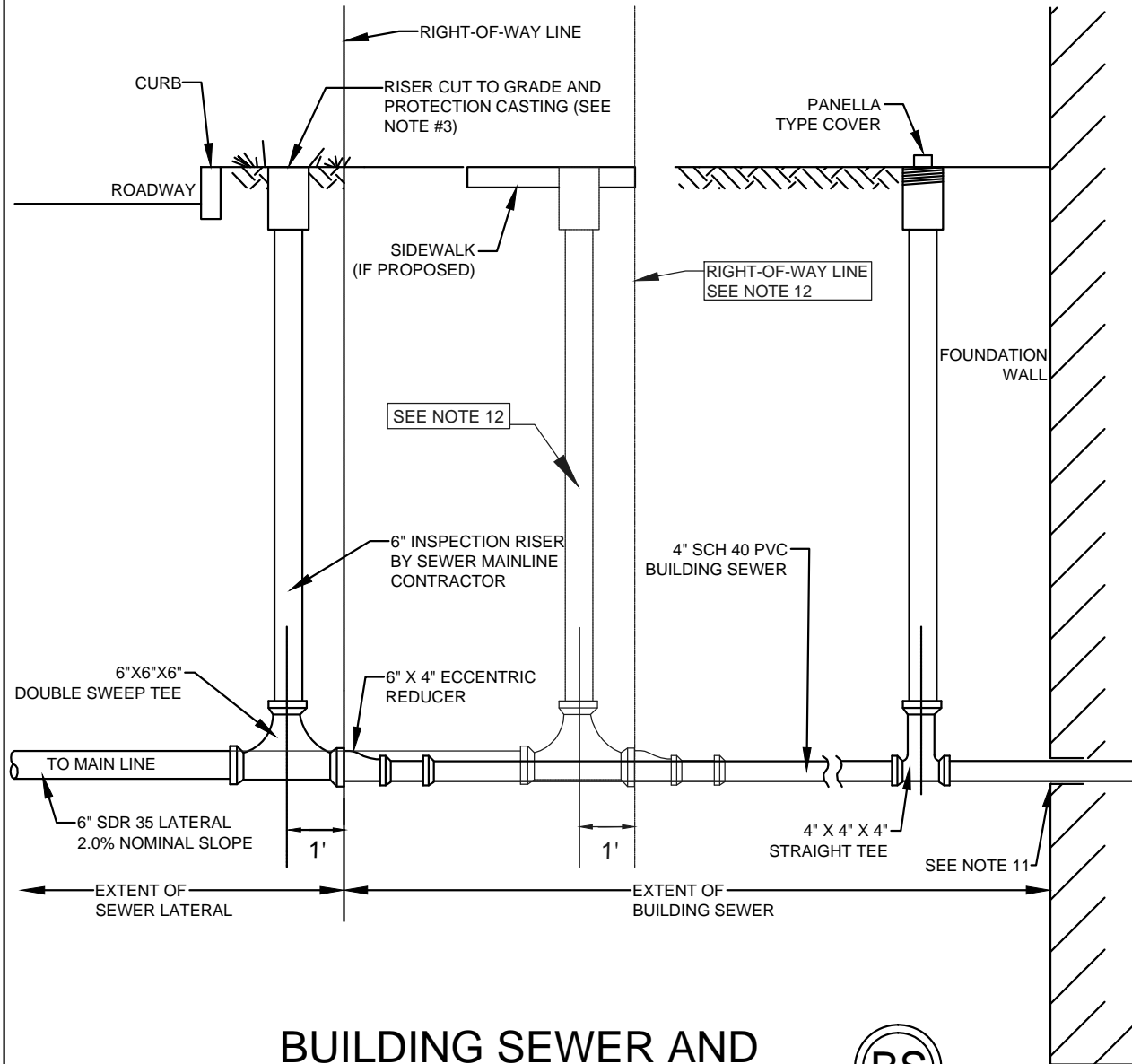




SERVICE CONNECTION  
DEEP SEWER





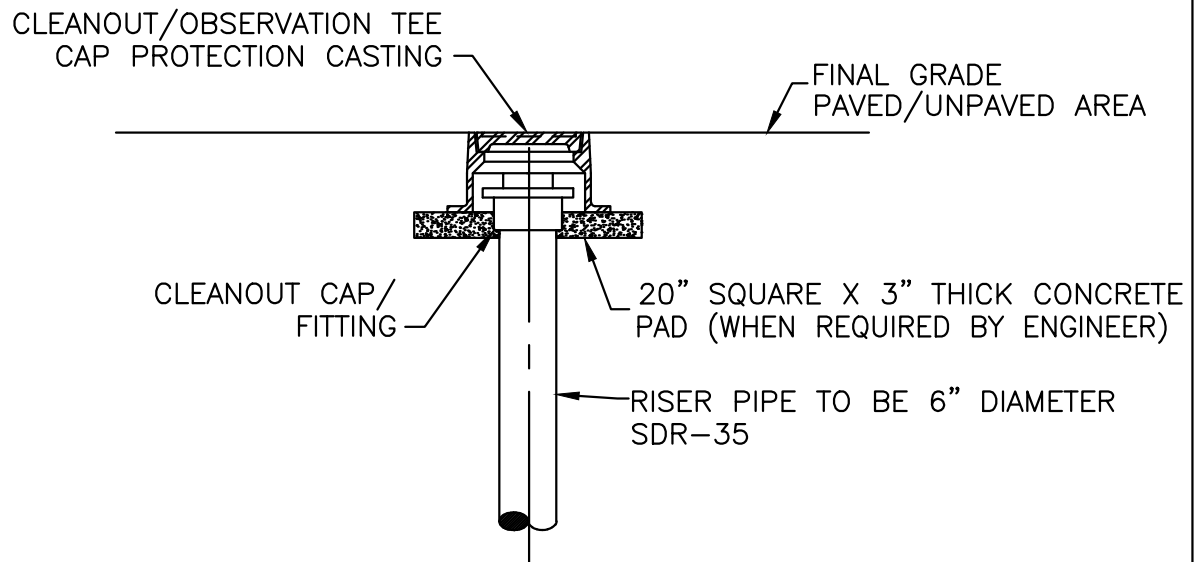
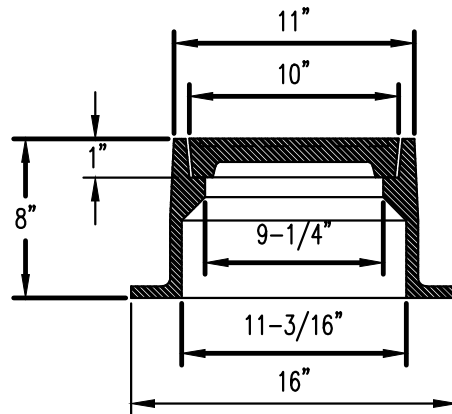


## BUILDING SEWER AND LATERAL DETAIL



### NOTES:

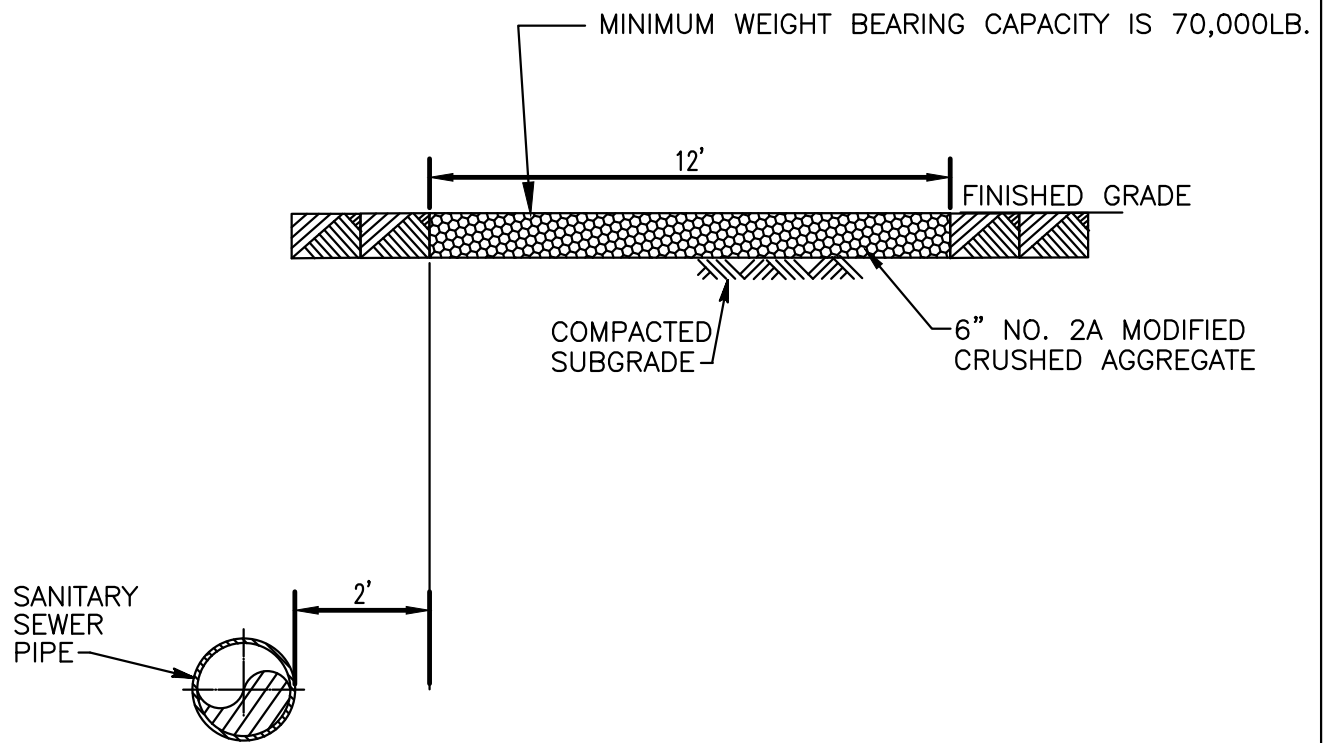
1. INSTALL RISER DURING CONSTRUCTION OF LATERAL.
2. SEWER MAINLINE CONTRACTOR RESPONSIBLE FOR LOCATING RIGHT-OF-WAY. IN ALL CASES THE 6 INCH INSPECTION TEE / CLEANOUT SHALL BE LOCATED IN THE PUBLIC RIGHT-OF-WAY.
3. PROVIDE CAP PROTECTION CASTING FOR ALL PAVED AREAS (SEE DETAIL).
4. ALL WORK TO BE PERFORMED IN ACCORDANCE WITH THE LATEST VERSION OF NORTH CORNWALL TOWNSHIP STANDARD CONSTRUCTION AND MATERIAL SPECIFICATIONS.
5. THE USE OF TEST TEES IS PROHIBITED. ALL TEES MUST BE RAISED TO SURFACE. MAXIMUM TEE / CLEANOUT SPACING IS 50 FEET.
6. THERE MUST BE A CLEANOUT LOCATED NEAR THE JUNCTION OF BUILDING SEWER AND THE BUILDING PLUMBING. IF CLEANOUT IS TO BE LOCATED OUTSIDE OF THE BUILDING, IT MUST BE BROUGHT UP TO FINISHED GRADE AS SHOWN ON DETAIL.
7. SEWER MUST BE COVERED BY A MINIMUM OF 48" OF BACKFILL.
8. INSPECTION OF ALL SEWERS IS REQUIRED AND MUST BE COORDINATED WITH NORTH CORNWALL TOWNSHIP OR TOWNSHIP'S AUTHORIZED AGENT. ALL NEW PIPE SHALL BE AIR TESTED, INCLUDING RISER PIPES.
9. A LOW PRESSURE AIR TEST IS REQUIRED OF THE LATERAL SERVICE CONNECTIONS AND BUILDING SEWER IN ACCORDANCE WITH THE NORTH CORNWALL TOWNSHIP STANDARD SPECIFICATIONS.
10. IN INSTANCES WHERE NORTH CORNWALL TOWNSHIP STANDARD SPECIFICATIONS CONFLICT WITH THE MOST RECENTLY UPDATED VERSION OF THE INTERNATIONAL PLUMBING CODE, THE MOST RESTRICTIVE STANDARDS WILL BE REQUIRED.
11. A WALL SLEEVE IS REQUIRED AT PENETRATION OF FOUNDATION PER THE INTERNATIONAL PLUMBING CODE
12. WHEN THE RIGHT OF WAY LINE IS LOCATED ON THE HOUSE SIDE OF THE SIDEWALK, THE 6" INSPECTION RISER SHALL BE CENTERED 1' ON THE STREET SIDE OF THE RIGHT OF WAY. IF THE TOP OF THE INSPECTION RISER WILL BE LOCATED WITHIN THE SIDEWALK/PAVED AREA USE CAP PROTECTION CASTINGS.



ACCEPTABLE MANUFACTURERS ARE:  
 NEENAH FOUNDRY COMPANY, MODEL NO. NF-1975 479  
 EAST JORDAN WORKS, INC. MODEL NO. 1565

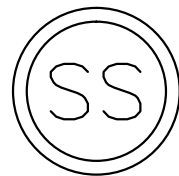
CAP PROTECTION CASTING DETAIL FOR  
USE ON OBSERVATION TEES  
IN PAVED AREAS

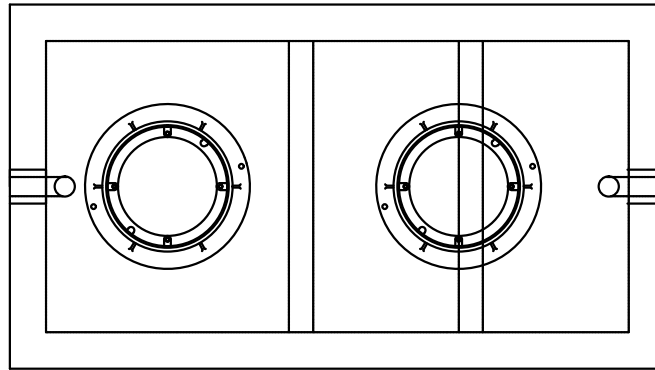




SECTIONAL ELEVATION

SURFACE STABILIZATION FOR SANITARY SEWERS LOCATED IN UNPAVED AREAS

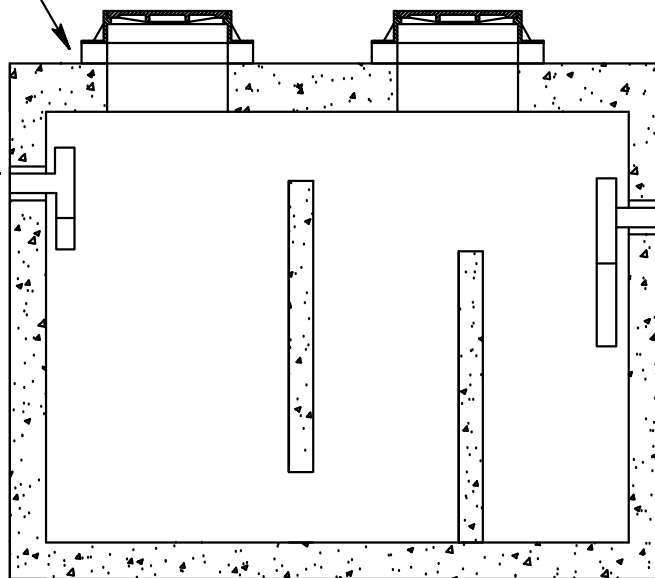




PLAN VIEW

POURED CONCRETE  
RISERS AS  
REQUIRED

INLET W/  
GASKETED  
PIPE OPENING



SECTION VIEW

OUTLET W/ GASKETED  
PIPE OPENING

NOTES:

1. SIZING OF THE GREASE INTERCEPTOR MUST BE IN ACCORDANCE WITH THE LATEST VERSION OF THE NORTH CORNWALL TOWNSHIP ORDINANCE REGULATING FATS, OILS AND GREASES.
2. GREASE INTERCEPTOR SHALL GENERALLY BE LOCATED OUTSIDE OF THE BUILDING OR STRUCTURE IN AN AREA ACCESSIBLE FOR REGULAR INSPECTION AND CLEANING AND REMOVAL OF THE INTERCEPTED WASTE. SEE THE LATEST VERSION OF THE NORTH CORNWALL TOWNSHIP ORDINANCE REGULATING FATS, OILS AND GREASES FOR MORE INFORMATION.
3. TOILETS, URINALS AND OTHER SIMILAR FIXTURES SHALL NOT DISCHARGE THROUGH A GREASE INTERCEPTOR.
4. THE INLET AND OUTLET TEES MUST BE CONSTRUCTED OF MATERIALS AS SPECIFIED IN THE LATEST VERSION OF THE NORTH CORNWALL TOWNSHIP ORDINANCE REGULATING FATS, OILS AND GREASES.
5. THE GENERATOR IS RESPONSIBLE FOR OBTAINING APPLICABLE PERMITS FOR THE INSTALLATION AND MAINTAINENCE OF A GREASE INTERCEPTOR.
6. IF LOCATED IN A PAVED AREA, THE GREASE INTERCEPTOR MUST BE DESIGNED FOR USE IN TRAFFIC AREAS.
7. MANHOLE FRAMES AND COVERS SHALL BE CONSISTENT WITH THE REQUIREMENTS OF SECTION 02601 OF THE SPECIFICATIONS
8. ALL GREASE INTERCEPTORS SHALL BE INSTALLED WITH PROVISIONS FOR EFFLUENT SAMPLING.

GREASE INTERCEPTOR (GI)