

**STANDARD CONSTRUCTION
AND
MATERIAL SPECIFICATIONS
FOR
SANITARY SEWER EXTENSIONS**

**NEW HANOVER TOWNSHIP
MONTGOMERY COUNTY,
PENNSYLVANIA**

January 2015

**NEW HANOVER TOWNSHIP
STANDARD CONSTRUCTION AND MATERIAL SPECIFICATIONS**

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PART 1 - GENERAL

1.1 DEFINITIONS

- A. Wherever in these Specifications the following words, terms and expressions, or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:
1. 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.
 2. 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 New Hanover Township Wastewater Collection System.
 3. 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.
 4. 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.
 5. Drawing 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.
 6. Engineer: The person or organization duly employed by the Township as consultant and authorized to observe the results of the performance of the work under Contract by the Contractor, acting directly or through properly authorized agents, engineers, assistants, observers 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.
 7. Observation: The examination of the work performed by the Contractor to ascertain its conformity with the Specifications.

8. 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.
9. 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.
10. 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.
11. Township: NEW HANOVER TOWNSHIP, acting directly or through any agent, officer or employee duly authorized to act for the said party in the execution of the work required by the Contract.
12. Authority: NEW HANOVER TOWNSHIP AUTHORITY.
13. AASHTO: American Association of State Highway and Transportation Officials.
14. ACI: American Concrete Institute.
15. AISC: American institute of Steel Construction.
16. ANSI: American National Standards Institute.
17. ASTM: American Society for Testing Materials.

1.2 DRAWINGS AND SPECIFICATIONS

- A. The Drawings and Specifications are complementary and the requirements of any one shall be considered as the requirements of all.
 1. The Specifications in this document are written as if they were included in the Contract Documents executed by and between the Developer and the Contractor. Whether they are so used is at the discretion of the Developer; however, the Township will not accept the sanitary sewer extensions provided by the Developer unless and until they conform to the requirements of these Standard Specifications.
 2. All drawings or plans pertaining to the Project (the Contract Drawings) shall be submitted by the Developer to the Township for review. After review of 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.

3. Deviations from the Drawings or Specifications required by the exigencies of construction will be determined by the Engineer only, and authorized in writing.
4. At all times the Contractor shall keep on the Project, available to the Engineer and his representatives, one (1) copy of the Drawings, and Specifications.

1.3 PRELIMINARY OBSERVATION

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

1.4 COMPETENT WORKMEN

- A. 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.
- B. The Contractor shall provide a competent and reliable person, who is delegated to be readily available and have full approval 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.

1.5 WORKING CONDITIONS

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

1.6 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 reviewed 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.

1.7 ADVERTISING

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

1.8 PERMITS AND LICENSES

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

1.9 CARE OF PUBLIC AND PRIVATE PROPERTY

- A. The Contractor shall take all necessary precaution to prevent damage to all overhead and underground structures and to protect and preserve property within or adjacent to the Project and shall be responsible for damage thereto. Special care 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.

- B. If the sewer lines cross telephone, telegraph, electric, television cables, gas, oil or water lines, no excavation or pipe laying shall be done at those crossings without the presence of an authorized representative from the office of the Township having jurisdiction. Attention is directed to the provisions of Act No. 287 (1974), as amended by Act No. 121 (2008) of the Commonwealth of Pennsylvania, and full compliance therewith is required.

1.10 SAFETY REQUIREMENTS

- A. 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 burning 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 212 - Official Traffic Control Devices and Publication 213 - Temporary Traffic Control Guidance which complements Section 901.
- B. 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.
- C. 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.
- D. 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.

1.11 REGULATIONS OF THE DEPARTMENT OF LABOR AND INDUSTRY

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

1.12 REGULATIONS AND REQUIREMENTS OF THE DEPARTMENT OF ENVIRONMENTAL PROTECTION

- A. The Contractor and the Developer are advised that they will be required to design and conduct their work in compliance with the rules, regulations and requirements of the Pennsylvania Department of Environmental Protection.

1.13 OBSERVANCE OF LAWS

- A. The Contractor at all times shall observe and comply with all Federal and State laws and regulations, and local bylaws, ordinances and regulations in any manner affecting the conduct of the work or applying to employees on the Project, as well as all safety precautions and orders or decrees which have been promulgated or enacted, or which may be promulgated or enacted, by any legal bodies or tribunals having Township 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.

1.14 CLEANING SITE

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

1.15 ENGINEER'S DUTIES, EXAMINATION AND INSPECTION

- A. The work shall at all times be subject to the examination and observation of the Engineer and his authorized assistants, who shall have free access to the work, and be furnished by the Contractor with every reasonable facility for examination of the work, to the extent of uncovering, testing or removing finished portions thereof. The Contractor shall provide all labor and equipment necessary for such examinations. The Engineer may require the Contractor to uncover for examination, or to remove any work done or placed in violation or disregard of instructions issued to the Contractor by the Engineer or his representative.
- B. The Engineer and his assistants are the representatives of the Township during the construction of the work. When so authorized by the Township, it shall be the duty of the Engineer to see that all materials and work are properly inspected and that all such materials and work conform fully to the requirements of the Specifications. He shall perform such other duties as may be assigned him from time to time and shall have such additional duties as may be defined elsewhere in these General Instructions. He shall in no case act as foreman or perform other duties for the Contractor nor interfere with the management of the work by the Contractor.
- C. All observations 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 observation, examination and test by the Engineer or his duly authorized representatives.
- D. 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 Township require the work to be specially tested or approved, the Contractor shall give the Engineer timely notice of its readiness for inspection.
- E. 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.
- F. 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.
- G. Any verbal opinion or suggestion which the Engineer may give the Contractor shall in no way be construed as binding the Township in any way.
- H. In case of any dispute relative to the quality of materials or work, the Engineer shall have Township 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.

1.16 DEFECTIVE WORK

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

1.17 NOTICE

- A. The service of any notice, by the Township or Engineer to the Developer or Contractor, shall be considered accomplished upon completion of any one of the following procedures.
 - 1. When delivered, in writing, to the person in charge of the office used by the addressee to conduct business;
 - 2. When delivered, in writing, to the addressee or any of his authorized agents in person;
 - 3. When delivered, in writing, to the addressee or any of his agents at the office used by the addressee to conduct the business of the Contractor at or near the Site of the work;
 - 4. When deposited in the United States Mail or Commercial Delivery Service, 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.

1.18 ENGINEERING STAKES

- A. The Contractor shall furnish, set and maintain 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.

1.19 INSURANCE AND INDEMNITY REQUIREMENTS

- A. The Developer shall not commence work until all protections required under this section are in full effect and verified to the satisfaction of the Township.
1. Duties of The Developer. Four (4) copies of the original certificates 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.
 2. Coverages to be Maintained by the Developer: The insurance types to be provided are General Liability, Automobile Liability, and Workers Compensation, and Railroad Protective Liability when Contract includes work on, under or adjacent to Railroad rights-of-way or properties. The specific insurance coverages and limits of liability shall be those normally carried by the Developer and/or his Contractors and Subcontractors and subject to the review and approval of the Township.
 3. Coverage Modifications Which Must be Obtained: Township and Engineer and each of their Officers, Agents and Employees shall be named as additional insureds with respect to all work performed in connection with this Project. This applies to General Liability, Automobile Liability and Railroad Protective Liability coverages.
 4. Township shall be notified by Registered Mail thirty (30) days in advance of any cancellation or any material change resulting in the elimination or reduction of any protection.
 5. Waiver of Subrogation in favor of the Township and Engineer and each of their Officers, Agents, and Employees applying to all Workers' Compensation coverages must be provided by the Developer unless not permitted by laws of the state in which this Project is constructed.
 6. Indemnification of Township and Engineer by Developer: Developer is responsible for all liabilities and duties assumed by Developer including but not limited to the indemnity liability in the Agreement between Township and Developer and the provisions of this subparagraph (d) and shall provide such protections for the Township and Engineer whether or not such claims, losses, liabilities or expenses are covered by insurance.
 7. The Developer shall at all times indemnify and save harmless the Township and Engineer of and from all claims of whatsoever nature, including without limitation claims which may be made by any of the employees of the Developer or by any employees of any Contractor or Subcontractor to whom the Developer may have let the performance of any part of the work and the Developer will appear for and defend the Township and Engineer against any and all such claims.

8. 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.
9. 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.
10. 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.
11. Insurance Companies used must be rated (A 10) or better by Best's Rating Service unless Township is notified and waives this requirement.

1.20 FEE REQUIREMENTS

- A. The Developer will be required to pay the following fees applicable to the sewer extension.
 1. DEP Filing Fee: A check made payable to Pennsylvania Department of Environmental Protection must accompany the permit application to DEP.
 2. Tapping Fee: The Developer must submit to the Township tapping fee(s) as may be required.
 3. Sewer Connection Permit Fee: The Developer must submit to the Township a House Connection Certification and fee(s) as may be required.
 4. Township Plumbing Permit Fee: The Developer must submit to the Township plumber permit fee(s) as may be required by the Township.
 5. Any other fees, inspection costs and bonds associated with other permits or licenses that are applicable to the extension.

1.21 ITEMS REQUIRED PRIOR TO BEGINNING CONSTRUCTION

- A. Sewer Connection Permit(s) applicable to the Project.
- B. Evidence that the final subdivision plan has been filed by the Municipality at the county courthouse, Recorder of Deeds office, if applicable.

- C. Performance and Payment Bonds or other financial security to assure completion of the sewer extension and to cover the warranty period.
- D. Receipt of a letter from the Developer stating the name of the Contractor who will be installing the sanitary sewer extension.
- E. Certificates of public liability and property damage, auto liability and workers' compensation insurance. The Township, Authority, and Engineer shall be certificate holders and shall be named by endorsement as additional insureds.
- F. Receipt from the Township of a copy of the Water Quality Management Permit issued by DEP, if applicable.
- G. A list of suppliers for the materials to be used in the sanitary sewer construction.
- H. Shop drawings of manhole bases, manhole risers, manhole frames and covers, pipe and other necessary construction materials reviewed by the Engineer.
- I. Certification from the pipe manufacturer that the pipe meets or exceeds the requirements of the Township's standard specifications.
- J. Written approval by the Township to proceed with construction.

1.22 DEDICATION OF SANITARY SEWER EXTENSION TO THE TOWNSHIP

- A. The Developer shall deliver a deed of conveyance transferring ownership of the sanitary sewer extension to the Township. Attached to the deed shall be a plat which accurately describes the location of the facilities to be dedicated. The description shall include bearings and distances which are tied to permanent features shown on a recorded plan of the property. If the Developer is a corporate entity, the deed of conveyance must be accompanied by a corporate resolution authorizing said conveyance. Upon receipt of the executed deed of conveyance from the Developer, the 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 one year from the date of the deed, or in the case of work on PennDOT right-of-way, for a period of two years from the date of the deed.

1.23 TELEVISUAL INSPECTION OF GRAVITY SEWERS

- A. Gravity sewers not dedicated to the Authority within one year after completion of construction shall be subject to an internal televisual inspection. The Contractor shall have a reputable Sewer Inspection Contractor inspect the collection system with a mobile television inspection unit in order to certify the integrity of the system. DVD inspection videos shall be submitted to the Authority Engineer for review. Such inspection shall take place during a wet weather period or when the groundwater table is high. The cost to perform the internal inspection and repair of all defects, problems, damages or items of poor workmanship that maybe found shall be solely the Developer's responsibility. All repairs shall be performed in a workmanlike manner under the direction and inspection of the Authority's Engineer, prior to the Authority accepting the lines for dedication.

1.24 STEEL PRODUCTS PROCUREMENT ACT

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

TECHNICAL SPECIFICATIONS

DIVISION 01
GENERAL REQUIREMENTS

SECTION 01010 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 SITE LOCATION

- A. Project location is in New Hanover Township, Montgomery County, Pennsylvania.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. Without intending to limit or restrict the extent of 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. Drawings: The following listed Sewer Detail Drawings represent the standards of construction for the Township and are bound in the back of the Specifications.
1. On the Sewer Detail Drawings, the words "Project Manual" are to be defined as these Standard Specifications.

Detail No.	Title
S-1	Typical Backfill Trench Restoration Detail
S-2	Concrete Cradle Detail
S-3	Concrete Encasement Detail
S-4	Typical Trench Plug Installation Detail
S-5	Typical Pipe Slope Restraint Detail
S-6	Vertical Thrust Blocking Detail
S-7	Horizontal Thrust Blocking Detail
S-8	Pipe Joint Restraint Detail
S-9	Gravity and Force Main Pipe Casing Detail
S-10	Crossing Sign Detail
S-11	Manhole Detail
S-12	Flat Top Manhole Detail
S-13	Typical Manhole Base Channel Configuration Detail
S-14	Precast Reinforced Concrete Manhole Base Detail
S-15	Sampling Manhole Detail
S-16	Outside Drop Manhole Detail
S-17	Manhole Steps Detail
S-18	Cast Iron Manhole Frame and Cover Detail
S-19	Tie-in to Existing Manhole Detail
S-20	Insertion Manhole Detail
S-21	Cast-in-Place Manhole Base on Existing Sewer Detail
S-22	Manhole Frame / Cover Protection Detail
S-23	Lateral Detail
S-24	Typical House Connection Detail

Detail No.	Title
S-25	Trap and Vent Protection Box Detail
S-26	Break-in Lateral Connection Detail
S-27	Plug Valve and Valve Box Installation Detail
S-28	Low Pressure Drop Connection Detail
S-29	Air Release Valve Manhole Detail
S-30	In-line Flushing/Cleanout Chamber Detail
S-31	Tracer Wire Test Station Detail
S-32	Typical Grinder Pump Installation Detail
S-33	Simplex Grinder Pump Station Detail
S-34	Duplex Grinder Pump Station Detail
S-35	Terminal Cleanout Assembly Detail
S-36	Intermediate Cleanout Assembly Detail
S-37	3 Way Branch Cleanout Assembly Detail

1.3 PRELIMINARY REQUIREMENTS

- A. 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. 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 New Hanover Township, other governing municipality or the Commonwealth of Pennsylvania Department of Transportation, as applicable. The cost of inspection by personnel of the Commonwealth of Pennsylvania Department of Transportation shall be paid by the Developer. 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. When Building Sewer connections are required as work of this project, construct them from the test tee (if applicable) to the building using materials required by New Hanover Township Code, as amended.
- D. Where feasible, and to the maximum extent possible, locate new sewers in streets and paved areas to facilitate access for maintenance purposes. If sewers must be located on private property, a right-of-way at least 30 feet wide centered on the sewer shall be dedicated from the Developer to the Township.

- E. Do not connect stormwater or groundwater drainage to any sewer extension of the Township's system. No rain water leaders, roof drainage, area or yard drainage, basement, surface or water from fire hydrants, ground water or water from underground drainage fields shall be permitted to drain into or be admitted into the sanitary sewer system, nor shall any of these be admitted to the sanitary sewer system by the use of pumps of any type. The sanitary sewer system, and all extensions, are intended to convey sanitary sewage only.
- F. Interfacing Existing Construction:
 - 1. Do not permit ground or surface water to enter the existing sanitary sewer facilities through the new sewer piping connection.
 - 2. Do not flush, drain or deposit water or debris from the new sewer piping or related construction into the existing sanitary sewer facilities.
 - 3. Install a watertight plug in new sewer piping entering a new manhole. Maintain the plug until all debris and accumulated water have been removed from the new sewer facilities and the new sewer facilities have passed all specified acceptance tests.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01010

SECTION 01300 – SUBMITTALS

PART 1 - GENERAL

1.1 SUBMISSIONS REQUIRED

- A. General: The descriptions 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 all submissions to the office of the Township unless otherwise directed by the Township.
- B. Definition: The term shop drawing used throughout this Section includes manufacturer's product data in the forms of descriptive literature, specifications and published detail drawings, and also Contractor prepared drawings, certified test records or reports and such other certificates required by the Specifications.

1.2 CONTRACT DRAWINGS – DEVELOPER SUBMISSION

- A. General:
 - 1. Submit two copies of drawings for review. After review of these drawings, make any corrections required and submit required copies.
 - 2. Sheet Size: 24 inches x 36 inches.
 - 3. Base all elevations on NAD 83 and NAVD 88 datum.
 - 4. Include a note on each drawing that materials used and construction methods employed are in accordance with the latest edition of the Standard Construction and Material Specifications for Sanitary Sewer Extension.
 - 5. For details of manholes, bedding, encasement, service connections, etc., make reference to the appropriate "Sewer Detail Drawing" bound herein.
 - 6. Bind drawings in sets and number them consecutively.
- B. Indicate on the drawings the following general items:
 - 1. Name of the Design Engineer.
 - 2. Seal of the Design Engineer.
 - 3. Signature of the Design Engineer.
 - 4. Name of the development and the owners.
 - 5. Date of plans and last revisions 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, if appropriate.
 - 7. Act 287 as amended (121) list of utilities.

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.
2. Index Map(s): Drawn to a scale of 1" = 400' and having the following items included thereon:
 - a. Sewer sizes other than 8-inch sewers.
 - b. Names of all streets.
 - c. Number designation of each manhole.
3. Detail Sheets (Plan and Profile): Plan View drawn to a scale of 1" = 40' and Profile View drawn to a horizontal scale of 1" = 40' and a vertical scale of 1" = 4' 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 must 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 and material of proposed sewer (Profile View).
 - i. Location, size and elevation of all existing and proposed underground utilities (Plan View and Profile View).

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

1. Number of 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 reproducibles of all Drawings, modified as necessary to show the facilities as constructed. Submit a certificate 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 by Act 121.

1.3 RIGHT-OF-WAY DRAWINGS

- A. Provide two (2) copies of all required plats and descriptions for rights-of-way.
- B. Provide a deed of conveyance transferring ownership of the sanitary sewer extension to the Township.

1.4 SHOP DRAWINGS – CONTRACTOR SUBMISSION

- A. Submit three (3) copies of each shop drawing with such promptness as to avoid delay in the work. For further expediency, electronic documents in a form acceptable to the Authority can be submitted in place of hard copies.
- B. Each submission of shop drawings must be accompanied by a letter of transmittal listing the items in the submission. Each shop drawing must 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 Township Standard Specifications and Details, but will present no difficulties in erection and completing his Contract, and 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 must 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; 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 marked as "No Exception Taken".
- E. Engineer review does not relieve the Contractor from the responsibility of proper fitting and construction of the work, nor from furnishing all appurtenances, devices, material and labor required for the installation which may not be indicated on the Drawings, in the Specifications or on the Submittals.

- F. Engineer's Action: Where action and return is required or requested, Engineer will review each submittal, mark with the action taken, and where possible return within two weeks of receipt. Where submittal must be held for coordination, Contractor will be so advised by Engineer.
1. Submittals returned with "NO EXCEPTION TAKEN" action indicates that the information submitted was found to be in conformance with the design concept and in compliance with the requirements of the Township. The Contractor remains responsible for work related errors, deviations, and discrepancies in the submittal, but may proceed with performance of the work covered by the submittal.
 2. Submittals returned with "MAKE CORRECTIONS NOTED" action indicates that the information submitted was found to be in conformance with the design concept and in compliance with the requirements of the Township, provided the noted clarifications or corrections are incorporated in the submitted information for Record Document purposes. The Contractor remains responsible for work related errors, deviations, and discrepancies in the submittal, but may proceed with performance of the work covered by the submittal. Resubmission of information is not required.
 3. Submittals returned with "AMEND AND RESUBMIT" action indicate that: (1) information submitted is at least partially not in conformance with the design concept (2) information submitted is at least partially not in compliance with the requirements of the Township, (3) submittal is incomplete and does not include all items required by the individual specification sections, or (4) certifications or computations required by the individual specification sections have not been included with the shop drawings and product data. Engineer will note the deficiencies or corrections required, and return the submittal to the Contractor. Performance of the work covered by the submittal shall not proceed until corrected information is submitted and corrections accepted.
 4. Submittals returned with "REJECTED - SEE REMARKS" action indicates that the Engineer interprets the information submitted to be not in conformance with the design concept or not in compliance with the Township Standards. This action may also indicate non-compliance with the Contractor's responsibility to review information and submit notification of deviations and discrepancies for the Engineer's review. Performance of the work shall not proceed until new information is submitted and reviewed.
 5. Review action does not establish submitted information as authorization to deviate from the Township Standards.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01300

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 TEMPORARY SERVICES

- A. General: Provide temporary services at the site of the Work throughout the entire period of construction and until the Work of the Contract is completed and the new facilities are placed in operation.
- B. Temporary Water Control:
 - 1. At all times during the construction of work of this Contract maintain the flow of storm water, naturally occurring water and wastewater in existing facilities and channels affected by the Work.
 - 2. Particular attention is directed to above requirement in regard to the maintenance of flow in existing sewer service connections during removal and replacement of the sewer main.
 - 3. Contractor assumes risk from floods or other causes, and any damages done to the work in progress or to work completed under Contract. Make repairs and replacements to the satisfaction of the Engineer.
 - 4. Contractor assumes responsibility for damages to property caused by flooding or backflooding of property due to blocking or restriction of storm water passages, natural waterways and wastewater facilities capacity during normal or excessive periods of water flow.
 - 5. At any time do not permit wastewater flow from existing sewers to flow into nearby waterways or to flow on surface areas. Furthermore, should an accidental discharge occur, notify the Department of Environmental Protection immediately at (610) 832-6000.
 - 6. The means and methods the Contractor employs to meet above requirements are at his discretion but will be subject to the Engineer's approval.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 REMOVAL

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

END OF SECTION 01500

SECTION 01570 - TRAFFIC REGULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Purpose: The purpose of this Section is to provide the Contractor with general guidelines for the control of traffic while the work of the Project within street right-of-way is being performed. The goal is to help ensure safe and efficient traffic movement through work areas and provide safety for the Contractor's work force.

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:

1. Furnish, erect and maintain at closures, intersections, and throughout the Project, the necessary approved barricades, suitable and sufficient lights, approved reflectors, danger signals, warning, detour and closure signs. Provide a sufficient number of watchmen and take the necessary and legal precautions for protection of work and safety of the public. Barricades, danger signals, signs and obstructions must be illuminated from sunset until sunrise. Materials and safety devices (i.e., barricades, flashing warning lights, torches, reflectors and signs) must conform to the State Department of Transportation Specifications.
2. Traffic regulation on streets other than State Highways must be performed in accordance with the requirements of New Hanover Township or other governing agency.
3. State Highways:
 - a. The Contractor is advised that he is required to provide traffic control in complete compliance with the rules and regulations of the Pennsylvania Department of Transportation (PDT), including but not necessarily limited to the following:
 - 1) PA Code Title 67, Transportation: Chapter 212 – Official Traffic Control Devices
 - 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) Pennsylvania Department of Transportation Publication 213 – Temporary Traffic Control Guidance
 - 5) Section 901 "Maintenance and Protection of Traffic During Construction" of the Pennsylvania Department of Transportation Specifications Publication 408, as supplemented, and such other sections therein which complement this Section.

- b. Fines and related costs resulting from the Contractor's failure to provide adequate traffic control shall be borne solely by the Contractor.

PART 2 - PRODUCTS

2.1 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, must conform to the requirements specified in Section 901 of the current edition of the 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 212 - Official Traffic Control Devices and Pennsylvania Department of Transportation Publication 213 – Temporary Traffic Control Guidance which complements Section 901.
- B. Provide danger signals and warning signs in the approved orange color.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01570

DIVISION 02
SITEWORK

SECTION 02010 - SUBSURFACE EXPLORATION

PART 1 - GENERAL

1.1 SCOPE

A. Construction Requirements:

1. In accordance with the Commonwealth of Pennsylvania Act No. 287, PA One Call System (POCS), 1-800-242-1776, the Contractor, prior to performing excavation or demolition work on the job site shall obtain all recorded locations of existing lines as outlined herein.
2. Attention is directed to the fact that there may be other lines in certain locations in addition to the recorded locations.
3. Contractor shall employ the services of a Third Party Line Locating Contractor to identify underground facilities above and beyond areas identified through the PA One Call system within the Owner's property, as necessary.

B. Related Requirements Specified Elsewhere:

1. PA Act No. 287
2. Pipeline Safety Act of 2006
3. US Department of Transportation – Chapter 4, "Accuracy of Information Regarding Buried Facilities"

1.2 QUALITY ASSURANCE

- A. Third Party Line Locating Contractor shall be a member in good standings with either National Utility Locating Contractors Association (NULCA) or the Underground Utility and Leak Locating Association (UU & LL).
- B. Work shall be performed in accordance with ASCE Standard 38-02 – Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data.

1.3 TEST PITS

- A. Digging Test Pits: In locations where new sewers are to be connected to existing sewers, 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 sewers. Dig such test pits only at the locations agreed to by and in the presence of the Engineer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 02010

SECTION 02151 - SHORING

PART 1 - GENERAL

1.1 RELATED WORK

- A. Division 2 Sections involving excavations.

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:

1. Shoring materials and installation work shall conform to Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees, specifically Occupational Safety and Health Administration 29 CFR Part 1926, Subpart P Excavation and OSHA technical manual, Section V, Chapter 2.
2. 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 Township or Engineer.
3. Contractor is responsible for means and methods of construction.
4. Provide material for sheet piling, sheeting bracing and shoring and drive or set in place in accordance with Federal, State and local laws for excavations and construction and as may be required to protect the workers and the public, or to maintain the specified trench widths.

1.3 SITE CONDITIONS

- A. Responsibility for Condition of Excavation:

1. Contractor shall protect excavations by shoring, bracing, sheet piling, trench shields, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation. The Contractor shall be entirely responsible for design, construction, and maintenance of shoring and other methods used to prevent failure or cave-in of trench sides. The Township or Engineer will assume no responsibility for injury to personnel or damage to property caused by trench cave-ins.
2. The failure or refusal of the Engineer to suggest the use of bracing, sheeting or shielding, or a better quality, grade, or section, or larger sizes of steel or timber, or to suggest sheeting, bracing, struts, or shoring to be left in place, shall not in any way or to any extent relieve the Contractor of any responsibility concerning the condition of excavation or of any of his obligations under the Contract, nor impose

any liability on the Engineer or the Township; nor shall any delay, whether caused by any action or want of action on the part of the Contractor, or by any act of the Engineer, Township, or their agents, or employees, resulting in the keeping of any excavation open longer than would otherwise have been necessary, relieve the Contractor from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of his obligations under the Contract relating to injury to persons or property, nor entitle him to any claims for compensation.

3. Contractor is to take videos and pictures of the existing conditions prior to the installation of shoring.
- B. Tight Sheeting:
1. Protect excavations deeper than eight feet with tight sheeting from the top of the original grade to below the trench subgrade except for excavations where stable rock is encountered. If stable rock is encountered at a depth greater than eight feet but above the trench subgrade, carry sheet down to the top of the rock.
- C. The Engineer reserves the right to order sheeting and bracing left in place for the protection of the finished Work or adjacent property. Sheeting and bracing which have been ordered left in place by the Engineer shall be removed for a distance of three feet below the established or existing grade, whichever is lower. Trench bracing, except that which must be left in place, may be removed when the backfilling has reached the respective levels of such bracing.
- D. Before starting Work, check and verify governing dimensions and elevations.
- E. Protect existing active sewer, water, gas, electricity and other utility services and structures.
- F. Existing utilities and structures:
1. Notify municipal agencies and service utility companies having jurisdiction. Comply with requirements of governing authorities and agencies for protection, relocation, removal and discontinuing of services, as affected by this Work.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 INSTALLATION

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

END OF SECTION 02151

SECTION 02221 - TRENCHING, BACKFILLING AND COMPACTING

PART 1 - GENERAL

1.1 RELATED WORK

- A. Subsurface Exploration: Section 02010
- B. Shoring: Section 02151
- C. Erosion and Sediment Pollution Control: Section 02270
- D. Division 3 – Concrete

1.2 DEFINITIONS

- A. Unclassified Excavation: Removal of materials of any kind in the excavation, including rock excavation.
- B. Miscellaneous Unclassified Excavation: Unclassified excavation required by the Engineer and not included in other items for payment.
- C. Rock Excavation: Removal of consolidated hard mineral material mass exceeding one-half cubic yard in volume which, in the opinion of the Engineer, cannot be excavated except by drilling and blasting or drilling and wedging. Structure foundations of concrete or of masonry or stone laid in cement-mortar will also be classified as rock if the volume requiring removal at any single location exceeds one-half cubic yard. No soft or disintegrated rock which can be removed with a pick, nor any material which can be broken down by sledge hammers, nor any ledge or single boulder less than one-half cubic yard in volume, nor loose, shaken, or previously blasted rock, nor broken stone in rock filling or elsewhere, nor rock exterior to the line of measurement as hereinafter specified, will be allowed as rock.
- D. Items involved in the excavation such as sidewalks, curbs and street or roadway paving of whatever material shall not be classified as rock excavation.
- E. Earth Excavation: Removal of materials of any kind in the excavation which, in the opinion of the Engineer, cannot be classified as rock excavation.
- F. Earth Excavation Below Subgrade: Same as earth excavation except such excavation is performed below elevations given as subgrade.
- G. Subgrade: Trench bottom prepared as specified to receive first class bedding, concrete cradle or concrete encasement or the bottom of excavations prepared to receive pipe line structures.
- H. Bedding: That stone material placed under the pipe.

- I. Haunching: That stone material placed from pipe bottom to the pipe centerline.
- J. Initial Backfill: That stone material from the pipe centerline to twelve (12) inches above top of pipe.

1.3 QUALITY ASSURANCE

A. 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.
 - a. Testing laboratory shall furnish both Engineer and Contractor two (2) copies of test result reports. Same reports will be considered as sufficient evidence of acceptance or rejection of materials represented.
 - b. Conduct aggregate quality tests in accordance with requirements of appropriate Referenced Standard for such materials.
 - c. The Engineer reserves the right to accept certificates of approved quality materials from an approved source in lieu of laboratory testing, or to require both.

1.4 REFERENCES

A. American Association of State Highway and Transportation Officials:

- 1. AASHTO T99 – Moisture-Density Relations of Soils, Using a 5.5 lb. Rammer and a 12 in. Drop.
- 2. AASHTO T191 – Standard Method of Test for Density of Soil In-Place by the Sand Cone Method.

B. The "PennDOT Sections" noted herein refer to sections contained in the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408 latest version. The references pertain only to materials, construction equipment, methods and labor. The payment provisions do not apply to work to be performed under this Contract.

C. All workmanship, materials and contractor's responsibility for all Work in and adjacent to PennDOT right-of-way shall be in compliance with PennDOT regulations, specifications and requirements. Where information in the specification is contradictory to current PennDOT requirements, PennDOT requirements shall govern. No additional compensation will be considered for claims of misleading or contradictory requirements.

D. Commonwealth of Pennsylvania Department of Transportation Specifications.

- 1. PennDOT 408, Section 703 Aggregates

- E. State Code: Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 459, Occupancy of Highways by Utilities, July 1989 (PennDOT Publication 408).
- F. State Publication: Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 212, Official Traffic Control Devices (PennDOT Publication 213).
- G. American Water Works Association (AWWA): C600, Installation of Ductile Iron Watermains and their Appurtenances and M41, Ductile Iron Pipe and Fittings.
- H. American Society for Testing and Materials:
 - 1. ASTM D 2321, Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
 - 2. ASTM D 2922; Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.5 SUBMITTALS

- A. Samples: Make all required submissions to the Engineer's Office.
 - 1. Aggregates: If requested by the Engineer, submit a 10 lb. sample, packaged in container of suitable strength, for Engineer's verification and certification for submission to testing laboratory.
- B. Test Reports:
 - 1. Submit testing laboratory aggregate test reports based on requirements stated in Source Quality Control.
 - 2. Compaction density test reports based on method of density determination as specified in Reference Standards and the method as approved by the Engineer.
- C. Certificates: Submit certificate from aggregate supplier based on requirements stated in Source Quality Control, when requested by Engineer.

1.6 PROJECT CONDITIONS

- A. Classification of Excavated Materials: Under Township or Authority contracts, all excavation shall be unclassified; that is, the removal of all material of any nature, kind, type or origin will be considered the same and shall be included in the unit/lump sum pricing as indicated in the Bid.

1.7 SITE CONDITIONS

A. Removal of Obstructions:

1. 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, the Contractor shall uncover and sustain the obstruction prior to the final disposition of obstruction. Additional precautions concerning obstructions as follows:
 - a. Do not interfere with persons, firms, corporations or utilities employing protective measures, removing, changing or replacing their property or structures, but allow said persons, firms, corporations or utilities to take such measures as they may consider necessary or advisable under the circumstances.
 - b. Break through and reconstruct if necessary, the invert or arch of any sewer, culvert or conduit that may be encountered if the said structure is in such a position, in the judgment of the Engineer, as not to require its removal, realignment or complete reconstruction.
 - c. Expenses incurred by the owner of the trackage for shoring his railroad tracks due to trenching crossing or paralleling the railroad right-of-way shall be borne by the Developer and/or Contractor whether billed to him directly or to the Township.

B. State Highway Pipe Foundation Underdrain: Replace underdrain which is damaged or removed during construction.

1. Work must be performed to the requirements and satisfaction of the Pennsylvania Department of Transportation.

C. Environmental Requirements:

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. Plan work so as to provide adequate protection during storms with provisions available at all time for preventing flood damage. Protect installed piping and other work at all times against damage from uplift due to high ground water levels.

5. Accommodation of Drainage: Keep gutters, sewers, drains and ditches open at all times for surface drainage. No damming or ponding or 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. Do not direct water flows across or over pavements except through approved pipes or properly constructed troughs. When so required, provide pipes or troughs of such sizes and lengths as may be required, and place the same as required. Perform grading in the vicinity of trenches so that the ground surface is properly pitched to prevent water running into the trenches.
 6. Pumping: Keep excavations free from water at all times during the performance of the work. Build dams and other devices necessary for this purpose, and provide and operate pumps of sufficient capacity for dewatering the excavations. 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 any portion of the work completed or in progress or produce an impediment to the use of streets, roads and highways.
 7. Do not dispose of water in trenches by draining through completed portions of sewer piping.
 8. When it is necessary to haul soft or wet soil material over roadways, use suitably tight vehicles to prevent spillage. Clear away spillage of materials on roadways caused by hauling.
 9. Provide effective dust control by sprinkling water, use of calcium chloride or any other method approved by Engineer. Employ dust control when, where and in a manner required by Engineer.
- D. Protection: Assume all risks attending the presence or proximity of overhead or underground public utility and private lines, pipes, conduits and support work for same, existing structures and property of whatever nature. Damages and expenses 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, by his work, rests solely with the Contractor.
1. 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.
 2. Pipe Supports: Adequately support underground pipes or conduits exposed as a result of excavations. Provide adequate support along their entire exposed length by timber or planking. Install such supports in such manner that backfilling may be performed without dislodging such pipes or conduits. Place and carefully compact Clean Earth Backfill or Aggregate Backfill, as required, around the supports, and leave such supports in place as a guard against breakage due to backfill settlement.

3. Temporary Protective Construction:
 - a. Temporary Fence Barricade: Erect and maintain substantial temporary fences surrounding excavation to prevent unauthorized persons entering such areas.
 - b. Temporary Fence: Where necessary, to keep one side of streets or roadway free from obstruction or to keep material piled alongside of the trench from falling on private property outside the right-of-way, erect and maintain a safe and substantial fence.
 - c. Barricades: Furnish and erect substantial barricades at crossings of trenches, or along trenches, to protect the traveling public.
 - d. 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.
 - e. Remove temporary protective construction at the completion of work on the Project.
- E. Structure Supports: Where passing buildings or any structure which by their construction or position might bring a great pressure upon the trenches, the right is reserved by the Engineer to require that such buildings or structures, be underpinned or supported and protected, or special sheeting be driven or that short lengths of trench be opened at one time.
- F. Accommodation of Traffic: Do not obstruct streets, roads and highways. Unless the Municipality or Governing Agency authorizes in writing the complete closing of the street, road or highway, employ such measures as may be necessary to keep the street, road or highway open and safe for traffic. Maintain a straight and continuous passageway on sidewalks and over crosswalks, at least three feet wide and free from obstructions. **DO NOT OBSTRUCT FIRE HYDRANTS.**
 1. At the shutdown of work at the end of the day all streets shall be left in such condition whereby they can be readily opened and safely traveled in cases of emergency such as fire or for ambulance service.
- G. 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. 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.
 2. The Contractor is solely responsible for injury to persons or property as a result of his use of explosives.
 3. Properly mat and securely cover blasts.
 4. Schedule blasting in the proximity of proposed new concrete work prior to placement of concrete.

5. Notify utility owners having structures of other installations (if any) above or below ground in proximity to the trenching work prior to use of explosives. Such notice must 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. Such notice shall not relieve the Contractor of responsibility of damage resulting from his use of explosives. The right is reserved to direct that rock within five feet of pipe, conduit or other structures encountered in the trench be removed by methods other than blasting.
 6. Provide competent blasting expert to supervise blasting.
 7. Predrilling and blasting not permitted without written permission of Engineer.
 8. Cease blasting operations when street paving adjacent to trench is damaged. Repair damaged street paving. Submit to Engineer methods to be used in subsequent blasting. Do not proceed with blasting without written approval of Engineer on methods to be used in subsequent blasting.
- H. Removal of Rock by Means Other Than Blasting: Where removal of rock by means other than blasting is required, in accordance with the requirements of State and local laws, rules and regulations, and utility owner requirements, remove by the use of mechanical surface impact equipment, or by drilling and hydraulic rock splitting equipment, or by other methods.
- I. Trench Work for Electrical:
1. Requirements specified herein for excavating, backfilling and compacting pipe line trench work shall also apply to such work required for electrical conduit installations.
 2. Exceptions to pipe line trench work requirements are as specified in the following specification parts.
- J. Excavation Condition: Condition and results of excavation are solely the responsibility of the Contractor. Remove slides and cave-ins at whatever time and under whatever circumstance they occur.
- K. 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.
- L. Borrow Material: When the required quantity of backfill material exceeds the quantity of suitable on site material, provide borrow material. 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. Borrow excavation will be subject to the Engineer's approval whose written consent shall be obtained prior to its use.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Select Backfill: Excavated material free of cinders, ashes, refuse, vegetable or organic material, boulders larger than 3", rocks, stone, or other material which, in the opinion of the Engineer, is unsuitable. If the excavated material is found to be unsuitable, the Contractor is required to obtain and backfill with suitable material at his expense. The Contractor may use suitable material from other project areas.
- B. Aggregate Backfill, Bedding and Haunching: Fine aggregates and coarse aggregates conforming to AASHTO and PennDOT requirements, see Drawings for dimensions.
- C. Classification of Backfill, Bedding and Haunching Materials:
 - 1. Aggregate Backfill of trench bottoms over-excavated at direction of Engineer to correct unstable trench bottom conditions: AASHTO #57 or as directed.
 - 2. Pipe Bedding and Haunching, Initial Backfill:
 - a. AASHTO #8 Course Aggregate, for pipe diameter 21" and below
 - b. AASHTO #57 Course Aggregate, for pipe diameter 24" and above
 - 3. Final Backfill:
 - a. Within PennDOT right-of-way and where shown on Drawings: 2RC Aggregate.
 - b. Within Township right-of-way or unpaved surfaces: 2A Modified Aggregate or Select Backfill as determined by Engineer.
- D. Underground Warning Tape:
 - 1. Printed polyethylene tape, three inches minimum width, color coded, one inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types.
 - 2. Non-magnetic for ductile iron pipe.
 - 3. Magnetic for PVC and HDPE pipe.
 - 4. Provide for:
 - a. Sanitary sewers, green.
 - b. Water line, blue.
 - c. Electric, red.

PART 3 - EXECUTION

3.1 TRENCH PREPARATION AND EXCAVATION

- A. The Contractor shall notify PA "One Call System" at (1-800-242-1776) in accordance with the regulations of Act 287, or latest revision. For those existing utilities on private property, contact the property owner and with their assistance locate the utilities on private property.
- B. General: Excavation of every description and of whatever substances encountered shall be performed to the lines, grades, levels, inverts, contours, and datums indicated on the Drawings and specified herein, or as directed by the Engineer.
 - 1. Excavation shall be made by open cut, unless written permission to tunnel or bore is given by the Engineer or is specifically outlined in the Specifications or shown on the Drawings.
 - 2. Open concrete and/or bituminous paving by cutting neat, straight lines by saw cutting. Saw cutting shall be performed with a "wet" type saw where water is applied to control dust during the sawing process.
 - 3. Trenches may be excavated and backfilled either by machinery or by hand as the Contractor may elect; provided, however the Contractor shall use hand excavation where necessary to protect existing structures, utilities, or private or public properties and provided further that backfilling shall be done by hand to the extent hereinafter specified.
 - 4. Blasting, if approved, shall be in strict conformance with these specifications.
- C. Stripping, Storing and Restoring Surface Items: The Contractor shall remove all topsoil, paving, sub-paving, curbing, gutters, brick, paving block, granite curbing, flagging or other similar materials, and grub and clear the surface over the area to be excavated. He shall properly store and preserve such materials that may be required for future use in restoring the surface. The Contractor shall be responsible for any loss or damage to said materials because of careless removal or neglectful or wasteful storage, disposal, or use of the materials. Any excavated materials not required for backfill or restoration shall be disposed of by the Contractor at his expense, at a suitable disposal location.
 - 1. All materials which may be removed, including rock, earth and sand taken from the excavation, shall be stored, if practical, in the roadway or right-of-way or such other suitable place and in such manner as the Engineer will approve.
 - 2. If more materials are removed from any trench than can be backfilled over the completed pipe or stored in the street, leaving space for traffic, the excess materials shall be removed and stored at a suitable site provided by the Contractor.
 - 3. The Contractor shall, at his own expense, bring back as much of the approved materials so removed as may be required to properly refill the trench.

4. When directed by the Engineer, the Contractor shall furnish such other suitable materials as may be necessary to properly refill the trench.
 5. The Contractor shall restore all shrubbery, fences, poles or other property and surface structures, removed or disturbed as a part of the Work, to a condition equal to that before the Work began, furnishing all labor and materials incidental thereto.
 6. The Engineer may mark certain trees, shrubs, or other items that are not to be disturbed or damaged. In the event such items are disturbed or damaged, they shall be replaced or compensated for at the Contractor's expense.
 7. Any tree which is approved by the Engineer for removal shall be cut into four foot lengths and stacked next to the pipe line right-of-way and become the property of the land owner.
- D. The Contractor may be required to work around existing utilities. If the Contractor damages any utilities, he must repair or replace them to the owner's satisfaction.
- E. Depth of Trench: A minimum of 4 feet of cover shall be provided unless otherwise specified on the Drawings.
- F. Width of Trench: Pipe trenches shall be sufficiently true in alignment to permit the pipe to be laid in the approximate center of the trench. The trench shall be wide enough to provide a free working space on each side of the pipe.
- G. Length of Trench:
1. No trench shall be opened more than 100 feet in advance of the pipe lines laid. Contractor shall provide all safety items such as sheeting, shoring and bracing.
 2. The Contractor shall limit all trench openings to a distance commensurate with all rules of safety.
 3. If the Work is stopped either totally or partially by his own accord or the direction of others, the Contractor shall refill the trench and temporarily repave or restore over the same at his expense and the trench shall not be opened until he is ready to proceed with the construction of the pipeline.
- H. Accommodations of Drainage: The Contractor shall keep gutters, sewers, drains and ditches open at all times so that the flow of storm or other waters shall not be obstructed. If the material excavated from the trenches must temporarily extend over gutters or other waterways, it shall be the duty of the Contractor to plank or bridge over the gutters, so that the flow of water is not impeded.
- I. Blasting and Explosives: The use of explosives shall be governed by the "Regulations for the Storage, Handling and the Use of Explosives" of the Pennsylvania Department of Labor and Industry, and federal Occupational Safety and Health Administration, 29 CFR, Part 1926.

1. All blasts shall be properly matted and securely covered. The Contractor shall be solely responsible for injury to persons or property located within or beyond the area or scope of the project that may result from his use of explosives.
 2. Contractor shall post a weekly and daily schedule of the street location of blasting at the Municipal Offices. The schedule shall be updated daily during blasting periods.
 3. All blasting shall be done under the supervision of a competent licensed blasting expert, and subject to the State, including Department of Labor and Industry, County, or local regulations for blasting. Whenever any pipe, main or conduit is encountered in the trench, all material within five feet of the same shall be removed by some method other than blasting or as otherwise governed by the owner of the utility.
 4. The Contractor shall be responsible for the depths to which all blasting is performed.
 5. Should any street paving adjoining any trench be damaged in consequence of the Contractor's blasting operating, he shall immediately cease his blasting operations and repair the damaged street paving; also, he shall not again proceed with any blasting until he has obtained approval from the Engineer.
 6. Blasting within State highway rights-of-way shall not be permitted unless authorized by PennDOT.
- J. Protection of Utilities, Property and Structures: The existence and location of underground utilities as indicated on the Drawings is presented merely to serve as a notification that such utilities do exist in the general proximity of the work. Any utilities not shown, or not located as shown, shall not be cause of the Contractor to deny responsibility for their protection and/or repair during construction.
1. The Contractor shall notify all utility companies in advance of construction, to include requesting the companies to establish location of their utilities, in accordance with Pennsylvania Act 287, or as further amended. Cooperate with agents of these companies during the progress of the work. Procedures for emergency action and repairs to utilities shall be established with the utility company prior to commencement of the work. During the course of his work, if the Contractor damages any of the aforementioned utilities, he shall immediately follow the procedure of emergency action and repair as established at his own expense. The Contractor shall determine the location of all utility lines on private property, with the assistance of the utility owner when on private property. The Contractor shall notify the Engineer when unexpected utilities are encountered during excavation.
 2. Whenever the Contractor, during the progress of the excavation, shall uncover service pipes or lines, which because of injury or age are in poor condition, he shall immediately notify the proper authority in order that steps may be taken for replacement or repair. Locations of repairs, and the procedures of repairs that have been made shall be recorded by the Contractor.

3. The Contractor shall, sustain in their places, and protect from direct or indirect injury, all pipes, conduits, existing sewerage systems, septic tanks, tile fields, fences, sidewalks, paving, curbs and other structures or property in the vicinity of his work, whether above or below the ground, or that may appear in the trench. He shall at all times have a sufficient quantity of repair pipe, timber and plank, chains, ropes, etc., on the ground and shall use them as necessary for sheeting his excavations and for sustaining or supporting any structures that are uncovered, undermined, endangered, threatened, or weakened, whether such structures are or are not shown on the Drawings.
 4. Pipes and underground conduits exposed as a result of the Contractor's operations shall be adequately supported along their entire exposed length by timber or planking, installed in such manner that the anchorage of the supporting members will not be disturbed or weakened during the backfilling operation. Backfill of selected material shall be carefully rammed and tamped under and around the supports and all supports shall be left in place as a guard against breakage of the supported structure due to trench settlement.
 5. Where necessary, in order to keep one side of the street or roadway free from any obstruction or to keep the material piled alongside of the trench from falling on private property outside the right-of-way, a safe and suitable fence shall be placed alongside the trench.
- K. Where lines are to be constructed on rights-of-way or easements in open areas, the maximum width of trench at the top specified hereinbefore may be exceeded only if the construction is kept entirely within the limits of the right-of-way or easements and can be carried on without damage to adjoining property. The angle of slope shall be the angle at which the trench bank will stand without sliding.
- L. Stream or Culvert Crossings: Excavate trenches in stream crossings or under culverts to the depth shown on the Drawings, Permit(s) or otherwise required by the Engineer.
1. Material excavated may be used as backfill unless specifically prohibited by any regulatory agency having jurisdiction.
 2. Make all necessary provisions for cofferdaming, dewatering, and removal of excess excavated material.
 3. Maintain the flow in the stream or culvert at all times.
 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 herein before the concrete encasement, he will be required to furnish and place all additional concrete required beyond the dimensions shown.
 5. Construct stream or culvert crossings in accordance with requirements indicated on the Drawings and Permit(s).

6. Copies of approved stream crossing permits by sanitary sewer facilities shall be provided to the Authority.

3.2 PIPE BEDDING AND TRENCH BACKFILL

- A. Bedding and Haunching: The trench shall be excavated to a depth of six inches below the outside diameter of the pipe barrel, or deeper if so specified. The resultant subgrade shall be undisturbed, or compacted as approved by the Engineer if disturbed. The bedding and haunching shall then be prepared by placing thoroughly compacted aggregate, shaped to conform to the bottom portion of the pipe or compacted against the bottom portion of the pipe, to a vertical distance of three inches above the lowest outside surface of the pipe. Contractor is required to properly haunch the pipe before any additional backfilling is allowed.
- B. Special Bedding:
 1. Concrete Cradle and Concrete Encasement: If concrete cradle and/or encasement is indicated on the Drawings or required by the Engineer, the trench shall be excavated to a depth of six inches below the outside of the barrel of pipes. All of this excavation may be done by machine.
 2. Unstable Subgrade: Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, any type or refuse, vegetable, or other organic material, or large pieces or fragments of inorganic material, which, in the opinion of the Engineer, should be removed, the Contractor shall excavate and remove such unsuitable material to the width and depth recommended by the Engineer.
 - a. Before pipe is laid, the subgrade shall be made by backfilling with aggregate material, as directed by the Engineer, in six inch (compacted thickness) layers thoroughly tamped and the bedding prepared as hereinbefore specified.
 3. Special Foundations: Where the bottom of the trench at the subgrade is found to consist of material which is unstable to such a degree that, in the opinion of the Engineer, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, the Contractor shall construct a foundation for the pipe, consisting of piling, timbers or other materials, in accordance with plans prepared by the Engineer.
- C. Backfilling Methods:
 1. General: Backfilling shall not be done in freezing weather except by permission of the Engineer, and it shall not be done with frozen material. Do not backfill when the material already in the trench is frozen.
 - a. Where Aggregate Backfill is not indicated on the Drawings or specified herein, and in the opinion of the Engineer should be used in any part of the Work, the Contractor shall furnish and backfill with aggregate as directed.

2. In or adjacent to state highways all backfill shall be in accordance with PennDOT requirements.
- D. Initial Backfill: Following placement of bedding and haunching material, initial backfill shall be placed to a depth over the crown of the pipe as shown on the Drawings. Compact the initial backfill in maximum twelve (12) inch (compacted thickness) layers. Use vibratory compactors of such size that will not damage the pipe or manual compaction methods as approved by the Engineer. Bring the backfill up both sides of the pipe simultaneously to prevent displacement of the pipe.
 - E. Aggregate Backfill to Restoration Depth (within State Highway or as directed by the Engineer): From twelve inches (12") above the top of the pipe to Restoration Depth, the trench shall be backfilled by hand or by approved mechanical methods. Backfill in this section of the trench shall be aggregate backfill material subject to limitations specified and consolidated by compacting in six inch layers. Any consolidation method utilizing water such as jetting or puddling will not be permitted. Consolidation shall proceed from the center of the trench to the sides to prevent arching.
 - F. Select Backfill to Restoration Depth (Township Roads and other locations where permitted): From twelve (12) inches above the top of the pipe to restoration depth, the trench shall be backfilled by hand or by approved mechanical methods. Backfilling this section of the trench shall be excavated material subject to limitations specified and consolidated by tamping in eight inch layers or other approved mechanical methods. Any consolidation method utilizing water, such as jetting or puddling will not be permitted. Consolidation shall proceed from the center of the trench to the sides to prevent arching. If the backfill contains too much moisture for optimum compaction, the Contractor shall dry the common backfill or provide aggregate backfill.
 1. Compacted layers may exceed eight (8) inches provided the Contractor can demonstrate that the compaction results as described in the follow sub-section (Compacting and Compaction Tests) are being obtained throughout the lifts of backfill.
 - G. Underground Warning Tape: For the purpose 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 modified herein. Bury tape at a depth of 12 inches below grade; in pavements, measure 12 inches down from subgrade of pavement. Tape to be installed along all mains, force mains and laterals.
 - H. Compacting and Compaction Tests:
 1. The Contractor will be required to perform a sample backfilling of a pipe segment early on in the construction, adequately justifying to the Engineer that his backfill and compaction operations are adequate to obtain the desired compaction results.
 2. Use mechanical tampers to compact backfill materials in trench refill operations to produce a density of backfill in each layer of not less than those specified below as a percentage of maximum standard density determined in accordance with AASHTO T99 or PennDOT requirements.

- a. Township paved areas and other areas subject to vehicular traffic: 97%
 - b. Grassed areas: 92%
 - c. State Highway areas: 100%
3. During the course of backfilling and compacting work, the Engineer or PennDOT may, at any location or depth of trench, require the Contractor to make tests to determine whether the Contractor's compaction operations are sufficient to meet specified requirements. Contractor shall retain the services of an independent testing agency for all compaction tests. Engineer shall approve all testing agencies. Contractor will be required to repair all backfill that does not conform to the compaction requirements.

END OF SECTION 02221

SECTION 02270 – EROSION AND SEDIMENT POLLUTION CONTROL

PART 1 - GENERAL

1.1 REQUIREMENTS OF REGULATORY AGENCIES

- A. Erosion and Sediment and Pollution Control Plan:
 - 1. Conduct soil erosion and sediment pollution control work in accordance with rules, regulations and requirements adopted by the Pennsylvania Department of Environmental Protection (DEP) and the Montgomery County Conservation District.
 - 2. Detail requirements for the control plan are described in an Erosion and Sediment Pollution Control Program Manual (363-2134-008), current version that may be obtained from PA DEP.
- B. Fines and related costs resulting from failure to provide adequate protection against soil erosion and sediment pollution control are the obligation of the Contractor.
- C. Erosion and sediment pollution control measures employed will be subject to approval and inspection by the Pennsylvania Department of Environmental Protection and/or County Conservation District.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 02270

SECTION 02300 - TUNNELING, BORING AND JACKING

PART 1 - GENERAL

1.1 RELATED WORK

- A. Shoring: Section 02151
- B. Trenching, Backfilling and Compacting: Section 02221
- C. Pipe Wastewater Sewers: Section 02722
- D. Force Mains: Section 02724
- E. Division 3 – Concrete

1.2 QUALITY ASSURANCE

A. Workmen Qualifications:

- 1. Employ in the work only personnel thoroughly trained and experienced in the skills required.
- 2. Have welds made only by welders, tackers and welding operators who have been previously qualified by tests as prescribed in the Structural Welding Code AWS D1.1 of the American Welding Society to perform the type of work required.

B. Design Criteria:

- 1. Provide encasing conduit under highways 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. Provide encasing conduit under railroad tracks of sufficient strength to support all superimposed loads, including a Cooper E 80 Loading with 50 percent added for impact.
- 3. Select casing pipe diameter to accommodate casing pipe joints, runners, and allowance for adequate installation space. Casing pipe diameter shall be no less than twice the diameter of the carrier pipe.

C. Requirements of Regulatory Agencies:

1. Work of this Section within State Highway right-of-way will be subject to inspection by representatives of the Commonwealth of Pennsylvania Department of Transportation, and the work must 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.
2. Inspection, insurance or other charges demanded by the Commonwealth of Pennsylvania Department of Transportation, or other Township having jurisdiction shall be paid for by the Developer.
3. 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.
4. 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.
5. The railroad company has the right to provide inspection and signaling and to support, reballast, or realign their tracks or perform other work by their own forces. The cost of such items are the responsibility of the Contractor.
6. 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.
7. If the thickness of the encasing conduit must be increased to meet the railroad company requirement, furnish and install such.
8. 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 railroad company.

D. Source Quality Control:

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

<u>MATERIAL</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Steel Pipe	ASTM A 139 or ASTM A 53	As specified in ASTM A 139 or or ASTM A 53 as applicable

2. Laboratory Tests: The Engineer reserves the right to require that laboratory tests also be conducted on materials that are shop tested. Furnish labor, materials, and equipment necessary for collecting, packaging, and identifying representative samples of materials to be tested and the shipping of such samples to the Testing Laboratory.

1.3 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, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 2. ASTM A 120, Specification for Pipe, Steel, Black and Hot-Dipped ZincCoated (Galvanized) Welded and Seamless for Ordinary Uses.
 3. ASTM A 123, Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
 4. ASTM A 139, Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 in. and over).
 5. ASTM A 307, Specification for Carbon Steel Externally Threaded Standard Fasteners.
 6. ASTM A 569, Specification for Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
 7. ASTM A 615, Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 8. ASTM C 33, Specification for Concrete Aggregates.
 9. ASTM F 467, Specification for Nonferrous Nuts for General Use.
 10. ASTM F 468, Specification for 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 703.2 Coarse Aggregate.

1.4 SUBMITTALS

- A. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, cuts or other data as required to provide a complete description of Products to be installed.
- B. Certificates: Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.

- C. Furnish PennDOT and the railroad company for approval, detail drawings, accompanied by design calculations, for the tunneling shield, tunneling pits, including sheeting and bracing, tunnel liner plate, and tunneling procedure. All such drawings and computations shall bear the seal of a Registered Professional Engineer.
- D. Furnish PennDOT and the railroad company for approval, detail drawings, accompanied by design calculations, for boring or jacking pits including sheeting and bracing, steel pipe and boring or jacking procedure, and grouting method. All such drawings and computations shall bear the seal of a Registered Professional Engineer.

1.5 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.

1.6 SITE CONDITIONS

- A. Scheduling:
 - 1. Perform operations continuously on a 24-hour basis if required by PennDOT.
 - 2. The railroad company will designate the acceptable time for constructing the railroad crossing. It is a requirement of the railroad company that operations must be conducted continuously on a 24-hour basis.
- B. 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. Explosives and Blasting: Not permitted in performance of work of this Section.

PART 2 - PRODUCTS

2.1 ENCASING CONDUIT

- A. Steel Tunnel Liner Plate: cold formed steel, four flanged liner plates.
 - 1. Minimum Inside Neutral Axis Diameter: As shown on the Drawings or as indicated by the Engineer.
 - 2. Minimum Thickness: U.S. Standard Gauge 8, marked on each liner plate by manufacturer.
 - 3. Steel: Structural quality hot rolled carbon steel; ASTM A 569.
 - 4. Provide tapped grout holes and plugs (minimum 1 1/2 inch diameter) in every third plate.

5. Hot Dipped Galvanized: ASTM A 123.
6. Nuts and Bolts: Minimum 1/2 inch diameter, coarse thread, conforming to ASTM A 307, Grade A.
7. Coating: Factory coat inside and outside with asphaltic material to a minimum thickness of 0.05 inch.
8. Acceptable Manufacturers:
 - a. Armco Drainage and Metal Products, Inc.
 - b. Or Equal.

B. Steel Pipe: ASTM A 139, Grade B or ASTM A 53, Grade B.

1. Minimum Diameter: As shown on the Drawings.
2. Minimum Wall Thickness: 0.50"

C. Casing Cradles/Spacers:

1. Constructed of two-piece solid shell of T-304 stainless steel, 14 gauge thickness; lined with ribbed PVC sheet, .090-inch thickness; 2-inch wide runners made from ultra-high molecular weight (UHMW) polymer and attached to T-304 stainless steel risers; fasteners shall be T-304 stainless steel.
2. The cradle shall be secured to the carrier pipe such that movement along the carrier pipe barrel will not occur when the carrier pipe is inserted into the casing pipe.
3. The cradles shall be sized such that the bell of the carrier pipe does not rest on the casing and such that an adequate clearance exists at the top of the cradle for ease of inserting the carrier pipe into the casing. A minimum of two casing cradles per pipe stick is required.
4. Acceptable Manufacturers: Advance Products and Systems, Inc.; Model SSI or Cascade Waterworks Mfg. Co., Style CCS.

D. Casing End Seals: Minimum 1/8-inch thick synthetic rubber with Type 304 stainless steel banding straps. Casing end seals shall be specifically designed for the size of the casing pipe and carrier pipe.

1. Acceptable Manufacturers: Advanced Products and Systems, Inc.; Model AC or AW

2.2 MISCELLANEOUS MATERIAL

A. Concrete: As specified in Section 03330:

1. Class B: 3000 psi.

- B. Aggregate Backfill:
 - 1. AASHTO No. 8 Coarse Aggregate conforming to PDT Section 703.2.
- C. Sand: ASTM C 33, fine aggregate.
- D. Hold Down Rod: Reinforcement bar, ASTM A 615, Grade 60, deformed.
 - 1. Field coat with Bitumastic No. 300-M as manufactured by Koppers Company, Inc. or equal.

PART 3 - EXECUTION

3.1 INSPECTION

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

3.2 PERFORMANCE

- A. Excavation: As specified in Section 02221 and such added requirements included herein:
 - 1. Should the Contractor in constructing any tunneling, boring or jacking pit excavate below the subgrade for the pipe sewer, he will be required to backfill the area excavated below the subgrade with Aggregate Backfill or with concrete as required by the Engineer.
- B. Tunneling:
 - 1. Tunneling shall conform to the applicable requirements of Section 02221 and all applicable requirements of PennDOT and the railroad company.
 - a. Install the tunnel liner plate to the limits indicated on the Drawings or required by the Engineer, PennDOT or the railroad company.
 - b. Exercise care in trimming the surface of the excavated section in order that the steel liner plates fit snugly against undisturbed material.
 - c. Do not advance excavation ahead of the previous installed liner plates any more than is necessary for the installation of the succeeding liner plate.
 - d. Support vertical face of the excavation as necessary to prevent sloughing. Completely bulkhead the heading at any interruption of the tunneling operation.
 - e. Paint field bolt heads and nuts.
 - 2. Grouting:
 - a. Place a uniform mixture of grout under pressure behind the liner plate and the undisturbed material.

- b. Provide grout holes tapped for no smaller than 1 1/2 inch pipe, spaced at approximately 3 feet around the circumference of the tunnel liner plates in every third ring.
- c. Start grouting at the lowest hole in each grout panel and proceed upwards simultaneously on both sides of the tunnel.
- d. Install threaded plug in each grout hole as the grouting is completed at that hole.
- e. 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:

- 1. Boring shall conform to the applicable requirements of the regulatory agency and additional requirements specified herein.
 - a. 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.
 - b. Excavate and sheet boring pit.
 - c. 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.
 - d. Over-cut by cutting head not to *exceed* the outside diameter of the encasing conduit by more than one-half inch.
 - e. The use of water or other liquids to facilitate casing placement and spoil removal is prohibited.
 - f. If voids develop or if bored hole diameter is more than 1 inch greater than the outside diameter of the encasing conduit, place Grout to fill voids.
 - g. 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.
 - h. Completely bulkhead heading at interruptions in boring operation.
 - i. Completely weld joints around the circumference between sections of steel pipe encasing.

D. Jacking.

- 1. Jacking shall conform to all applicable requirements of the regulatory agencies and additional requirements specified herein. This operation shall be conducted without handmining ahead of the pipe and without the use of any type of boring, augering, or drilling equipment.
 - a. 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.
 - b. Preliminary work shall consist of excavating and sheeting an acceptable shaft on the downstream side of the crossing and the installation of a backstop and guide timbers.
 - c. Design: Bracing and backstops shall be so designed and jacks of sufficient rating used so that the jacking can be progressed without stoppage except for adding lengths of pipe.
 - d. Accurately place guide timbers on line and grade.

- e. Support: The vertical face of the excavation shall be supported as necessary to prevent sloughing.
 - f. Use poling boards and bulkheads as required if subgrade conditions in the heading are unstable.
 - g. Jacking and excavation within the pipe shall proceed simultaneously with the ground being cut no more than 2 inch outside the pipe at the top and sides and not less than 2 inch above subgrade at the bottom.
 - h. The use of water or other liquids to facilitate casing placement and spoil removal is prohibited.
 - i. If voids develop or if jacked hole diameter is more than 1 inch greater than the outside diameter of the encasing conduit place grout to fill voids in manner approved by the regulatory agencies.
 - j. 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.
 - k. Completely bulkhead heading at interruptions in jacking operation.
 - l. Completely weld joints around the circumference between sections of steel pipe encasing.
- E. Laying and Testing Pipe: Lay and test pipe in encasing conduit as specified in Sections 02722 and 02724 and such added requirements included herein.
- 1. Support and maintain the alignment and grade of sewer piping until the runners or concrete cradle is installed and concrete has cured.
 - 2. Provide runners or concrete cradle as indicated on Detail Drawings. Concrete construction as specified in Section 03300.
 - 3. Paint exposed portion of hold down rod if used.
- F. Encasing Conduit Filling and Closing: After the sewer pipe has been installed in the encasing conduit and has been tested, fill the encasing conduit with sand.
- 1. Close one end of encasing conduit with a rubberized end seal before filling encasing conduit. Close other end of encasing conduit with rubberized end seal after filling encasing conduit or as operation dictates.

3.3 FIELD QUALITY CONTROL

- A. Testing: After laying pipe in encasing conduit and before filling conduit conduct line acceptance testing as specified in Sections 02722 and 02724.

END OF SECTION 02300

SECTION 02601 - MANHOLES

PART 1 - GENERAL

1.1 RELATED WORK

- A. Trenching, Backfilling and Compacting: Section 02221
- B. Pipe Wastewater Sewer: Section 02722
- C. Division 3 – Concrete.

1.2 QUALITY ASSURANCE

A. Shop Inspection:

- 1. All materials furnished by the Contractor shall be certified by the supplier for compliance with the pertinent Specifications. Shop inspections and testing may be required. The cost of shop testing shall be borne by the supplier or the Contractor.

B. Field Inspection:

- 1. All materials shall be furnished and installed and tested for defects in material and/or workmanship in the manner specified and in the presence of and as approved by the Engineer.

C. Source Quality Control:

- 1. Maintain uniform quality of products and component compatibility by using the products of one manufacturer in the case of precast, reinforced concrete manholes.
- 2. Obtain Certificate of Construction Compliance with ASTM C478 from the precast reinforced concrete manhole manufacturer. Submit same Certificate as part of required submittals.
- 3. Shop and Laboratory Tests: In accordance with Article 1.06 of the General Instructions, materials stated herein require periodic testing as required by the Engineer.

D. Initial Manholes: Construct first manhole to demonstrate the following, and serve as the minimum acceptable conditions of construction through the project.

- 1. Demonstrate manhole base construction methods and channel formation.
- 2. Demonstrate manhole component sealing in the case of precast, reinforced concrete manholes.

3. Demonstrate manhole step alignment.
4. Demonstrate pipe opening sealing.
5. Demonstrate heat shrinkable wrap sealing.
6. When pavement is installed, demonstrate method of adjustment of manhole frame and cover to grade, and manhole frame and cover attachment.
7. Upon completion, demonstrate successful manhole acceptance test.

1.3 REFERENCES

A. American Society for Testing and Materials:

1. ASTM A 48, Specification for Gray Iron Castings.
2. ASTM A 276, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
3. ASTM A 307, Specification for Carbon Steel Externally Threaded Standard Fasteners.
4. ASTM A 615, Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
5. ASTM C 139, Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
6. ASTM C 270, Specification for Mortar for Unit Masonry.
7. ASTM C 361, Specification for Reinforced Concrete Low-Head Pressure Pipe.
8. ASTM C 443, Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
9. ASTM C 478, Specification for Precast Reinforced Concrete Manhole Sections.
10. ASTM C 923, Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
11. ASTM D 695, Test Method for Compressive Properties of Rigid Plastics.
12. ASTM D 2146, Specification for Polypropylene Plastic Molding and Extrusion Materials.

B. American Association of State Highway and Transportation Officials (AASHTO) Standards as referenced throughout these Specifications.

C. American Water Works Association:

1. AWWA C 302, AWWA Standard for Reinforced Concrete Water Pipe Noncylinder Type, Not Prestressed.

D. Federal Specifications:

1. Fed. Spec. SS-S-210A, Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints (Type 1 Rope Form).

1.4 SUBMITTALS

A. Shop Drawings and Product Data:

1. Manufacturer's published detail drawings, modified to suit design conditions if required, and Contractor prepared drawings as applicable.
2. Manufacturer's descriptive literature and specifications covering the product specified. Include installation information.

B. Certificates:

1. Certified records or reports of results of shop tests; such records or reports to contain a sworn statement that shop tests have been made as specified.
2. Manufacturer's sworn certification that components and products will be manufactured in accordance with specified reference standards for components and products.
3. Manufacturer's sworn certification that manhole frame and cover tensile test bars were poured from the same iron as castings they represent.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

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

1.6 SITE CONDITIONS

A. Environmental Requirements:

1. In no instance set or construct manhole bases on subgrade containing frost.
2. To improve workability of "Preformed Plastic Sealing Compound" during cold weather, store such at temperature above 70°F or artificially warm compound in a manner satisfactory to the Engineer.
3. During warm weather stiffen "Preformed Plastic Sealing Compound" by placing under cold water or by other means as recommended by the compound manufacturer.

PART 2 - PRODUCTS

2.1 BASIC MATERIALS

- A. Cast-In-Place Concrete products: Formwork and Cast-In-Place Concrete per requirements of Division 3 - Concrete.
- B. Waterproofed Mortar: Material composition meeting requirements of ASTM C 270, Type M with waterproofing admixture included.
 - 1. Xypex Chemical Corporation; Xypex Admix
 - 2. Grace Construction Materials; Hydratite
 - 3. Or Equal.
- C. Epoxy Bonding Compound: Provide a high-modulus, low-viscosity, moisture insensitive epoxy adhesive having the following characteristics.
 - 1. Mix Ratio: 100 percent solids, two-component; mixed one part by volume component B to two parts by volume component A.
 - 2. Ultimate Compressive Strength: 12,000 psi after cure (28 days) at 73 degrees F. and 50 percent relative humidity determined in accordance with ASTM D 695.
 - 3. Acceptable Manufacturers:
 - a. Sika Corporation; Sikadur 32, Hi-Mod.
 - b. Or Equal
- D. Manhole Steps: Design as indicated on Sewer Detail Drawings.
 - 1. Aluminum Step: Aluminum Alloy AA Designation 6061-T6 with standard mill finish. Step type shall be drop front design with non-slip serrated step surface. Coat that portion of aluminum step being embedded in concrete with heavy bodied bituminous paint.
 - 2. Reinforced Plastic Step: Composed of a 3/8 inch Grade 60, ASTM A 615 deformed steel reinforcing bar completely encapsulated in Grade 49108, ASTM D 2146 polypropylene copolymer compound, Type II; M. A. Industries, Inc., Type PS4, or equal.
- E. Manhole Frame and Cover: Gray iron castings conforming to ASTM A48, Class No. 30, designed for AASHTO Highway Loading Class HS-20. Provide castings of uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion, or other defects. Covers to be self-sealing. Basis of design equal to No. R-1642, as manufactured by Neenah Foundry Company. Frame and cover design and dimensions as indicated on Sewer Detail Drawings.
 - 1. Finish: Bearing surfaces machined to prevent rocking and rattling under traffic. Casting surfaces shotblast cleaned and coated with asphalt paint, non-tacky drying.

2. Identification: Cast the word "NHTA SANITARY SEWER" integrally on cover in 2-inch size raised letters.
 3. Frame Hold-down Bolts: ASTM A 307.
 4. Anchor Bolts: J or L shape with standard coarse thread ends, ASTM A307.
 5. Cover Gasket: One piece O-ring gasket factory installed in a machined rectangular or dovetail groove in the cover bearing surface.
 - a. Gasket material of neoprene composition having good abrasion resistance, low compression set, 40 durometer hardness and suited for use in sanitary sewer manholes.
 - b. Gluing of gasket is not permitted.
- F. Watertight Manhole Frame and Cover: Gray iron castings conforming to previously specified requirements for Manhole Frame and Cover with the addition of cover hold-down bolts. Cover Hold-down Bolts: Type 316 stainless steel, ASTM A 276, bolts and washers. Basis of design equal to R-1915 Series as manufactured by Neenah Foundry Company. Frame and cover design and dimensions as indicated on Sewer Detail Drawings.
- G. Preformed Plastic Sealing Compound: Fed, Spec. SS-S-210A, Type 1, Rope Form, of either bitumastic base compound or butyl rubber base compound, and shipped protected in a removable two-piece wrapper. Size cross-section of rope form to provide squeeze-out of material around entire interior and exterior circumference when joint is completed.
1. ConSeal, CS-102
 2. Or Equal
- H. Waterstop: Waterstop shall consist of sodium bentonite and butyl rubber compound formed into uniform coils. Coils shall contain flexible strip waterstop and shall have dimensions of 1" x 3/4". Adhesive may be required to place the waterstop. Waterstop-RX bentonite waterstop and Cetseal adhesive as manufactured by Colloid Environmental Technologies Company (CETCO) or equivalent.
- I. Plastic Manhole Insert: Manufactured from High Density Polyethylene (HDPE), heavy weight polypropylene strap, and a factory installed closed-cell neoprene gasket. Parson Environmental Products or equal.
- J. Heat-shrinkable Manhole Joint Wrap:
1. Material: Irradiated and cross-linked polyethylene impermeable backing, coated with protective heat-activated adhesive.
 2. Bonding: Bond to primed concrete, metal, and fiberglass surfaces.
 3. Closure: Separate closure seal to secure sleeve in place during installation and seal overlap area.

4. Functional Performance of Heat-Shrinkable Sleeves having Peel Strength, ASTM D 1000: 8.6 psi, Lap Shear, ASTM D 1002: 1.5 psi, Water Absorption, ASTM D 570: 0.05 % maximum, and Low Temperature Flexibility, ASTM D 2671: -40 °F.
 5. Supplied Thickness of 101 mils with Fully Recovered Thickness: 125 mils.
 6. Shrink Factor: 40% minimum.
 7. Sleeve Backing Tensile Strength, ASTM D 638: 2900 psi (20 MPa),Elongation, ASTM D 638: 600%, Hardness, ASTM D 2240, Shore D: 46, and Abrasion Resistance, ASTM D 1044: 35 mg.
 8. Use: Primes steel, concrete, and fiberglass surfaces for installation of sleeve.
 9. Manufacturer: Canusa WrapidSeal or equal
- K. Epoxy Sealant: Provide UV resistant two (2) part epoxy sealant where required and where heat shrinkable wrap is not easily applied. Use Underground Technologies, Veil Safe or equal.

2.2 PRECAST REINFORCED CONCRETE MANHOLE COMPONENTS

- A. Materials and Construction: 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. Lifting Holes and Lugs: Thru-wall holes not permitted in manhole component construction.
 4. Manhole Steps: Factory installed in manhole components, prealigned vertically, spaced on equal centers, and located the minimum distance from ends of risers and top sections as indicated on the Sewer Detail Drawings.
 5. Manhole Component Seals: Manhole component joints factory formed for self-centering concrete to concrete bearing employing either a rubber compression gasket or preformed plastic sealing compound.
 - a. Rubber Compression Gasket: Composition conforming to ASTM C 361 or ASTM C 443.
 - b. Preformed Plastic Sealing Compound: As specified previously.
 6. Manhole Component Design: Base, riser section and top section dimensions and diameters, not consistent with ASTM C 478, are as indicated on Sewer Detail Drawings.

7. Where indicated on the Drawings, provide thermo formed semi-rigid thermo plastic liner, conforming to ASTM D 1784 sub-class 14344, with dovetail ribs to be cast integrally and securely into the concrete structure. The liner shall be 65 mils in thickness and shall be white in color in order to reflect light. Liner shall be Dura Plate 100 as manufactured by A-Lok Products, or equal.
 8. Where indicated on the Drawings, provide spray-on polyurea or high build epoxy lining system to manufacturer's instruction. Thickness shall be indicated by Engineer upon material review. This type of liner shall be required when corrosion conditions and/or high groundwater tables are present. Sprayroq, Parsonpoxy SEL-80HB or equal.
- B. Precast Bases and Riser Sections: Design, materials and construction as specified previously.
- C. Pipe Openings: Custom preformed during manufacturing in each base and riser section requiring such, to accommodate type of pipe and pipe opening seal provided.
1. Pipe Opening Seals: Resilient gasket type, cast integrally with manhole component conforming to requirements specified in ASTM C923 and of the following acceptable pipe seals:
 - a. A Lok Products Corporation; A Lok Manhole Pipe Seal.
 - b. Scales Manufacturing Corporation; RES-SEAL.
 - c. Thunderline Corporation; LINK-SEAL Modular Wall and Casing Seal.
 - d. Dual Seal Gaskets, Inc.; DUAL SEAL II.
- D. Precast Top Sections: Of materials and construction, as specified previously, except additional and differing requirements as follows:
1. Hold-Down Bolt Inserts: Factory cast in top section no less than two (2) 3/4-inch threaded inserts or slotted inserts to accommodate manhole frame hold-down bolts. Threaded inserts of 3-inch depth. Both insert types designed for an ultimate load in tension of 12,500 pounds. Inserts factory plugged for shipping. Coordinate insert location with manhole component manufacturer to assure proper location in top sections.
 2. Flat Slab Tops: Tops factory formed to properly accept and support required manhole frame and cover and formed to join riser section in a matching joint.
 3. Eccentric Cone Tops: Manufacture to same minimum wall thickness and with same area of circumferential steel reinforcement as riser sections.
- E. Precast Grade Rings: Leveling and adjusting units of 3-inches or 4-inches thickness of materials and constructions as specified previously. Factory cast grade rings with hold down bolt holes matching location of same in manhole frame. Design must provide for full bearing of manhole frame.

F. Coatings:

1. Prepare surfaces to be coated in accordance with the written instructions of the coating manufacturer, including cleaning, sandblasting, or acid etching as necessary.
2. Factory coat entire exterior of precast manhole components with two (2) coats of Induron Ruff Stuff 2100 Coal Tar Epoxy, or equal, to dry-film thickness of 7- or 8-mils per coat, coating to be repaired in the field as warranted.
3. Factory coat entire interior of precast manhole components with one (1) coat of Parsonpoxy SEL-80, or equal, to dry-film thickness of 20- mils, coating to be repaired in the field as warranted.

2.3 OPTIONS IN PRODUCTS

- A. Manhole Construction Options: Unless indicated otherwise on the Drawings, construct only one type of manhole throughout this Project. Select the manhole construction type from the options listed as follows:
 1. All-precast reinforced concrete manhole components.
 2. All-precast reinforced concrete manhole components except manhole base. Base of cast-in-place concrete.
 3. Precast reinforced concrete grade rings in any of above manhole construction.
- B. Manhole Steps Option: Provide one type of manhole step throughout the Project selected from the types specified previously.
- C. Manhole Component Seals Option: Provide one type of manhole component seal throughout the Project selected from the seal types specified previously.
- D. Manhole Pipe Opening Seals Option: Provide one type pipe opening seal throughout the Project.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect precast reinforced concrete manhole components in accordance with requirements of ASTM C 478 regarding repairable defects and defects subject to rejection by the Engineer.
- B. All material found during the progress of the work, either before or after installation, to have cracks, flaws or other defects will be rejected by the Engineer. All defective materials furnished by the Contractor shall be promptly removed from the site.

3.2 PREPARATION

- A. Keep pipe and manhole interiors cleared of debris as construction progresses.
- B. Earthwork: Perform earthwork for manhole installation as specified in Section 02221 and according to the following:
 - 1. Make excavations for manholes to a nearly vertical plane beginning at bottom of excavation one-foot beyond manhole base outside diameter (6-inches each side) to two-feet beyond manhole base outside diameter dimension for top of excavation limit (one-foot each side).
 - 2. 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 previously.
 - 3. Should "bottom of excavation limit" be exceeded, provide concrete cradle or encasement for pipes entering or leaving manhole.

3.3 MANHOLE CONSTRUCTION METHODS

- A. Cast-In-Place Concrete Manhole Base: Construct in accordance with design and dimensions indicated on Sewer Detail Drawings. When necessary to construct wider or deeper manhole bases than indicated or specified, build such bases as required by the Engineer.
 - 1. Form and pour concrete in accordance with requirements of Division 3 - Concrete. Additional requirements as follows:
 - a. Vibrate poured concrete using mechanical vibrator of a type and design approved by Engineer. Use vibrators of type capable of transmitting vibration to concrete in frequencies of not less than five thousand impulses per minute.
 - b. Form and pour joint monolithically in manhole base top to match joint of adjoining precast riser section. Use template as obtained from precast concrete manhole component manufacturer of manhole components used in the Project.
 - c. Do not place precast riser sections on cast-in-place bases for a minimum of forty-eight hours after pour.
 - 2. Install sewer piping in cast-in-place manhole bases prior to pouring the concrete.
 - a. Apply Epoxy Bonding Compound in accordance with manufacturer's instructions to pipe at base connection prior to pouring the concrete.
 - b. Install PVC Waterstop on pipes entering and leaving manhole base prior to pouring concrete. Install PVC Waterstop in accordance with manufacturer's written instructions.
 - 3. Use Class A (4500 psi) concrete unless indicated otherwise on Drawings.
 - 4. Coat bases in accordance with the requirements for precast manhole components.

- B. Precast Concrete Bases: Install bases on a 6-inch deep compacted layer of aggregate meeting requirements of First Class Bedding as specified in Section 02221.
1. When using prefabricated pipe opening seals for connecting pipes into manholes, and such seals create an annular space on interior and exterior of manhole wall pipe openings after pipe connection is made, fill such annular spaces with preformed plastic sealing compound.
 - a. Tightly caulk sealing compound into annular spaces in a manner to completely fill the spaces and render the installation watertight.
 - b. Following sealing compound installation, trowel compound surface smooth and flush with interior face of manhole.
- C. Concrete Channel Fill: Field pour concrete channel fill for each manhole base.
1. Form inverts directly in concrete channel fill.
 2. Accurately shape invert to a semi-circular bottom conforming to inside of connecting pipes, and steel trowel finish to a smooth dense surface.
 3. Make changes in size and grade gradually.
 4. Make changes in direction of entering sewer and branches to a true curve of as large a radius as manhole size will permit.
 5. Make slopes gradual outside the invert channels.
 6. Use Class B (3000 psi) concrete.
- D. Manhole Wall Erection: Provide precast reinforced concrete straight riser, tapered riser and top sections necessary to construct complete manholes. Fit the different manhole components together to permit watertight jointing and true vertical alignment of manhole steps.
1. Manhole Wall Erection: Provide precast reinforced concrete straight riser, tapered riser and top sections necessary to construct complete manholes. Fit the different manhole components together to permit watertight jointing and true vertical alignment of manhole steps. When preformed plastic sealing compound is used between sections, install sealing compound in accordance with manufacturer's recommendations, and join sections also in accordance with written instructions of manhole component manufacturer.
 - a. Prime joint surfaces if required by preformed sealing compound manufacturer.
 - b. If sealing compound is installed in advance of section joining leave exposed half of two piece protective wrapper in place until just prior to section joining.
 - c. Use preformed sealing compound as the sole element utilized in sealing section joints from internal and external hydrostatic pressure.
 - d. Following manhole section installation, trowel sealing compound surface smooth and flush with interior face of manhole.
 - e. Make pipe connections into manhole walls as specified previously for pipes connecting into manhole bases.

- E. Lifting Recess Sealing: Seal with properly designed tapered rubber plugs. Drive plugs into recesses in such manner to render holes completely water and air tight. Sealing of lifting recesses with grout not permitted. Thru-wall lifting holes are not permitted.
- F. Frame and Cover Installation: Where required, make final adjustment of frame to elevation using materials selected in Contractor Options.
 - 1. Set precast grade rings in Waterproof Mortar. Mortar thickness not to exceed 3/4-inch maximum and 3/8-inch minimum. Wet, but do not saturate concrete masonry units and precast grade rings immediately before laying.
 - 2. Precast Grade Ring: Pre-set to proper plane and elevation using wedge or blocks of cementitious material not exceeding one square inch wide on all sides. No more than four wedges or blocks per grade ring permitted. Incorporate wedges or blocks in fresh mortar in a manner to completely encase each. Crown fresh mortar to produce squeeze-out between grade rings. Tool exposed joints with appropriately shaped tool and compact mortar edge into joints. Clean off excess mortar prior to initial mortar set.
 - 3. Bolt manhole frames in place on manhole top section, or on leveling units if required, after installing 1/2-inch thick preformed plastic sealing compound on bearing surface of manhole frame. Remove excess sealing compound squeeze-out after manhole frame is bolted in place.
 - 4. Use bolts of sufficient length to properly pass through leveling units, if any, engage full depth of manhole top section inserts and allowing enough threaded end to pass through manhole frame to properly tighten nut and washer. Tighten manhole frame bolts after mortar has cured.
- G. Plugging Pipe Openings: Plug pipe openings in manholes where such openings are required for future pipe connections.
 - 1. Use masonry units and waterproofed mortar laid up to prevent deterioration.
 - 2. Install such materials to meet exfiltration limits and to allow future removal without damage to manhole.
- H. Joint Wrap or Sealant: Apply heat-shrinkable wrap or epoxy sealant per the manufacturer's recommendations.
- I. Drop Manholes: Make drop connections in all manholes where the drop invert is 2 feet or more, or as required by the Engineer. Construct in accordance with Type indicated on Sewer Detail Drawings. Use same type pipe and fittings in drop connection as used in sewer line from which drop connection is made.

3.4 INTERFACING EXISTING CONSTRUCTION

- A. Connections To Existing Sewers: Where new manholes are constructed on existing sewers the Contractor shall have the option to use cast-in-place manhole bases or precast bases, both as specified previously.

1. Replace with new, broken or damaged pipe resulting from this work. New pipe material shall match existing. Use compatible joint materials or specified pipe coupling.
 2. Connect new pipe to new manhole bases or new in-line structures as specified previously.
 3. If precast manhole bases are used replace existing sewer pipe with new to first joint outside the manhole base.
 4. Maintain flow of existing sewer both during construction operations and until concrete is cured both in the case of cast-in-place work and formed inverts.
 5. Cut with a saw piping to be removed. Chipping or breaking pipe with a hammer not permitted.
 6. Bases shall be constructed per Sewer Detail Drawings.
- B. Connections To Existing Manholes: Where new sewer mains are connected to existing manholes the Contractor shall make the connection per Sewer Detail Drawings.

3.5 FIELD QUALITY CONTROL

- A. General: Test each manhole constructed in the Project by one of the methods specified herein. If the manhole is constructed on an existing sewer where sewage flow must be maintained, the test will be waived.
1. Conduct tests in presence of and to complete satisfaction of the Engineer.
 2. Should a manhole not satisfactorily pass testing, discontinue manhole construction in the Project until such manhole does test satisfactorily.
 3. Prior to testing manholes, thoroughly clean and seal openings, both to complete satisfaction of the Engineer. Seal openings using properly sized plugs.
 4. Perform testing with frames installed. The joint between the manhole and the manhole frame shall be included in the test.
 5. The Contractor may elect to make a test prior to backfilling for his own purposes; however, the tests of the manholes for acceptance, shall be conducted after the backfilling has been completed.
 6. Provide tools, materials (including water), equipment and instruments necessary to conduct manhole testing specified herein.
 - a. Vacuum Testing Equipment:
 - 1) Use vacuum apparatus equipped with necessary piping, control valves and gauges to control air removal rate from manhole and to monitor vacuum.
 - 2) Provide an extra vacuum gauge of known accuracy to frequently check test equipment and apparatus.

- 3) Vacuum testing equipment and associated testing apparatus subject to Engineer's approval.
- 4) Provide seal plate with vacuum piping connections for inserting in manhole frame.

B. Exfiltration Test Procedure:

1. Completely fill manhole with water.
2. Allow water filled manhole to stand four hours prior to testing to allow absorbing in materials.
3. At commencement of test, fill manhole to top of manhole frame.
4. During a four consecutive hour period keep an accurate record of the amount of water to be added because of exfiltration. Acceptable limits of exfiltration as follows:
5. Consider manhole acceptable when exfiltration rate does not exceed a rate of 0.038 gallons a day per inch of manhole diameter per vertical foot of manhole.

C. Vacuum Test Procedure:

1. Perform vacuum testing in accordance with the testing equipment manufacturer's written instructions.
2. Draw a vacuum of 10 inches of mercury and close the valves.
3. Consider manhole acceptable when vacuum does not drop below 9 inches of mercury for the following manhole sizes and times:
 - a. 4 foot diameter - 60 seconds.
 - b. 5 foot diameter - 75 seconds.
 - c. 6 foot diameter - 90 seconds.

D. Repair and Retest: Determine source or sources of leaks in manholes failing acceptable limits of exfiltration.

1. Repair or replace defective materials and workmanship, as is the case, and conduct such additional manhole acceptance tests and such subsequent repairs and retesting as required until manholes meet test requirements.
2. Materials and methods used to make manhole repairs must meet with Engineer's approval prior to use.

END OF SECTION 02601

SECTION 02722 – PIPED WASTEWATER SEWER

PART 1 - GENERAL

1.1 RELATED WORK

- A. Trenching Backfilling and Compacting: Section 02221.
- B. Manholes: Section 02601.

1.2 QUALITY ASSURANCE

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

- 1. Use only one type and class of pipe in any continuous line of sewer between structures.
- 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 5 feet for pipe sewers.

- B. Source Quality Control:

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

<u>MATERIAL</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Ductile Iron Pipe	ANSI A 21.51	As specified in ANSI A 21.51
Polyvinyl Chloride Pipe	ASTM D 3034	As specified in ASTM D 3034
	ASTM F 789	ASTM F 789
	ASTM F 679 or	ASTM F 679 or
	ASTM F 794	ASTM F 794
	as applicable	as applicable

- 2. Laboratory Tests: The Engineer reserves the right to require that laboratory tests also be conducted on materials that are shop tested. Furnish labor, materials, and equipment necessary for collecting, packaging, and identifying representative samples of materials to be tested and the shipping of such samples to the Testing Laboratory.

3. The Engineer reserves the right to accept certified test records or reports of previously conducted tests.
4. Disposition of Defective Material: All material found during the progress of the work, either before or after installation, to have cracks, flaws or other defects will be rejected by the Engineer. All defective materials furnished by the Contractor shall be promptly removed by him from the site at his own expense.

1.3 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 924, Standard Practice For Testing Concrete Pipe Sewer Lines By Low-Pressure Air Test Method.
3. ASTM D 2321, Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
4. ASTM D 2564, Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
5. ASTM D 3034, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
6. ASTM D 3212, Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
7. ASTM F 477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
8. ASTM F 679, Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
9. ASTM F 789, Specification for Type PS-46 Poly (Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings.
10. ASTM F 794, Specification for Poly (Vinyl Chloride) (PVC) Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

C. American Water Works Association:

1. AWWA C 100, Cast-Iron Pressure Fittings.
2. AWWA C 104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
3. AWWA C 151, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
4. AWWA C 600, Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances.

5. C605 – Underground installation of polyvinyl chloride (PVC) pressure pipe and fittings for water.

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.

1.4 SUBMITTALS

- A. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, catalog cut or other data as required to provide a complete description of piping and piping specialties.

B. Certificates:

1. Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.
2. Manufacturer's sworn certification that pipe will be manufactured in accordance with specified reference standards for each pipe type.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

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

1.6 SITE CONDITIONS

A. Environmental Requirements:

1. Keep trenches dewatered until pipe joints have been made and concrete cradle and encasement, if any, have cured.
2. Under no circumstances lay pipe in water or on bedding containing frost.
3. Do not lay pipe when weather conditions are unsuitable, as determined by the Engineer, for pipe laying work.
4. To improve workability of "Preformed Plastic Sealing Compound" during cold weather, store such at temperature above 70 degrees F or artificially warm compound in a manner satisfactory to the Engineer.
5. During warm weather stiffen "Preformed Plastic Sealing Compound" by placing under cold water or by other means as recommended by the compound manufacturer.
6. Depth Considerations: Where the cover over a gravity sewer main is less than 14 feet, SDR-35 is acceptable; from 14 to 20 feet, SDR-26 is acceptable; and greater than 20 feet DIP in the appropriate class is acceptable.

PART 2 - PRODUCTS

2.1 SEWER PIPE AND FITTINGS

- A. For pipe joints, use rubber gaskets suitable for conveying domestic sewage.
- B. Ductile Iron (DIP):
 - 1. Pipe: ANSI A21.50 and ANSI A 21.51.
 - 2. Wall Thickness Class (Buried): As indicated on Drawings or as determined by the Engineer.
 - 3. Fittings: Gray iron or ductile iron ANSI A21.10. Fittings larger than 48 in. AWWA C100 Class B.
 - 4. Joints:
 - a. Rubber-Gasket Joints (Buried): ANSI A 21.11.
 - 1) 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 or regulatory agency.
 - 5. Lining and Coating:
 - a. Pipe and Fitting Lining: Pipe manufacturer applied ceramic epoxy coating. The material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. Lining must be in compliance with ASTM B-117, ASTM G-95, ASTM D-714, and ASTM G-22 applied to the inside of pipe and fittings. Pipe manufacturer must be approved by coating manufacturer and shall apply the coating in strict accordance to coating manufacturer's instruction. Use Induron Protecto 401 or equal.
 - b. 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.
 - 6. For crossings where the main will be installed in a casing pipe, the carrier pipe will be required to be ductile iron with a locking bell and spigot arrangement in order to prevent the pipe from coming apart if pullback is required for future repairs or replacement. The locking pipe shall meet the requirements listed above and be in accordance with applicable requirements of ANSI/AWWA C110/A21.10 and/or C153/A21.53 with the exception of the manufacturer's proprietary design dimensions. Use US Pipe TR Flex or equal.
- C. Polyvinyl Chloride Pipe (PVC):
 - 1. Pipe, Solid Wall, 6 through 15 Inch Diameters: Type PSM SDR-35/SDR-26, ASTM D 3034, or Type PS-46/PS-115, ASTM F 789 (to 18 inch diameter).

2. Pipe, Solid Wall, 18 through 48 Inch Diameters: Type PS-46/PS-115, ASTM F 679.
3. Fittings: Conforming to same applicable ASTM Specification requirements for pipe.
4. Joints: Push-on with elastomeric gasket, ASTM D 3212; and ASTM F 477 for gasket specifications.
 - a. Gaskets shall be locked to the pipe bell to prevent displacement when pipes are joined.
- D. PVC Waterstop: Gasket type waterstop composed of virgin polyvinyl chloride (PVC) such as manufactured by Fernco Joint Sealer Co.; CMA Concrete Manhole Adapter. (CMA Waterstop distributed by The General Engineering Company, Frederick, Maryland).
- E. Pipe Coupling: Solid sleeve couplings or transition couplings shall include a ductile iron mechanical joint solid sleeve with mechanical restraint glands and transition gaskets if required. Use Mega-Lug or equal.

2.2 SERVICE CONNECTION PIPE AND FITTINGS

- A. Polyvinyl Chloride (PVC) Pipe, 6-Inch Diameter: Service connection piping may be the same as specified for Sewer Pipe and Fitting.
- B. Cast Iron Saddles (For Other Than Plastic Pipe): Correctly contoured for outside diameter of pipe and incorporating a gasket and band assembly.
 1. Saddle Body: The saddle body is cast from ductile (nodular) iron, meeting or exceeding ASTM A 536, Grade 65-45-12
 2. Gasket: Gasket is made from virgin Styrene Butadiene Rubber (SBR) compounded for water and sewer service in accordance with ASTM D 2000.
 3. Band: Type 304 (18-8) Stainless Steel, 3 1/2 inches wide to spread out clamping forces on the pipe. M.I.G. and T.I.G welds. Passivated for corrosion resistance.
 4. Bolts, Nuts, and Washers: Type 304 (18-8) Stainless Steel, passivated for resistance to corrosion. 1/2" National Coarse roll thread.
 5. Coating: Fusion bonded epoxy.
 6. Acceptable Manufacturer: Romac "CB" or equal.
 7. Pressure Rating: Saddle connection shall be rated for 7 psi.
- C. Pipe Plugs: Designed for permanent installation and removable. Obtain plugs for various types of pipe used from the respective pipe manufacturer.

D. Sewer Vent and Cleanout Protection:

1. Unit shall have a cast iron body and Lid suitable for traffic loadings similar to a "Stratton box".
2. Dimensions:
 - a. Length – 10 ½ inches (minimum)
 - b. Diameter – 5 ¼ inches (minimum)
3. Shaft shall have continuous extension on the bottom circumference.
4. Lid shall have the word "SEWER" cast on the top.

2.3 OPTIONS IN PRODUCTS

A. Sewer Pipe and Fittings Options: Unless indicated otherwise on the Drawings, the sewer mains in this Project shall incorporate only one of the listed types of pipe for a given range of pipe sizes. However, use only pipes of the material options listed. The options are as follows:

1. Six through 15 inch diameter size range:
 - a. Polyvinyl Chloride Pipe (PVC) type PSM SDR-35/SDR-26 or PS-46/PS-115.
2. 18 inch through 48 inch diameters:
 - a. Polyvinyl Chloride Pipe (PVC) Solid Wall, PS-46/PS-115.
3. Pipe Material Option Exception: Ductile Iron Pipe (DIP), with either push-on or mechanical joints, may be used for pipe sizes 8 through 48 inches.
4. Required Pipe Material Exception: Use only DIP where required by the Engineer because of prevailing site conditions, where required by utility companies and/or local governmental bodies, or where the sewer main is laid in fill material.
5. Concrete encasement of Polyvinyl Chloride Pipe (PVC) will not be permitted.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect each section of pipe and each pipe fitting before laying in conformance with the inspection requirements of the appropriate referenced standard.
- B. Remove rejected pipe from the Project.

3.2 PREPARATION

A. General:

1. Clean piping interior prior to laying pipe and following pipe laying.
2. Keep open ends of piping and pipe attachment openings capped or plugged until actual connection or actual pipe testing.
3. Excavate trenches in rock at least 25-feet in advance of pipe laying. Protect pipe ends from blasting.

B. Earthwork: Perform earthwork for sewer installation as specified in Section 02221.

3.3 SEWER CONSTRUCTION METHODS

A. General: All pipe shall be laid to a uniform line and grade between manholes, socket ends upgrade, with a firm and even bearing along the barrel of the pipe, close joints and smooth invert. The spigot end of the pipe is to be centered in, shoved tight and secured against the bell or socket of the previously laid pipe. The interior of each pipe shall be cleaned of all excess joint and foreign material before the next pipe is laid. The pipe shall be laid in the bedding materials as specified in Section 02221. Pipe-laying shall commence at the lowest point and proceed upgrade. At the close of each day's work, and at such other times when pipe is not being laid, the open end of the pipe shall be protected with a close fitting stopper.

B. Joints: Make joints in strict accordance with manufacturer's installation instructions.

C. Laying Specified Types of Plastic Pipe: Installation and joint assembly according to ASTM D 2321.

D. Construction Control:

1. The use of laser equipment will be permitted. Cut sheets for all manhole runs as required.
2. Regardless of control used, the Contractor shall provide alternative verification of grade as work progresses. Pipe not laid to proper line and grade will be removed and reconstructed at the Contractor's expense.
3. Provide temporary bench marks for grade verification.

E. Variations: The Engineer reserves the right to vary the line and/or grade from that shown on the drawings for pipe lines and manholes when such changes may be necessary or advantageous. No claims will be allowed for changes in location or grade except as such changes are made after trenching has been done.

- F. Sanitary Sewer near Water Mains. The Engineer may vary the location of sanitary sewers in close proximity to water mains. No variations on location will be permitted without approval of the Engineer.
1. Horizontal Separation - Sewers should be laid at least 10 feet horizontally from any existing or proposed water main. Should local conditions prevent a lateral separation of 10 feet, a sewer main may be laid closer to the 10 feet to a water main if (1) it is laid in a separate trench, or if required and approved by Engineer (2) it is laid in the same trench with the water mains located at one side of the bench of undisturbed earth and if in either case the elevation of the crown of the sewer is at least 18 inches below the invert of the water main.
 2. 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 requirement, the water main shall be relocated to provide this separation or reconstruct it with mechanical joint pipe for a distance of 10 feet on each side of the sewer. One full length of water main should be centered over the sewer so that joints will be as far from the sewer as possible.
 3. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both the water main and sewer shall be constructed of mechanical joint ductile iron pipe and shall be pressure tested to assure water tightness; or, the sewer shall be concrete encased for a distance of 10 feet on either side of the water main in accordance with the details shown on the contract drawings or as ordered by the Engineer.
- G. Handling of Sewer Line Materials into Trench: Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, jointing materials, etc. shall be carefully lowered into the trench piece-by-piece by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to sewer line materials and/or workmen. Under no circumstances shall such materials be dropped or dumped into the trench.
- H. Pipe Clearance in Rocks: Ledge rock, boulders and large stones shall be removed to provide a clearance of at least six inches below and on each side of all pipe and fittings.
1. The specified minimum clearances are the minimum clear distances which will be permitted between any part of the pipe and/or fitting being laid and any part, projection or point of such rock, boulder or stone.
- I. Concrete Cradle and Encasement:
1. Preparation: Prior to the formation of cradle or encasement, if any, temporary supports consisting of timber wedges and solid concrete bricks or cap blocks shall be used to support the pipe in place. Temporary supports shall have minimum dimensions and shall support the pipe at not more than two locations, one at the bottom of the barrel of the pipe adjacent to the shoulder of the socket and the other near the spigot end.

2. Placing: After jointing of the pipe has been completed, concrete shall be uniformly poured beneath and on both sides of the pipe. Placement shall be done by the use of suitable equipment. The concrete shall be wet enough during placement to permit its flow, without excessive prodding, to all required points around the pipe surface. The width of cradle shall be such as to fill completely the trench width. In case of extremely wide trenches, concrete encasement may be confined above the top of the pipe to a narrower width but in no case shall it be less than the width of trench required for the size of pipe being used. Before depositing concrete, the space within the limits of the pour shall have been cleared of all debris and water. Water shall not be allowed to rise adjacent to, or flow over, concrete deposited for less than 24 hours. Concrete shall be protected from the direct rays of the sun and kept moist, by a method acceptable to the Engineer, for a period of seven days or until backfilling is begun. In no case shall backfilling begin within 24 hours of the time of placing and the Engineer shall have strict control of the rate of backfilling.

3. Concrete: 3000 psi per requirements of Section 03300.

J. Service Connection Fittings:

1. Wyes: Make connections to sewer using wye fittings of same material and joint configuration as the sewer at planned point of branch connection.
 - a. Use commercially manufactured wye fittings and one-eighth bends.
 - b. Set wye 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. Saddles: Make connections to sewers, which incorporate a saddle connection, by machine cutting a hole in the sewer of proper size to accommodate the saddle. Use a machine specifically designed for the purpose; no other means of making the hole permitted.
 - a. Install saddle in accordance with manufacturer's installation instructions.
3. Pipe Outlet: Connect service connection piping to outlet in manner specified for joining pipe.
4. 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.

- K. 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 Sewer Detail Drawing.

- L. Connections to Existing Manholes or Structures: Core bore required opening or openings so as to prevent cracking and spalling concrete. Make openings of sufficient size to accommodate pipe with PVC Waterstop installed and one inch of annular grout space. Grout annular space using Non-Shrink and Non-Metallic Grout as specified in Section 03600. Make connection watertight. Form a new invert channel in the existing manhole base to properly connect the flow through the existing manhole. Do not permit ground water, surface water or debris to enter the existing facilities through the new connection. Provide drop connection if connection invert is 2 feet or more above the manhole invert. Construct connections or drop connection in accordance with design shown on Sewer Detail Drawing.
- M. Reconnection of Existing Service Connections: Use wye fittings or saddles for connection to the sewer main. Use pipe if required as specified previously. Make connection to existing piping with suitable rigid pipe couplings.

3.4 SERVICE CONNECTION CONSTRUCTION

- A. General Requirements: Build service connections (house or other service lines) to such points indicated on Sewer Detail Drawings. Lay and join service connections in every respect as specified previously 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: If required, install a 6 x 6 x 6-inch test tee on upper free end of service connections (test tee for Owner's use in testing house or building sewer lines connected to service connection). Provide test tees of same material as service connection. Close two outlets of test tee with Plugs. Type of plug used and method of installation subject to Engineer's approval. Installed plugs shall successfully pass Line Acceptance Test.
 - 3. In general, where depth of sewer invert is 12-feet or more, or elsewhere as designated by the Engineer, install service connections to enter the sewer as shown on Sewer Detail Drawings for "Service Connection-Deep Sewer". Use same material used for service connections.
 - 4. Where DIP is used for pipe sewer mains, use PVC pipe for service connection piping. Coating system shall be properly restored where DIP material is cut away for connection. Provide suitable adaptor.

3.5 PIPELINE TESTING PREPARATION

- A. Backfill trenches in accordance with detail on Drawings.
- B. Provide pressure pipeline with concrete reaction support blocking.
- C. Flush pipeline to remove debris. Collect and dispose of flushing water and debris.
- D. Clean pipelines by propelling a snug fitting rubber ball through the pipeline with water from the upstream manhole to the downstream manhole. Investigate and correct any stoppage of the cleaning ball. Collect and dispose of cleaning water and debris.

E. Lamping:

1. After flushing and cleaning, lamp gravity pipeline in the presence of the Engineer.
2. Assist the Engineer in the lamping operation by shining a light at one end of each pipeline section between manholes. The Engineer will observe the light at the other end. Pipeline that has not been installed with uniform line and grade will be rejected. Remove and re-lay rejected pipeline sections. Reclean and lamp until pipeline section achieves a uniform line and grade to the satisfaction of the Engineer.

F. Plug outlets, wye-branches and laterals. Brace plugs to offset thrust.

G. All testing for pipes and manholes shall be conducted with a Township representative on site.

3.6 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.
2. Conduct tests of every kind in the presence of and to the satisfaction of the Engineer.
3. The Township reserves the right to retest at the Contractor's expense, any piping throughout the duration of the Construction Period. Piping found to be defective shall be repaired or replaced prior to acceptance by the Township.

3.7 TESTING GRAVITY SEWER PIPELINES

A. Low Pressure Air Test:

1. Test each newly installed section of gravity sewer line between manholes.
2. Slowly introduce air pressure to approximately 5.0 psig.
3. Allow pressure to stabilize for at least five minutes. Adjust pressure to 3.5 psig or the increased test pressure as determined below if groundwater is present. Start the test.

4. Test:

- a. Determine the test duration for a sewer section with a single pipe size from the table below:

Nominal Pipe Size	T (Time) Min/100 Ft.	
4	.3	3 minutes minimum
6	.7	3 minutes minimum
8	1.2	4 minutes minimum
10	1.5	4 minutes minimum
12	1.8	4 minutes minimum
15	2.0	4 minutes minimum
18	2.2	4 minutes minimum
21	2.4	5 minutes minimum
24	2.6	5 minutes minimum
30	3.0	5 minutes minimum

- b. Record the drop in pressure during the test period. If the air pressure has dropped more than 1.0 psig during the test period, the line is presumed to have failed. If the 1.0 psig air pressure drop has not occurred during the test period, the test shall be discontinued and the line will be accepted.
- c. If the line fails, determine the source of the air leakage, make corrections and retest. The Contractor has the option to test the section in incremental stages until the leaks are isolated. After the leaks are repaired, retest the entire section between manholes.

B. Infiltration Test:

1. Use only when gravity pipeline is submerged in groundwater. Obtain prior approval of the Engineer.
2. Maximum Allowable Infiltration: 100-gallons per inch of pipe diameter per mile per day for any one section under test, including the allowances for leakage from manholes.

C. Infiltration:

1. After the air testing described in the preceding paragraph has been completed by the Contractor, regardless of any indications of the test results made by the Engineer or the Township, the Engineer and the Township reserve the right to perform field investigations, prior to final written acceptance of each sewer run by the Township and/or during the required one-year correction period, to establish the leakage of groundwater into the sewer and laterals constructed. The cost of these investigations shall be borne by the Township.
2. Should the leakage exceed 100 gallons per day per inch diameter per mile of pipe for any section, the Contractor shall, at the direction of the Engineer or Township, and at no cost to the Owner, perform any additional testing or corrective work required to reduce the infiltration in each manhole run from those lines installed by the Contractor to less than 100 gallons per day per inch diameter per mile of pipe. This leakage applies to each manhole run separately and should not be construed to mean total leakage in the total system. The scope of this corrective work shall include, but not be limited to, cleaning, televising and testing the sewer and laterals to the limits installed by the Contractor, to include testing and grouting of joints, excavation and replacement of faulty or damaged portions of the work, and all final restoration.

3.8 DEFLECTION TESTING OF PLASTIC SEWER PIPE

- A. At the direction of the Engineer, perform vertical ring deflection testing on suspect portions of PVC sewer piping, in the presence of the Engineer, after backfilling has been in place for at least 30 days but not longer than 12 months.
- B. The maximum allowable deflection for installed plastic sewer pipe shall be limited to 5% of the original vertical internal diameter.
- C. Perform deflection testing with a deflectometer, calibrated television, or a properly sized "Go, No-Go" mandrel. The mandrel(s) shall be constructed at the Contractor's expense and subject to the approval of the Engineer.
- D. Pipe exceeding the allowable deflection shall be located, excavated, replaced, and retested at the sole expense of the Contractor.

3.9 TEST REPORTS

- A. The Contractor shall submit a written, certified report which includes the detailed testing log with times and results for all pipe segments and manholes.

3.10 ACCEPTANCE

- A. Observation of successful testing of manholes and sewers by the Engineer does not constitute acceptance of the system or any portion thereof. Upon completion of any determined portion of a total system, and successful testing thereof, the Engineer may recommend to the Township to allow for service connections to become active on the new mains. The township will not take dedication of the sewer main extension until all required testing, inspection, and required documentation is submitted.

END OF SECTION 02722

SECTION 02724 - FORCE MAINS

PART 1 - GENERAL

1.1 RELATED WORK

- A. Trenching, Backfilling and Compacting: Section 02221.
- B. Manholes: Section 02601.
- C. Piped Wastewater Sewer: Section 02722.

1.2 QUALITY ASSURANCE

- A. Design Criteria: In addition to the design requirements of the Pennsylvania Department of Environmental Protection, comply with the following:
 - 1. Use only one type and class of pipe in any continuous force main between structures.
 - 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 4 feet for force mains.
- B. Source Quality Control:
 - 1. Shop Tests: In accordance with Article 1.06 of the General Instructions, factory test pipe materials listed in the following. Each pipe manufacturer must have facilities to perform listed tests. The Engineer reserves the right to require the manufacturer to perform such additional number of tests as the Engineer may deem necessary to establish the quality of the material offered for use.

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

- 2. Laboratory Tests: The Engineer reserves the right to require that laboratory tests also be conducted on materials that are shop tested. Furnish labor, materials, and equipment necessary for collecting, packaging, and identifying representative samples of materials to be tested and the shipping of such samples to the Testing Laboratory.

1.3 REFERENCES

A. American National Standards Institute:

1. ANSI A 21.4, Cement-Mortar Lining for Cast Iron and Ductile-Iron Pipe and Fittings for Water.
2. ANSI A 21.10, Gray-Iron and Ductile-Iron Fittings, 2 through 48 inches, for Water and Other Liquids.
3. ANSI A 21.11, Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
4. ANSI A 21.15, Flanged Cast-Iron and Ductile-Iron pipe with Threaded Flanges.
5. ANSI A 21.50, Thickness Design of Ductile-Iron Pipe.
6. ANSI A 21.51, Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
7. ANSI B 16.1, Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
8. ANSI B 16.21, Nonmetallic Gaskets for Pipe Flanges.
9. ANSI B 18.2.1, Square and Hex Bolts and Screws, Including Askew head Bolts, Hex Cap Screws, and Lag Screws.
10. ANSI B 18.2.2, Square and Hex Nuts.

B. American Society for Testing and Materials:

1. ASTM A 48, Specification for Gray Iron Castings.
2. ASTM A 240, Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
3. ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
4. ASTM B 85, Specification for Aluminum-Alloy Die Castings.
5. ASTM B 371, Specification for Copper-Zinc-Silicon Alloy Rod.
6. ASTM B 438, Specification for Sintered Bronze Bearings (Oil-Impregnated).
7. ASTM B 584, Specification for Copper Alloy Sand Castings for General Applications.
8. ASTM D 2241, Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series).
9. ASTM D 3139, Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
10. ASTM F 477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. American Water Works Association:

1. AWWA C 104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C 151, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
3. AWWA C 509, Resilient-Seated Gate Valves, 3 Through 12 NPS, for Water and Sewage Systems.
4. AWWA C 550, Protective Interior Coatings for Valves and Hydrants.

1.4 SUBMITTALS

- #### A. Shop Drawings and Product Data:
- Furnish completely dimensioned shop drawings, cuts or other data as required to provide a complete description of piping, piping specialties, and valves.

B. Certificates:

1. Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified. Certification to be sworn by and bear the seal of a Registered Professional Engineer.
2. Manufacturer's sworn certification that pipe will be manufactured in accordance with specified reference standards for each pipe type.

C. Submit design calculations for air release, and air and vacuum valves.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

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

1.6 SITE CONDITIONS

A. Environmental Requirements:

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

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Ductile Iron (DIP):

1. Pipe: ANSI A21.50 and ANSI A21.51.
2. Wall Thickness Class (Buried): As indicated on Drawings or as required by the Engineer.
3. Wall Thickness Class (Exposed): Class 53 except as noted otherwise on Drawings.
4. Fittings: Gray iron or ductile iron ANSI A21.10, rated for 250 psi working pressure.

5. Joints:

- a. Rubber-Gasket Joints (Buried): ANSI A21.11.
 - 1) 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.
 - 2) Provide rubber gaskets suitable for conveying domestic sewage.
 - 3) Provide locking rubber gaskets where required per the Sewer Detail Drawings.
- b. 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:
 - 1) United States Pipe and Foundry Company; TRFLEX.
 - 2) Or Equal.
- c. Mechanical Restraint Glands: Glands shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10. The devices shall have a working pressure rating of 350 psi for 3-16 inch and 250 psi for 18-48 inch. Provide joints for pipe and fittings similar to the following:
 - 1) EBAA iron, Mega-Lug
 - 2) Or Equal.
- d. Flanged Joints (Exposed): ANSI A21.15.
 - 1) Gaskets: 1/16 in. thick cloth insertion rubber full face type conforming to ANSI B16.21.
 - 2) Bolts: ANSI B18.2.1.
 - 3) Nuts: ANSI B18.2.2.
- e. Pipe Coupling: Solid sleeve couplings or transition couplings shall include a ductile iron mechanical joint solid sleeve with mechanical restraint glands and transition gaskets if required. Use Mega-Lug or equal.

6. Lining and Coating:

- a. Pipe and Fitting Lining (Full Pipe Design): Manufacturer's standard cement-mortar lining in accordance with AWWA C 104, single thickness. Lining shall include an asphaltic seal coat to prevent moisture loss in cement-mortar curing sequence.
- b. Pipe and Fitting Lining (Less Than Full Pipe Design): Pipe manufacturer applied ceramic epoxy coating. The material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. Lining must be in compliance with ASTM B-117, ASTM G-95, ASTM D-714, and ASTM G-22 applied to the inside of pipe and fittings. Pipe manufacturer must be approved

by coating manufacturer and shall apply the coating in strict accordance to coating manufacturer's instruction. Use Induron Protecto 401 or equal.

- c. Pipe and Fitting Coating: Manufacturer's standard asphaltic coating, approximately one mil thick in accordance with AWWA C 151, applied to the outside of pipe and fittings.
- 7. For crossings where the main will be installed in a casing pipe, the carrier pipe will be required to be ductile iron with a locking bell and spigot arrangement in order to prevent the pipe from coming apart if pullback is required for future repairs. The locking pipe shall meet the requirements listed above and be in accordance with applicable requirements of ANSI/AWWA C110/A21.10 and/or C153/A21.53 with the exception of the manufacturer's proprietary design dimensions. Use US Pipe TR Flex or equal.

B. Polyvinyl Chloride Pipe and Fittings (PVC):

- 1. To and including 4-inch Diameter: ASTM D2241, SDR 21.
 - a. Pressure Class: 200 psi.
 - b. Pipe Joints: Push-on or compression type, joint performance ASTM D3139, rubber gasket suitable for domestic sewage service ASTM F477.

2.2 PIPING SPECIALTIES

- A. Wall Sleeves: Cast iron with intermediate anchoring flange in center of sleeve. Provide wall sleeves similar to those by Clow Corporation, American Cast Iron Pipe Co., U.S. Pipe and Foundry Co., or equal.
- B. Vault Piping: 316 Stainless Steel Schedule 40 pipe.

2.3 SEWAGE VALVE

- A. 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 a conical body shape, designed to maintain the maximum distance between the liquid and the sealing mechanism and still obtain minimum body length. Valve construction as follows:
 - 1. Valve Bodies: Reinforced Nylon or Stainless Steel SAE 316 as required by Engineer.
 - 2. Discharge Outlet: Polypropylene.
 - 3. Seals: BUNA-N.
 - 4. Float Stem: Stainless Steel SAE 316.
 - 5. Floats: Foamed Polypropylene.

6. Rolling Seal Assembly: Nitrile Rubber, EPDM, and Stainless Steel.
7. Backflushing and Cleaning Accessories: Accessories shall be provided with the valve.
8. Test Pressure: Valve shall be tested to 250 psi.
9. Operating Pressure Range: 3 to 150 psi.
10. Valve shall be capable of being reconfigured to act as air release only or vacuum only, if it is determined to be a more appropriate configuration for the application.
11. Acceptable Manufacturers:
 - a. A.P.I. D-025
 - b. Or Equal

2.4 GATE VALVE

- A. Cleanout Assembly Gate Valve: Class 125 stainless steel gate, screw-in bonnet, non-rising stem, tapered solid wedge, and rated 200 psi non-shock cold water, oil or gas. Valve body shall indicate ratings and manufacturer identification. Design of valve stuffing box of such that repacking under pressure is possible. Valve particulars as follows:
 1. Ends: Female standard pipe size to national standard hose.
 2. Handwheel: Aluminum handwheel and identification plate (opening direction indicated), with stainless steel nut.
 3. Valve Stem: Stainless Steel.
 4. Packing Nut/Packing Gland: Stainless Steel.
 5. Packing: PTFE.
 6. Stuffing Box, Bonnet, Valve Body, Wedge, and Hose Cap: Stainless Steel.
 7. Acceptable Manufacturers:
 - a. Crane Company
 - b. Or Equal

2.5 PLUG VALVES

- A. Eccentric Plug Valve:
 1. Plug valves shall be quarter-turn, non-lubricated, eccentric type with resilient faced plug.
 2. The valves shall be designed, manufactured and tested in accordance with American Water Works Association Standard ANSI/AWWA C517.

3. Mechanical joint valves shall fully comply with ANSI/AWWA C111/A21.11.
4. Port areas of not less than 100% of pipe are shall be supplied on all valves.
5. The valve seat shall be a welded overlay of 95% pure nickel applied directly to the body on a pre-machined, cast seating surface and machined to a smooth finish.
6. Shaft seals shall consist of V-type packing in a fixed gland with an adjustable follower designed to prevent over compression of the packing and to meet design parameters of the packing manufacturer. Removable slotted shims shall be provided under the follower flanges to provide for adjustment and prevent over tightening.
7. Permanently lubricated, radial shaft bearings shall be supplied in the upper and lower bearing journals. Thrust bearings shall be provided in the upper and lower journal areas.
8. Both the packing and bearings in the upper and lower journals shall be protected by a drip tight Buna-N shaft seal located on the valve shaft to minimize the entrance of grit into the bearing journal and shaft seal areas.
9. The valve body and cover shall be constructed of ASTM A126 Class B cast iron for working pressures up to 175 psig (1200 kPa). The words "SEAT END" shall be cast on the exterior of the body seat end.
10. The plug shall be of one-piece construction and made of ASTM A126 Class B cast iron or ASTM A536 Grade 65-45-12 ductile iron and fully encapsulated with a resilient facing per ASTM D2000-BG and ANSI/AWWA C517 requirements.
11. Radial shaft bearings shall be constructed of self-lubricating type 316 stainless steel. The top thrust bearing shall be Teflon. The bottom thrust bearing shall be Type 316 stainless steel. Cover bolts shall be corrosion resistant with zinc plating.
12. Valves shall include a totally enclosed and sealed worm gear actuator and externally adjustable open and closed stops. The worm segment gear shall be ASTM A536 Grade 65-45-12 ductile iron with a precision bore and keyway for connection to the valve shaft. Bronze radial bearings shall be provided for the segment gear and worm shaft. Alloy steel roller thrust bearings shall be provided for the hardened worm.
13. All gear actuators shall be designed to withstand, without damage, a rim pull of 200 lb. on the handwheel and an input torque of 300 foot pounds for nuts.
14. Buried service actuators shall be packed with grease and sealed for temporary submergence to 20 feet of water. Exposed worm shafts shall be stainless steel.
15. The interior and exterior of the valve shall be coated with fusion bonded epoxy.
16. Acceptable Manufacturers:
 - a. Valmatic Series 5700R

- b. Or Equal

2.6 AIR RELEASE AND CLEANOUT CHAMBERS

- A. Materials for chambers as specified for precast manholes in Section 02601.

- 1. Sump Frame and Grate: Cast Iron, ASTM A-48.

2.7 VALVE BOXES

- A. Cast iron extension roadway type, three-piece construction, and of screw adjustment design.

- 1. Boxes shall have 5 1/4-inch minimum shaft diameter and cover marked SEWER.
 - 2. Boxes hot-coated inside and out with a tar or asphalt compound.

2.8 TRACER WIRE

- A. Tracer wire shall be a #10 AWG HS-CCS high-strength copper clad steel conductor (HS-CCS), insulated with a 30 mil, high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. HS-CCS conductor must be a 21% conductivity for locating purposes, Break load 600# minimum. Copperhead or equal.

2.9 OPTIONS IN PRODUCTS

- A. Force Main Pipe and Fittings Options: Construct the force mains in this Project with either DIP or PVC pipe and fittings. However, use only one type of pipe and fittings throughout.

- 1. Through four-inch diameter:
 - a. Ductile Iron Pipe.
 - b. Polyvinyl Chloride Pipe
 - 2. Five-inch and larger diameters:
 - a. Ductile Iron Pipe.

- B. Provide only ductile iron pipe and stainless steel fittings within air release and cleanout chambers. A mixture of types not acceptable.

- C. Provide either concrete thrust blocks or restrained joints at changes of directions in ductile iron pipe runs. A mixture of types not acceptable.

PART 3 - EXECUTION

3.1 INSPECTION

- A. As specified in Section 02722.

3.2 PREPARATION

- A. As specified in Section 02722.

3.3 FORCE MAIN CONSTRUCTION METHODS

- A. Construct in accordance with applicable requirements of Section 02722 with the following additional requirements.

1. Unless indicated otherwise, install piping with not less than 4'-0" of cover.
2. Flanged Joints: For DIP shall be faced true, fitted with gaskets, and drawn up square and tight to insure full gasket flow and satisfactory seal.
3. Concrete Thrust Blocks: Provide concrete thrust blocks at each fitting, and at locations where horizontal and/or vertical deflections are made in the joints of the force mains. Use Class B concrete. Design of thrust blocks as indicated on Sewer Detail Drawing.
4. Joint Restraints: Install on buried DIP at changes in direction of pipe runs and at terminal ends of pipe runs in accordance with the Sewer Detail Drawings.

- B. Setting Valves and Boxes:

1. Unless otherwise directed by the Engineer, set valves and boxes truly vertical.
2. Set valve boxes neatly to grade and in such a way that the box does not transfer shock or stress to the valve. Exercise care to center the box over the wrench nut of the valve.

3.4 AIR RELEASE AND CLEANOUT CHAMBER CONSTRUCTION METHODS

- A. As specified in Section 02601 and as indicated on Sewer Detail Drawings.

3.5 FIELD QUALITY CONTROL

- A. General Requirements: Conduct tests specified herein so that each force main installed in the Project is tested to the Engineer's satisfaction.
 1. Provide tools, materials (including water), apparatus and instruments necessary for force main testing.

2. Conduct tests of every kind in the presence of and to the satisfaction of the Engineer.
 3. Provide an extra pressure gauge of known accuracy to frequently check test equipment and apparatus.
 4. The hydrostatic testing equipment and associated testing apparatus is subject to Engineer's approval.
 5. When the length of the force main exceeds 1000 feet, test the force main in section. The length of each section to be determined by the Engineer.
 6. If PVC pipe is used, test for pipe diameter deflection according to requirements of Section 02722.
- B. Cleaning Prior to Tests: Before tests are conducted, clean piping.
- C. Line Acceptance Test:
1. Pressure test after the line has been laid and partially backfilled between joints. Should the Contractor elect to backfill the entire trench, or any portion thereof, prior to testing, the Contractor shall locate and repair any leaks which occur during the test.
 2. Pressure and leak test at fifty percent (50%) above normal working pressure at the highest point along the test section as determined by the Engineer in the presence of the Engineer or Owner's representative and in accordance with the local plumbing code. In no case shall the test pressure be less than 150 psi. Test pressure shall not vary by more than 5 psi for the duration of the test.
 3. Contractor shall provide temporary plugs, caps, vents, fill, apparatus necessary for testing. Apply pressure with a pump connected to the main. Measure make-up water with a meter.
 4. Inspect fittings, joints and valves during testing. Any defective components shall be removed and replaced by the Contractor.
 5. Before applying the specified pressure test, all air shall be expelled from the pipe.
 6. While the test pressure is being maintained, all exposed pipes, fittings, valves and joints shall be inspected for leaks. The test pressure shall be maintained for a period of not less than two (2) hours if joints are exposed and four (4) hours when joints are covered or less if deemed appropriate by the Engineer.

7. The allowable leakage in gallons per hour per 1,000 feet of pipeline, shall be as noted in the following table:

	Nominal Pipe Diameter (Inches)					
Average Testing Pressure	4	6	8	10	12	16
150	0.37	0.55	0.74	0.92	1.10	1.47
175	0.40	0.59	0.80	0.99	1.19	1.59
200	0.43	0.64	0.85	1.06	1.28	1.70
225	0.45	0.68	0.90	1.13	1.35	1.80

8. If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.
9. Large diameter piping shall be leak tested for zero leakage.
10. Tests shall be repeated until results are in conformance with specified requirements.
11. Submit test reports.
- D. The Contractor may elect to make a leakage test prior to backfilling the trenches, for his own purposes; however, the leakage tests of the force mains or sections thereof for acceptance, shall be conducted after the backfilling of the benches has been completed.
- E. The Township reserves the right to retest (at its own expense) any installed piping throughout the duration of the Construction Period. Piping found to be defective shall be repaired or replaced prior to acceptance by the Township.

END OF SECTION 02724

SECTION 02725 - LOW PRESSURE WASTEWATER

PART 1 - GENERAL

1.1 RELATED WORK

- A. Trenching, Backfilling and Compacting: Section 02221.
- B. Manholes: Section 02601.
- C. Piped Wastewater Sewer: Section 02722.
- D. Division 3 - Concrete.
- E. Grinder Pump Units: Section 11304.

1.2 QUALITY ASSURANCE

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

- 1. Use only one type and class of pipe in any continuous sewer between structures.
- 2. Use pipe and fittings designed to withstand imposed trench loadings and prevailing site conditions at the various locations.

- B. Source Quality Control:

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

<u>MATERIAL</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Ductile Iron Pipe	ANSI A 21.51	As specified in ANSI A 21.51
Polyvinyl Chloride Pipe	ASTM D 2241	As specified in ASTM D2241

- 2. Laboratory Tests: The Engineer reserves the right to require that laboratory tests also be conducted on materials that are shop tested. Furnish labor, materials, and equipment necessary for collecting, packaging, and identifying representative samples of materials to be tested and the shipping of such samples to the Testing Laboratory.

1.3 REFERENCES

A. American National Standards Institute:

1. ANSI A 21.10, Gray-Iron and Ductile-Iron Fittings, 2 through 48 inches, for Water and Other Liquids.
2. ANSI A 21.11, Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
3. ANSI A 21.15, Flanged Cast-Iron and Ductile-Iron Pipe with Threaded Flanges.
4. ANSI A 21.50, Thickness Design of Ductile-Iron Pipe.
5. ANSI A 21.51, Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
6. ANSI B1.1, Unified Inch Screw Threads.
7. ANSI B 16.1, Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
8. ANSI B 16.21, Nonmetallic Gaskets for Pipe Flanges.
9. ANSI B 18.2.1, Square and Hex Bolts and Screws, Including Askew head Bolts, Hex Cap Screws, and Lag Screws.
10. ANSI B 18.2.2, Square and Hex Nuts.

B. American Society for Testing and Materials:

1. ASTM A 47, Specification for Malleable Iron Castings.
2. ASTM A 48, Specification for Gray Iron Castings.
3. ASTM A 123, Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. ASTM A 126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
5. ASTM A 183, Specification for Carbon Steel Track Bolts and Nuts.
6. ASTM A 240, Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
7. ASTM A 283, Specification for Low and Intermediate Tensile Strength Carbon Steel Plates of Structural Quality.
8. ASTM A 307, Specification for Carbon Steel Externally Threaded Standard Fasteners.
9. ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
10. ASTM B 140, Specification for Copper Zinc-Lead (Leaded Red Brass or Hardware Bronze) Rod, Bar and Shapes.
11. ASTM B 371, Specification for Copper-Zinc-Silicon Alloy Rod.
12. ASTM B 584, Specification for Copper Alloy Sand Castings for General Applications.
13. ASTM C 534, Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
14. ASTM C 547, Specification for Mineral Fiber Preformed Pipe Insulation.
15. ASTM D 1784, Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
16. ASTM D 1785, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80 and 120.
17. ASTM D 2241, Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series).
18. ASTM D 2321, Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
19. ASTM D 2466, Specification for Socket-Type Poly (Vinyl Chloride) PVC Plastic Pipe Fittings, Schedule 40.
20. ASTM D 2564, Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

21. ASTM D 2774, Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.
22. ASTM D 2855, Recommended Practice for Making Solvent-Cemented Joints With Poly (Vinyl Chloride) PVC Pipe and Fittings.
23. ASTM D 3139, Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
24. ASTM E 84, Test Method for Surface Burning Characteristics of Building Materials.
25. ASTM F 477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. American Water Works Association:

1. AWWA C 104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C 151, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
3. AWWA C 600, Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances.
4. AWWA C 800, Threads for Underground Service Line Fittings (with Appendix on Collected Standards for Service Line Materials).

1.4 SUBMITTALS

A. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, catalog cuts and product data as required to provide a complete description of the following:

1. Pipe and Pipe Fittings
2. Piping Specialties
3. Combination Sewage Valve
4. Air Release and Cleanout Chambers

B. Certificates:

1. Certified records or reports of results of Shop Tests, such records or reports to contain a sworn statement that Shop Tests have been made as specified. Certification to be sworn by and bear the seal of a Registered Professional Engineer.
2. Manufacturer's sworn certification that pipe will be manufactured in accordance with specified reference standards for each pipe type.

C. Submit design calculations for air release, and air and vacuum valves.

1.5 SITE CONDITIONS

A. Environmental Requirements:

1. Keep trenches dewatered until pipe joints have been made and concrete cradle and encasement, if any, have cured.
2. Under no circumstances lay pipe in water or on bedding containing frost.

3. Do not lay pipe when weather conditions are unsuitable, as determined by the Engineer, for pipe laying work.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Polyvinyl Chloride Pipe and Fittings (PVC):

1. Pipe: ASTM D 2241, SDR 21 PVC; Pressure Class 200 psi.
 - a. Pipe Joints: Push-on or compression type, joint performance ASTM D 3139, rubber gasket suitable for domestic sewage service ASTM F 477.
 - b. Fitting Joints: Same as pipe or socket-type, ASTM D 2564 unless flanged joints are indicated on the Drawings.
 - c. Socket Type Fittings: ASTM D 2466 manufactured from Class 12454-B Rigid PVC Compound.
 - d. Flanges: PVC Schedule 40 150-lb. flanges manufactured from Rigid PVC Compounds conforming to ASTM D 1784.
 - 1) Gaskets: Soft rubber full face flat type.
 - 2) Bolts: Steel conforming to ASTM A 307.
 - e. Solvent: ASTM D 2564

B. Ductile Iron Pipe and Fittings (DIP):

1. Pipe: ANSI A21.50 and ANSI A21.51.
2. Wall Thickness Class (Buried): As indicated on Drawings, or as required by the Engineer.
3. Wall Thickness Class (Exposed): Class 53 except as noted otherwise on Drawings.
4. Fittings: Gray iron or ductile iron ANSI A21.10, rated for 250 psi working pressure.
5. Joints: Provide rubber gaskets suitable for domestic sewage service.
 - a. Rubber-Gasket Joints (Buried): ANSI A 21.11
 - 1) 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 or regulatory agency.
 - b. Flanged Joints (Exposed): ANSI A 21.15
 - 1) Gaskets: 1/16 inch thick cloth insertion rubber full face type conforming to ANSI B16.21.
 - 2) Bolts: ANSI B 18.2.1
 - 3) Nuts: ANSI B 18.2.2

6. Lining and Coating:

- a. Pipe and Fitting Lining (Full Pipe Design): Manufacturer's standard cement-mortar lining in accordance with AWWA C 104, single thickness. Lining shall include an asphaltic seal coat to prevent moisture loss in cement-mortar curing sequence.
- b. Pipe and Fitting Lining (Less Than Full Pipe Design): Pipe manufacturer applied ceramic epoxy coating. The material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. Lining must be in compliance with ASTM B-117, ASTM G-95, ASTM D-714, and ASTM G-22 applied to the inside of pipe and fittings. Pipe manufacturer must be approved by coating manufacturer and shall apply the coating in strict accordance to coating manufacturer's instruction. Use Induron Protecto 401 or equal.
- c. Pipe and Fitting Coating: Manufacturer's standard asphaltic coating, approximately one mil thick in accordance with AWWA C 151, applied to the outside of pipe and fittings.

7. For crossings where the main will be installed in a casing pipe, the carrier pipe will be required to be ductile iron with a locking bell and spigot arrangement in order to prevent the pipe from coming apart if pullback is required for future repairs. The locking pipe shall meet the requirements listed above and be in accordance with applicable requirements of ANSI/AWWA C110/A21.10 and/or C153/A21.53 with the exception of the manufacturer's proprietary design dimensions. Use US Pipe TR Flex or equal.

C. Provide adaptors, nipples, caps, etc., as required.

D. Flanged Adapters: For joining plain-end pipe to flanged fittings, valves and pumps.

1. Acceptable Manufacturers:

- a. EBAA Iron, Mega Lug
- b. Or Equal

2.2 PIPING SPECIALTIES

A. Valve Boxes: Cast iron extension roadway type, three-piece construction, and of screw adjustment design.

1. Boxes shall have 5 1/4-inch minimum shaft diameter and a 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 on Piping: Insulation manufactured by closed cell, 5 to 6 pounds cubic feet density foamed plastic, with thermal conductivity of 0.26 BTUH per square foot per degree per inch at 70 degrees F. mean temperature, water vapor transmission rating of less than 0.1 perms. per inch, and a self-extinguishing fire-rating; ASTM E 84. Insulation manufactured to meet requirements of ASTM C 534. Use insulation manufacturer's companion joint malding/sealing adhesive to make permanent insulation joints.

1. Fitting Insulation (Flexible): Insulate fittings and valve bodies with sleeves of same insulation thickness used on adjacent piping and having an inside diameter larger enough to fit over the insulation on adjacent piping.

2. Acceptable Manufacturers:
 - a. Owens-Corning Fiberglass
 - b. Or Equal
- C. Curb Stop and Box: Designed to conform to AWWA Standard C-800
 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. Pipe Coupling: Solid sleeve couplings or transition couplings shall include a ductile iron mechanical joint solid sleeve with mechanical restraint glands and transition gaskets if required.
 1. Acceptable Manufacturers:
 - a. EBBA Iron, Mega-Lug
 - b. Or Equal
- E. Service Saddle: Cast iron with stainless steel band, Ford Iron Service Saddle, Style FS202 or FC202, or equal.
- F. Sewage Check Valve: The check valve shall be constructed of 304 stainless steel or PVC material (ASTM 12454 cell class per ASTM D-1784). The check valve will provide a full ported passageway to match pipe diameter and shall introduce minimal friction loss at maximum rated flow. The flapper hinge design shall provide a maximum degree of freedom and ensure seating at low back pressure.
- G. Ball Valve: Provide Hayward TB True Union PVC or equal valves as shown on the Drawings. Valves shall be of drop-tight PVC construction (ASTM 12454 cell class per ASTM D-1784), counter-turn shutoff, reversible PTFE seats, double o-ring stem seals, 2" square operating nut, stem extension, and 250 psi rated pressure. An Arch pattern curb box made from ABS with cast iron lid labeled "SEWER" shall be required for each buried ball valve. Cleanout ball valves shall have a lever operator.
- H. Cleanout Access Box: Provide a precast insulated concrete box per Sewer Detail Drawing with a cast iron frame and cover labeled "SEWER" capable of HS-20 loading.
- I. Cam Lock Hose Fitting: Coupling shall be made of malleable iron or stainless steel and shall have a working pressure of 150 psi. A rubber washer shall seal connection to flushing hose. A dust cap shall be provided.
- J. Flushing Hydrant: Provide flushing cleanout assembly to include below grade bronze body ball valve with chrome plated ball and valve stem extension for operating access within the cleanout access box. Use GIL Industries, Slimline or equal.

2.3 COMBINATION SEWAGE VALVE

- A. 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 a conical body shape, designed to maintain the maximum distance between the liquid and the sealing mechanism and still obtain minimum body length. Valve construction as follows:
1. Valve Bodies: Reinforced Nylon or Stainless Steel SAE 316 as required by Engineer
 2. Discharge Outlet: Polypropylene
 3. Seals: BUNA-N
 4. Float Stem: Stainless Steel SAE 316
 5. Floats: Foamed Polypropylene
 6. Rolling Seal Assembly: Nitrile Rubber, E.P.D.M., and Stainless Steel
 7. Backflushing and Cleaning Accessories: Accessories shall be provided with the valve.
 8. Test Pressure: Valve shall be tested to 250 psi.
 9. Operating pressure range: 3 to 150 psi.
 10. Valve shall be capable of being reconfigured to act as air release only or vacuum only, if it is determined to be a more appropriate configuration for the application.
 11. Acceptable Manufacturers:
 - a. A.P.I. D-025
 - b. Or Equal

2.4 VALVES

- A. General:
1. Provide valves of the same type by same manufacturer, suitable for the intended service.
 2. Markings factory cast on the bonnet or body of each valve indicating manufacturer's name or mark, year of valve casting, size of valve, directional flow arrow and designation of working water pressure.
 3. Valve pressure-temperature ratings of not less than the design criteria applicable to the system components.
 4. Valves shall open to the left (counterclockwise). Valves operated by either nut or handwheel as indicated on the Drawings. Operating nuts or wheels shall have cast thereon an arrow indicating the direction of opening.

5. Provide extension stems with bronze bushed stem guides where required.
6. Valve ends as indicated on the Drawings and unless indicated otherwise shall conform to the following:
 - a. Flanged: ANSI B16.1

B. Gate Valves:

1. General:
 - a. Design working pressure at 200 psi.
 - b. Valves of rising stem type except when installed underground or otherwise indicated on Drawings.
 - c. Valve stuffing box of such design that valve can be packed under pressure when in fully open position.
2. Valves Smaller Than 3-inches in Diameter:
 - a. Solid bronze with tapered split wedge disc.
 - b. Physical properties of brass pressure-containing parts shall conform to ASTM B62.
 - c. Stems fabricated of ASTM B371, Alloy A (rolled silicon brass), ASTM B584 Copper Alloy No. 876 (silicon bronze plus silicon brass), or other material equally resistant to dezincification.
3. Tapping Valve:
 - a. Oversized seat rings.
 - b. Raised male face on flanged end for bolting to tapping sleeve.
 - c. Mechanical or push-on joint with slotted holes for bolting to tapping machine.
4. Valve Boxes: Cast iron extension roadway type, three-piece construction, and of screw adjustment design.
 - a. Boxes shall have 5-1/4-inch minimum shaft diameter and cover marked SEWER.
 - b. Boxes hot coated inside and out with a tar or asphalt compound.

C. Plug Valves:

1. Eccentric Plug Valve:
 - a. Plug valves shall be quarter-turn, non-lubricated, eccentric type with resilient faced plug.
 - b. The valves shall be designed, manufactured and tested in accordance with American Water Works Association Standard ANSI/AWWA C517.
 - c. Mechanical joint valves shall fully comply with ANSI/AWWA C111/A21.11.
 - d. Port areas of not less than 100% of pipe are shall be supplied on all valves.
 - e. The valve seat shall be a welded overlay of 95% pure nickel applied directly to the body on a pre-machined, cast seating surface and machined to a smooth finish.

- f. Shaft seals shall consist of V-type packing in a fixed gland with an adjustable follower designed to prevent over compression of the packing and to meet design parameters of the packing manufacturer. Removable slotted shims shall be provided under the follower flanges to provide for adjustment and prevent over tightening.
- g. Permanently lubricated, radial shaft bearings shall be supplied in the upper and lower bearing journals. Thrust bearings shall be provided in the upper and lower journal areas.
- h. Both the packing and bearings in the upper and lower journals shall be protected by a drip tight Buna-N shaft seal located on the valve shaft to minimize the entrance of grit into the bearing journal and shaft seal areas.
- i. The valve body and cover shall be constructed of ASTM A126 Class B cast iron for working pressures up to 175 psig (1200 kPa). The words "SEAT END" shall be cast on the exterior of the body seat end.
- j. The plug shall be of one-piece construction and made of ASTM A126 Class B cast iron or ASTM A536 Grade 65-45-12 ductile iron and fully encapsulated with a resilient facing per ASTM D2000-BG and ANSI/AWWA C517 requirements.
- k. Radial shaft bearings shall be constructed of self-lubricating type 316 stainless steel. The top thrust bearing shall be Teflon. The bottom thrust bearing shall be Type 316 stainless steel. Cover bolts shall be corrosion resistant with zinc plating.
- l. Valves shall include a totally enclosed and sealed worm gear actuator and externally adjustable open and closed stops. The worm segment gear shall be ASTM A536 Grade 65-45-12 ductile iron with a precision bore and keyway for connection to the valve shaft. Bronze radial bearings shall be provided for the segment gear and worm shaft. Alloy steel roller thrust bearings shall be provided for the hardened worm.
- m. All gear actuators shall be designed to withstand, without damage, a rim pull of 200 lb. on the handwheel and an input torque of 300 foot pounds for nuts.
- n. Buried service actuators shall be packed with grease and sealed for temporary submergence to 20 feet of water. Exposed worm shafts shall be stainless steel.
- o. The interior and exterior of the valve shall be coated with fusion bonded epoxy.
- p. Acceptable Manufacturers:
 - 1) Valmatic Series 5700R
 - 2) Or Equal

D. Bronze Ball Valve:

- 1. Valve of solid bronze body, ASTM B 584, and having straight-through flow passage.
- 2. Seats and O-rings of Buna-N.
- 3. Valves shall be quarter-turn operated with a T-handle or round handle suitable for use in confined spaces and which will allow sufficient space for operation within the valve box. Handle shall indicate whether valve is in open or closed position.
- 4. Threaded end valves available in sizes 1/4 inch through 2 inches shall be rated 200 psi.

5. Ball and Stem: Brass, chrome finish, ASTM B 140.
6. Acceptable Manufacturers:
 - a. Crane Company
 - b. Or Approved Equal

2.5 AIR RELEASE AND CLEANOUT CHAMBERS

- A. Air Release Chambers: Precast manholes as specified in Section 02601.
- B. Cleanout Chambers: Provide chambers composed of sections of reinforced concrete Class HI pipe, aggregate base, and frame and cover. Dimensions are as indicated on the Sewer Detail Drawings.
 1. Frames and Covers: Cast iron, ASTM A48. The word SEWER cast on cover. Neenah No. R-1642, or equal.
- C. Use ductile iron pipe and ductile iron or cast iron fittings within air release and cleanout chambers except where other type of pipe is indicated on the Sewer Detail Drawings.

PART 3 - EXECUTION

3.1 INSPECTION

- A. As specified in Section 02722.
- B. Remove rejected pipe from the Project immediately to avoid confusing rejected pipe with new pipe.

3.2 PREPARATION

- A. As specified in Section 02722.
- B. Earthwork: Perform earthwork for sewer installation as specified in Section 02221.

3.3 LOW PRESSURE SEWER CONSTRUCTION METHODS

- A. Construct in accordance with applicable requirements of Section 02722 with the following additional requirements.
 1. Unless indicated otherwise, install piping with not less than four feet of cover.
 2. Concrete Thrust Blocks: Provide concrete thrust blocks at each fitting, and at locations where horizontal and/or vertical deflections are made in the joints of the force mains. Use Class B concrete. Design of thrust blocks as indicated on Sewer Detail Drawing.

- B. Laying Specified Types of Plastic Pipe: Perform installation and joint assembly according to ASTM D 2321 for Class I bedding material and ASTM D 2855.
- C. Laying Ductile Iron Pipe: Perform installation and joint assembly according to AWWA C 600, and as follows:
 - 1. Where necessary to field cut pipe, use approved pipe cutter, milling cutter or abrasive wheel saw.
 - 2. Flanged Joints: For DIP shall be faced true, fitted with gaskets, and drawn up square and tight to insure full gasket flow and satisfactory seal.
- D. Joints: Make joints in joining of pipe materials, specified under PART 2 and not specifically covered for installation under PART 3 of this Specification, in strict accordance with manufacturer's installation instructions and such included reference standards.
 - 1. Arrange 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.
 - 4. Flanged Joints: Make joints faced true, fitted with gaskets, and drawn up square and tight to ensure full gasket flow and satisfactory seal.

3.4 AIR RELEASE AND CLEANOUT CHAMBER CONSTRUCTION METHODS

- A. As specified in Section 02601 for precast manholes, and as indicated on the Drawings.
- B. Carefully inspect installed work which is to be insulated and verify such work to be complete, including system or equipment testing, to such point where insulating work may begin.
 - 1. Provide insulation on piping and fittings that will be exposed to freezing temperatures.
 - 2. Apply insulation on clean, dry surfaces only. Perform cleaning required for removal of construction debris, spills, etc.
 - 3. Flexible Insulation Installation: Install on piping according to manufacturer's instructions, using specified adhesive to seal both longitudinal and butt joints. Insulate in-line appurtenances to the same thickness as adjoining insulation. Install in 1/2-inch thickness.
 - 4. Outdoor Installation: Weatherize Flexible Insulation exposed to weather using those protective and moisture impervious materials as recommended by the insulation manufacturer.

3.5 FIELD QUALITY CONTROL

- A. General Requirements: Conduct tests specified herein so that the pressure wastewater sewers installed in the Project are tested to the Engineer's satisfaction.
 - 1. Provide tools, materials (including water), apparatus and instruments necessary for force main testing.
 - 2. Conduct tests of every kind in the presence of and to the satisfaction of the Engineer.
 - 3. Provide an extra pressure gauge of known accuracy to frequently check test equipment and apparatus.
 - 4. Hydrostatic testing equipment and associated testing apparatus subject to Engineer's approval.
 - 5. When the length of the sewer exceeds 1000 feet, test the sewer in sections.
 - 6. Do not use in-line valves to isolate sections for testing.
- B. Cleaning Prior to Tests: Before tests are conducted, clean piping interior.
- C. Line Acceptance Test: Follow test procedure in Section 02724.

END OF SECTION 02725

DIVISION 03
CONCRETE

SECTION 03100 – CONCRETE FORMWORK

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Design Criteria:

1. The Contractor is responsible for design, engineering and construction of formwork.
2. 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.

1.2 REFERENCES

A. American Concrete Institute:

1. ACI 347, Recommended Practice for Concrete Formwork.
2. ACI 350, Concrete Sanitary Engineering Structures.

B. American Plywood Association: APA Grade-Trademarks.

C. US 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.

1.3 SITE CONDITIONS

A. Protection:

1. 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.
2. In event of damage to erected forms, make necessary repairs or replacements prior to concrete pours.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Form Lumber Materials:

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.
3. Provide lumber free of material defects that would deform the finished concrete product.

B. Plywood:

1. Form Sheathing and Panels: Not less than 5/8 inch thick Exterior Type B-B Plywood Class I and II EXT-APA conforming to U.S. Product Standard PS-1-74.
2. Provide Class II only on surfaces not exposed to view.

C. Steel:

1. Metal Forms of a pre-engineered standard design, but conforming to the concrete sections indicated on the Drawings, may be used in lieu of wood forms.

D. Form Ties:

1. Provide factory fabricated, adjustable-length, removable or snap-off metal form ties conforming to ACI 347 and ACI 350.
2. Provide snap-off metal ties with ends that break at least 1-1/2 inches from the face of the wall.
3. Removable ties that leave holes larger than 7/8 inches are not permitted.
4. Form ties fabricated on the project site and wire ties or flat bands are not acceptable.

5. 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

3.1 INSPECTION

- A. Prior to placement of concrete, inspect forms for cleanliness and accuracy of alignment.

3.2 PREPARATION

- A. Apply form coatings in accordance with manufacturer's specifications.
- B. Do not allow excess form coating material to accumulate in the forms.
- C. Do not allow form coatings to come in contact with construction joints or reinforcing steel.

3.3 ERECTION

- A. General: 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: Earth forms are not permitted in the Project.

3.4 FORM REMOVAL

- A. Remove forms in accordance with ACI 347 without damage to concrete and in a manner to insure complete safety to the structure.
 - 1. Cutting form ties back from the face of the concrete is not permitted.
- B. Upon removal of forms, notify the Engineer in order that a review of the newly stripped surfaces may be made before patching.

3.5 RE-USE OF FORMS

- A. Forms for re-use shall meet new form requirements with respect to effect on poured concrete appearance and structural stability.
- B. 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).

END OF SECTION 03100

SECTION 03200 – CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 RELATED WORK

- A. Concrete Formwork: Section 03100.

1.2 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 Steel Wire, Plain, for Concrete Reinforcement.
- 2. ASTM A 185, Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.
- 3. ASTM A 307, Specification for Carbon Steel Externally Threaded Standard Fasteners.
- 4. ASTM A 320, Specification for Alloys-Steel Bolting Materials for Low-Temperature Service.
- 5. ASTM A 615, Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

- C. Concrete Reinforcing Steel Institute: CRSI, Manual of Standard Practice for Reinforcing Concrete Construction.

1.3 SUBMITTALS

- A. Shop Drawings and Product Data:

- 1. Prepare shop drawings of concrete reinforcement in accordance with American Concrete Institute's Standard ACI 315.
- 2. Indicate bending diagrams, splicing and lap of rods, and shapes, dimensions and details of bar reinforcing and accessories.

- B. Test Reports:

- 1. Submit two copies of reports showing the results of tests. Such tests conducted in accordance with the American Society for Testing and Materials Specifications.

2. Test Requirements may be waived, based upon certified copies of mill test reports.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Storage of Materials:

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

1.5 SITE CONDITIONS

- ##### A. Protection: Protect in-place reinforcing from excessive construction traffic and other work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing Steel:

1. Reinforcement Bars: ASTM A 615, Grade 60, Deformed steel reinforcing bars, which shall satisfy the exceptions in ACI Building Code, AASHTO and Federal Specifications.
2. Wire: ASTM A 82.
3. Welded Wire Fabric: ASTM A 185.
4. Metal Accessories: CRSI Manual of Standard Practice for Reinforcing Concrete Construction.

B. Anchors:

1. Steel Anchor Bolts: Shapes as indicated, ASTM F 1554, Grade 36 with galvanized finish.
2. Stainless Steel Anchor Bolts: ASTM A 320 Grade B8, AISI Type 304.

2.2 FABRICATION

A. General: Perform bending of steel reinforcement by the cold bending method.

1. Do not use bars with kinks or bends not indicated on Drawings.
2. Perform bar shape fabricating in a manner that will not injure the material or lessen the member strength.
3. Use a designed bending machine, either hand or power-operated.

4. 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

3.1 INSPECTION

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

3.2 INSTALLATION

- A. Placing:
 1. Place metal reinforcement accurately and securely brace against displacement through the use of reinforcing accessories in accordance with ACI 318.
 2. Terminate reinforcement 2-inches from face of expansion joints.
 3. Continue reinforcement across or through construction joints.
 4. When obstructions interfere with the placement of reinforcing, pass such obstructions by placing reinforcing around and not bending the reinforcing to clear the obstructions.
 5. Install welded wire fabric as indicated, lapping joints 6-inches and wiring securely. Extend welded wire fabric to within 2-inches of sides and ends of slabs.
 6. Do not lay metal reinforcement on formwork. Raise reinforcement as concrete is placed.
 7. Support reinforcing using metal accessories; products other than metal accessories not permitted.
- B. Splicing:
 1. Splice metal reinforcement as indicated and in accordance with ACI 318.
 2. Welding of crossing bars (tack welding) is not permitted without approval of Engineer.
 3. Secure metal reinforcement at intersections with not less than 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: Metal reinforcement, at the time concrete is placed, shall be free from rust, scale or other coatings that will destroy or reduce bond.
- E. Concrete Reinforcement Protection:
 - 1. Provide protection for reinforcement during concrete pours in accordance with ACI 318, unless indicated otherwise on the Drawings.
 - 2. On exterior exposed work, no ties or spacers will be permitted to remain within 314 inches of the finished surfaces.

END OF SECTION 03200

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED WORK

- A. Concrete Formwork: Section 03100.
- B. Concrete Reinforcement: Section 03200.

1.2 QUALITY ASSURANCE

- A. Testing Agency: Meeting requirements of The American Society for Testing and Materials Recommended Practice for Inspection and Testing Agencies for Concrete and Steel in Construction ASTM E 329.
- 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 Method 1. Test to consist of four compression test cylinders for each class of concrete with one broken at seven days and two broken at 28 days and one held in reserve; ASTM C 192 and ASTM C 39.

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials, AASHTO M182 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 94, Specification for Ready-Mixed Concrete.
 5. ASTM C 143, Test Method for Slump of Portland Cement Concrete.
 6. ASTM C 150, Specification for Portland Cement.
 7. ASTM C 156, Test Method for Water Retention By Concrete Curing Materials.
 8. ASTM C 171, Specification for Sheet Materials for Curing Concrete.
 9. ASTM C 172, Method of Sampling Fresh Concrete.
 10. ASTM C 173, Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 11. ASTM C 192, Method of Making and Curing Concrete Test Specimens in the Laboratory.
 12. ASTM C 231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 13. ASTM C 260, Specification for Air-Entraining Admixtures for Concrete.
 14. ASTM C 309, Specification for Liquid Membrane - Forming Compounds for Curing Concrete.
 15. ASTM C 494, Specification for Chemical Admixtures for Concrete.
 16. ASTM C 881; Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
 17. ASTM C 882; Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete.
 18. ASTM D 570, Test Method for Water Absorption of Plastics.
 19. ASTM D 638; Test Method for Tensile Properties of Plastics.
 20. ASTM D 732; Test Method for Shear Strength of Plastics by Punch Tool.

21. ASTM D 790; Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

D. U. S. Army Corps of Engineers Specifications: 1. U. S. Corps of Engineers CRD-C 572 Specification for Waterstop.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive product data and current specifications covering named manufactured products herein. Include installation instructions.

B. Samples: Submit samples of materials being used when requested by the Engineer including names, sources and descriptions.

C. Design Mix: Prior to production of concrete, submit for approval a design mix indicating materials proportions and water-cement ratio. Use materials in such proposed design mix as specified herein. Make such adjustments in the proposed design mix as directed by the Engineer.

D. 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.

E. Delivery Tickets: A delivery ticket shall accompany each load of concrete from the batch plant.

1. Tickets must 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.

1.5 SITE CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement:

1. Portland Cement: ASTM C 150 of the following Type(s):

a. Type II, Moderate Sulfate Resistance.

- b. Type HI, High Early Strength.
- 2. Only one brand and manufacturer of approved cement shall be used for exposed concrete.
- B. Normalweight 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 1/2-inches.
 - a. One-fifth narrowest dimension between sides of forms within which concrete is to be cast.
 - b. Three-fourths of the minimum clear spacing between reinforcing bars or between reinforcing bars and forms.
 - c. One-third the slab thickness for unreinforced slabs.
- C. Water: Potable quality, free from deleterious amounts of acids, alkalis, and organic substances.
- D. Concrete Admixtures:
 - 1. Calcium Chloride: Not permitted.
 - 2. Provide admixtures produced and serviced by established, reputable manufacturers and use in compliance with manufacturer's recommendations.
 - 3. Air-Entraining Admixture: Use a product conforming to requirements of ASTM C 260.
 - 4. Water-Reducing Admixture: Use a product conforming to requirements of ASTM C 494 Type A and that is free of chloride.
 - 5. Water-Reducing and Retarding Admixture: Use a product conforming to requirements of ASTM C 494 Type D and that is free of chloride.
 - 6. Water-Reducing and Accelerating Admixture: Use a product conforming to requirements of ASTM C 494 Type E and that is free of chloride.
- E. Waterstops: 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. R638.
 - 2. Acceptable Manufacturers:
 - a. Vinylex Corporation (Catalog Nos. as specified above).
 - b. Greenstreak.
- F. 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.

- G. 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.
- H. 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, ASTM D 695 at 28 days:
 - a. Compressive Strength: 8,500 psi. min.
 - b. Modulus of Elasticity: 375,000 psi. min.
 2. Tensile Properties, ASTM D 638 at 14 days:
 - 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, ASTM D 790 at 14 days:
 - a. Flexural Strength (Modulus of Rupture): 6,300 psi. min.
 - b. Tangent Modulus of Elasticity in Bending: 400,000 psi. min.
 4. Shear Strength, ASTM D 732 at 14 days: 5000 psi. min.
 5. Total Water Absorption, ASTM D 570 at 7 days: One percent maximum (two hour boil).
 6. Bond Strength, 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.

2.2 CONCRETE QUALITY

- A. Contactor Note: Use Class A concrete for all concrete work except where otherwise indicated on Drawings or specified herein.
- B. Selection of Proportions for Normalweight Concrete: ACI 211.1.
- C. Proportions of Ingredients: Establish proportions, including water-cement ratio on the basis of field experience, with the materials specified herein.
 - 1. Field Experience: ACI 301, Method 2 and ACI 318.
- D. Water-Cement Ratio: Class A Concrete only shall have a maximum water cement ratio of 0.50.
- E. Classes of Concrete:
 - 1. Class A: 4000 psi minimum compressive strength at 28 days; 564 pounds per cubic yard minimum cement content.
 - 2. Class B: 3000 psi minimum compressive strength at 28 days; 517 pounds per cubic yard minimum cement content.

2.3 ADMIXTURES

- A. Air Entraining: Air-entrain all concrete. Total air content required as follows:

Maximum-size coarse aggregate, inch	Air content, percent by volume
1-1/2	5 ± 1
3/4 or 1	6 ± 1
3/8 or 1/2	7-1/2 ± 1

- B. Water-Reducing Admixture: Unless high temperatures occur and/or placing conditions dictate a change, all concrete shall contain the water-reducing admixture.
- C. Water-Reducing and Retarding Admixture: When high temperatures occur and/or placing conditions dictate, the Engineer may require a change from the water-reducing admixture (Type A) to a water-reducing and retarding admixture (Type D).
- D. Water-Reducing and Accelerating Admixture: When low temperatures occur and/or placing conditions dictate, the Engineer may require a change from the water-reducing admixture (Type A) to a water-reducing and accelerating admixture (Type E).

- E. Slump: Proportion and produce concrete to have a slump, not to exceed 4 in. if consolidated by vibration. Slump, not to exceed 5 in. if consolidated by rodding, spading or other manual methods.

PART 3 - EXECUTION

3.1 INSPECTION

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

3.2 JOINTS AND EMBEDDED ITEMS

- A. Bond new concrete with hardened concrete as follows:
 - 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 1/2- inch thickness. Use grout of same material composition and proportions of concrete being poured except coarse aggregate omitted. Grout shall have a slump of 6-inches minimum.
 - 3. Place new concrete on grout before it has attained its initial set.
 - 4. Other bonding methods must be approved by Engineer prior to their use.
 - 5. Apply Epoxy Bonding Compound over existing prepared concrete in accordance with manufacturer's instructions.
- B. Waterstops:
 - 1. Install in construction joints, expansion joints and where required for watertightness.
 - 2. Hold end joints to a minimum.
 - 3. Make watertightness of joints the same as continuous waterstop material and to permanently develop not less than 50 percent of the mechanical strength of the parent section and to permanently retain their flexibility.
 - 4. Adequately support waterstops to prevent displacement and deformity of the waterstops during concrete pours.
 - 5. 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.

- C. Other Embedded Items: Place sleeves, inserts, anchors and embedded items required for adjoining work prior to concreting. Place accurately, and support against displacement.

3.3 PRODUCTION OF CONCRETE

A. Ready-Mixed Concrete:

1. Batched, mixed and transported in accordance with ASTM C 94.
2. Plant equipment and facilities shall conform to the Check List for Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association.

3.4 PLACING

A. General: In general, conduct concrete placement work in accordance with AC1 304 and such additional requirements as specified herein.

1. Discharge of the concrete shall be completed with 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. Preparation:

1. Prepare formwork in advance and remove snow, ice, water and debris from within forms. Formwork as specified in Section 03100.
2. Pre-position reinforcement in advance of concrete pours. Concrete reinforcement as specified in Section 03200.
3. Pre-position anchors and embedded items.
4. Wet subgrades in accordance with ACI to eliminate water loss from concrete.
5. Do not place concrete on frozen surfaces.

C. Conveying:

1. Handle concrete from mixer to final deposit rapidly by methods which will prevent segregation or loss of ingredients to maintain required quality of concrete.
2. Do not convey concrete through aluminum or aluminum alloy.
3. Do not place concrete by pumps or other similar devices without prior written approval of Engineer.

D. Depositing:

1. Do not allow concrete to drop vertically more than 4 feet.
2. Deposit in approximately horizontal layers of 12 to 18 inches.

3. Do not allow concrete to flow laterally more than 3 feet.
 4. Carry on placing at such a rate that concrete which is being integrated with fresh concrete is still plastic.
 5. Do not deposit concrete on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within sections.
 6. Do not use concrete which has partially hardened or has been contaminated by foreign materials.
 7. Do not subject concrete to procedures which will cause segregation.
 8. Do not place concrete in forms containing standing water.
 9. Do not bend reinforcement out of position when placing concrete.
- E. Consolidation:
1. 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.
 2. Use vibration equipment of internal type and not the type attached to forms and reinforcement.
 3. Use vibrators capable of transmitting vibration to concrete in frequencies sufficient to provide satisfactory consolidation.
 4. Do not leave vibrators in one spot long enough to cause segregation. Remove concrete segregated by vibrator operation.
 5. Do not use vibrators to spread concrete.
 6. Have sufficient reserve vibration equipment to guard against shutdown of work occasioned by failure of equipment in operation.
- F. Cold Weather Concreting: In general, perform cold weather concrete work in accordance with AC' 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, Degree F.

Air temperature, deg. F.	For sections with least dimension less than 12 inch	For sections with least dimension 12 inch or greater
30 to 45	60	50
0 to 30	65	55

2. 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.
 3. Provide equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather. Do not use foreign materials or materials containing snow or ice.
 4. Surfaces which the concrete is to come in contact with must be free of frost, snow and ice.
 5. Concrete placed in forms shall have a temperature of 50 degrees F. or higher after placement. Maintain this temperature a minimum of 5 days. Provide additional time if necessary for proper curing.
 6. Housing, covering or other protection used in curing shall remain intact at least 24 hours after artificial heating is discontinued. Do not place dependence on salt or other chemicals for the prevention of freezing.
- G. 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.
- H. Underwater Concreting:
1. When permitted by Engineer, foundation concrete may be placed in still water.
 2. Concrete placed in water shall contain twenty-five percent of cement over and above the amount specified for the particular class of concrete used.
 3. Do not deposit concrete in water which has a temperature below 40 degrees F.
 4. 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.
 5. Protect placed concrete from water motion for at least 4 days and longer if required.

3.5 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.
- C. Application for Finishes:
 - 1. Spade Finish:
 - a. Surfaces to be backfilled with earth.
 - b. Surfaces to be rubbed.
 - 2. Floated Finish:
 - a. Surfaces to receive Steel Trowel Finish.
 - 3. Smooth Rubbed Finish, Exterior Applications:
 - a. Exposed surfaces of concrete structures.
 - b. Vertical surfaces of troughs, channels and such other passages for the flow of liquids.
 - 4. Steel Trowel Finish:
 - a. Bottom surfaces of troughs, channels and such other passages for the flow of liquids.

3.6 CURING AND PROTECTION

- A. General: Immediately after placement, 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 7 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. 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.

3.7 FIELD QUALITY CONTROL

A. Testing and Inspection:

1. Materials and operations shall be tested and inspected as work progresses. Failure to detect defective work will not prevent rejection when defect is discovered, nor will it obligate the Engineer for final acceptance.
2. Secure composite sample in accordance with ASTM C 172.
3. Mold and cure four test specimens for each strength test in accordance with ASTM C 31.
4. Test specimens in accordance with ASTM C 39. Test one specimen at 7 days for information and two at 28 days for acceptance. One specimen held in reserve.
5. 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.
6. Make slump tests for each strength test and whenever consistency of concrete appears to vary in accordance with ASTM C 143.
7. 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:

1. 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.
2. 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.

END OF SECTION 03300

SECTION 03600 - GROUT

PART 1 - GENERAL

1.1 RELATED WORK

- A. Cast-in-Place Concrete Section 03300.
- B. Individual grouting requirements as specified in various other Sections of these Specifications.

1.2 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM C 191, Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
 - 2. ASTM C 596, Test Method for Drying Shrinkage of Mortar Containing Portland Cement.
 - 3. ASTM C 827, Test Method for Early Volume Change of Cementitious Mixtures.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Prevent moisture damage and contamination of materials
- B. Store materials in undamaged condition with seals and labels intact as packaged by the manufacturer.

1.4 SITE CONDITIONS

- A. Protect against high and low temperatures and bad weather in accordance with American Concrete Institute standards for placement of concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Non-Shrink Non-Metallic Grout: Factory premixed material containing no corrosive irons, aluminums, chemicals or gypsums.
 - 1. Grouts containing water reducers, accelerators, or fluidifiers shall have no drying shrinkage greater than the equivalent and cement and water mix as tested per ASTM C 596.
 - 2. Grout shall be nonshrink before initial set and show no expansion after set as tested per ASTM C 827.

3. Initial set of grout not less than 60 minutes per 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 Manufacturer: U.S. Grout Corporation; FIVE STAR, or equal.

2.2 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

3.1 PREPARATION

A. Forming:

1. Use forming procedures that allow proper and complete placement of grout.
2. Anchor Support elements so no movement is possible.
3. Remove supports only after grout has hardened.
4. Pre-treat with forming oils wood forms that may absorb moisture.

B. Preparation of Surface:

1. Non-Shrink Grout: Prepare in accordance with manufacturer's printed instructions.

3.2 MIXING

A. Time:

1. Non-Shrink Grout: In accordance with manufacturer's printed instructions.

3.3 PLACING

- A. Non-Shrink Non-Metallic Grout: Perform grout placement in accordance with the recommendations of AC1 and the manufacturer's published specifications for mixing and placing. Place non-shrink non-metallic grout only where indicated on Drawings.

END OF SECTION 03600

DIVISION 11
EQUIPMENT

SECTION 11304 - GRINDER PUMP UNITS

PART 1 - GENERAL

1.1 RELATED WORK

- A. Trenching, Backfilling, and Compacting: Section 02221.
- B. Manholes: Section 02601.
- C. Pressure Wastewater Sewer: Section 02725.
- D. Division 3 – Concrete.

1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualification: Consideration will be given only to manufacturers or fabricators meeting the following qualifications:
 - 1. Three years minimum experience producing Units of equal quality to the type specified herein.
 - 2. Three years minimum experience of in-service, satisfactorily operating Units of the type specified herein.
 - 3. Manufactured grinder pump units shall have been tested to certify capability to perform, as specified herein, in either individual or low pressure sewer system applications.
 - 4. Historical and certified data substantiating the above qualifications available to the Engineer upon request.
- B. Design Criteria: Units shall meet accepted standards for plumbing equipment for use in or near structures, and shall operate free from noise, odor or health hazards.
 - 1. Grinder: Capability of reducing the components in normal domestic sewage, including a reasonable amount of foreign objects, such as paper, wood, plastic, glass, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and a minimum of 1 1/4 inch diameter discharge piping.
 - a. Position the grinder in such a way that solids are fed in an upflow direction.
 - 2. Pump: Must be capable of delivering 11 GPM against a normal rated total dynamic head of 92 feet. Pump of such design to allow for removal from tank, without use of tools, to the immediate area outside of tank with electrical and control connections intact.

3. Pump and motor to have the capability of running dry for extended periods of time without damage to motor or seals.
 4. Motor: 2 Horsepower minimum for Centrifugal and 1 Horsepower minimum for Semi-Positive Displacement.
 5. Tank: Completely watertight, 60 gallon capacity (minimum) and designed to withstand the minimum depth of bury earthload indicated. Tank manufacturer shall calculate the tank anti-flotation anchor and provide an appropriate design for the anchor.
 - a. Provide a 7 foot deep tank, minimum.
 6. Inlet Size: 4-inch diameter, minimum.
 7. Discharge Size: 1-1/4-inch diameter, minimum.
- C. Requirements of Regulatory Agencies: Comply with construction code requirements of State, County, and such other political subdivision specifications as may exceed the requirements of the codes, standards and approving bodies referenced throughout these Specifications.
1. Provide electrical control panels and grinder pump units constructed in accordance with the requirements of the Underwriters Laboratory, or other nationally recognized certification agency, and labelled accordingly.
 2. Units shall comply with the applicable requirements of the Pennsylvania Department of Environmental Protection and the National Sanitation Foundation.
- D. Source Quality Control:
1. Shop Tests: In accordance with Article 1.06 of the General Instructions, factory test each unit. The 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.
 - a. Submit the proposed types of tests in the Shop Drawing submittal.
 - b. Test to assure watertightness of the Unit for the proposed installation depth.
 - c. Test pump output in gallons per minute at 15 psi and 35 psi.
 - d. Test amperage and wattage of electrical consumption.
 2. Laboratory Tests: The Engineer reserves the right to require that laboratory tests also be conducted on Units that have been shop tested. When the Engineer so orders, furnish without compensation, labor, materials, and equipment necessary packaging, and shipping the grinder pump unit to the Test Laboratory.
 3. Provide certification that the units have been tested successfully for watertightness.

4. Single Source Responsibility: To ensure single source responsibility and part supply, provide the pump components, tank, internal piping system and electrical controls from one grinder pump manufacturer.
- E. Initial Unit Installation: To serve as the minimum acceptable conditions of installation throughout the Project, install the first unit in the Project to demonstrate the following:
 1. Bedding and concrete construction.
 2. Pipe connections to the Unit and watertightness of the complete Unit.
 3. Proper electrical work operation of the Unit.
- F. Collection System: When new sewage collection systems are proposed for new or existing developments that require grinder pumps to obtain sanitary sewer service, the following requirements apply:
 1. All grinder pumps connected to the system shall be the same make and model.
 2. The pump manufacturer shall provide a letter indicating that hydraulic analysis was completed to prove all proposed grinder units will be capable of pumping into the collection system under peak operation/flow times. Supporting calculations will be required if determined to be necessary by the Engineer.
 3. A Professional Engineer will be required to sign and seal the design drawings.
 4. If a low pressure main is used to collect sewage flow from multiple grinder pump units, then calculations shall be supplied to verify that scouring velocity is achieved at least once per day.
 5. Low pressure main shall discharge into a gravity manhole per the Sewer Detail Drawings.

1.3 REFERENCES

- A. American National Standards Institute:
 1. ANSI B2.1, Pipe Threads.
 2. ANSI B16.3, Malleable-Iron Screwed Fittings, 150 and 300 lb.
 3. ANSI C2, National Electrical Safety Code.

B. American Society for Testing and Materials:

1. ASTM A 48, Specification for Gray Iron Castings.
2. ASTM A 536, Specification for Ductile Iron Castings.
3. ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
4. ASTM B 371, Specification for Copper-Zinc-Silicon Alloy Rod.
5. ASTM B 584, Specification for Copper Alloy Sand Castings for General Applications.
6. ASTM C 581, Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass Fiber Reinforced Structures, Intended for Liquid Service.
7. ASTM C 582, Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion Resistant Equipment.
8. ASTM D 1784, Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
9. ASTM D 1785, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80 and 120.
10. ASTM D 2241, Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series).
11. ASTM D 2466, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
12. ASTM D 3139, Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
13. ASTM D 3299, Specification for Filament-Wound Glass Fiber Reinforced Polyester Chemical-Resistant Tanks.
14. ASTM F 477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. Federal Specifications:

1. Fed. Spec. WW-C-581D, Conduit, Metal, Rigid and Coupling Elbow and Nipple, Electrical Conduit, Zinc-Coated.

D. Institute of Electrical and Electronics Engineers.

E. National Bureau of Standards: Product Standard PS 15-69, Custom Molded Reinforced Polyester Chemical Resistant Process Equipment.

F. National Electrical Code (NEC).

G. National Electric Manufacturer's Association (NEMA) Standards of Construction.

- H. National Fire Protection Association (NFPA): NFPA 70; National Electrical Code, and current amendments.
- I. Underwriters' Laboratories (UL) Listings and Approvals on specified Products.

1.4 SUBMITTALS

A. Shop Drawings:

1. Submit for approval completely dimensioned shop, layout or setting drawings and catalog cuts or other data as required to provide a complete description of system equipment specified in this Section.
2. Submit shop drawings certified for construction by the manufacturer which includes location of electrical connections; wiring diagrams; anchor bolt layout; details indicating construction and materials of construction; diameter of shafting; dimensions and rated horsepower of all motors; gear and bearing ratings; service factors and weights of principal parts and completely assembled equipment.
3. Submit evidence of Underwriters' Laboratories (UL) Listings and Approvals on the electrical control panel and grinder pump.

B. Certificates:

1. Submit certified records or reports of results of shop tests for each Unit. Such records or reports shall contain a sworn statement that shop tests have been made as specified.
2. Submit manufacturer's sworn certification that components and products will be manufactured in accordance with specified reference standards for components.

C. Operation and Maintenance Manuals: Within four weeks following the receipt of approved shop drawings, submit to the Engineer for review and approval, three copies of manuals prepared by the manufacturer/supplier, or the Contractor. The submission and approval of each set of manuals will be considered to be an integral part of furnishing and installation of the respective equipment or system. Incomplete or inadequate manuals will be returned to the Contractor for correction and resubmission.

1. Include the following elements in each manual:
 - a. Erection or installation instructions.
 - b. Start-up procedures.
 - c. Recommended and alternative procedures.
 - d. Schedule of preventive maintenance requirements.
 - e. Detailed maintenance procedures.
 - f. Schedule of lubrication requirements.
 - g. Data sheet listing pertinent equipment or system information, as well as the addresses and telephone numbers of the nearest sales and service representatives.

1.5 DELIVERY, STORAGE AND HANDLING

- A. To prevent damage and defects, transport, store and handle the units and Products specified herein in a manner recommended by the respective manufacturers.

1.6 SITE CONDITIONS

- A. Environmental Requirements:

- 1. In no instance set units on subgrade containing frost or on unacceptable subgrade which condition has been determined unacceptable by the Engineer.

- B. Electrical Interface:

- 1. Install or mount those electrical components or apparatus as furnished by the Product manufacturers of those Products specified herein.
 - 2. Property owner will be responsible for permanent power wiring, including final connections of such to the electrical components or apparatus of the grinder pump units.

PART 2 - PRODUCTS

2.1 GRINDER PUMP UNIT

- A. General: Provide prefabricated, completely assembled Unit, suitable for conveying domestic sewage and for underground installation. Unit shall have one (Simplex) or two (Duplex) grinder pumps, as indicated on the Drawings.
 - 1. Unit shall include tank, sewage grinder pump(s), mercury switch level controls or other non-fouling level control, discharge piping, with hydraulically sealed discharge flange(s), pump mounting plate(s), with bottom rail supports, upper rail supports, pump guide rails, rail supports, lifting chain, or cable, control panel, control panel enclosure, electrical wiring, alarm devices, piping, and other necessary accessories as specified herein and as indicated on the Sewer Detail Drawings.
 - 2. Provide materials, where exposed to wastewater, that have inherent corrosion protection; i.e., cast iron, fiberglass, stainless steel, PVC.
 - 3. Duplex installations shall permit the independent removal of each grinder pump from the sump basin for maintenance or inspection, and the return of the pump to service without draining or entering the sump basin.

B. Tank: Tank construction of fiberglass reinforced polyester, High Density Polyethylene, or precast concrete.

1. Fiberglass Reinforced Polyester (FRP): Tank construction shall conform to ASTM C 582 and C 581 Standards with a minimum wall thickness of ¼-inch.
 - a. Manufactured according to ASTM D 3299 Standards for filament wound tanks or NBS PS 15-69 Standards for contact molded tanks.
 - b. Polyester Resin: Atlac 382 / DION 382.
 - c. Flush, slip resistant bolt down cover with padlock.
 - d. Connections: Watertight and suitable for attaching PVC pipe; 4-inch minimum diameter inlet and 1 1/4-inch minimum diameter discharge with plugs or caps.
 - e. Anti-Flotation Anchor: Provide precast or field cast concrete anchor in accordance with tank manufacturer's recommendations. The tank manufacturer shall provide the design and size of the anchor as specified previously under Design Criteria.
2. High Density Polyethylene (HDPE): Tank construction shall be of extrusion grade or injection molding grade high density polyethylene. Corrugated sections are to be of double wall construction with the internal wall being generally smooth to encourage scouring. Corrugated outside walls are to be a minimum of ¼-inch thick.
 - a. Connections: Watertight and suitable for attaching PVC pipe; 4-inch diameter inlet and 1 1/4-inch diameter discharge with plugs or caps.
 - b. Flush, slip resistant bolt down cover with padlock.
3. Precast Concrete Manhole: Conforming to the requirements of Section 02601.

2.2 CENTRIFUGAL GRINDER PUMPS

A. Centrifugal Grinder Pump Component Construction:

1. Casing: Pump casing, oil casing and motor casing of high quality ASTM A48 cast iron. Pump casing construction of single volute type, ribbed to prevent excessive deflection and hydrostatically tested to twice the design. Volute sized at all points to pass solids which can pass through the impeller and internally finished to provide smooth, unobstructed flow.
2. Hardware: All exposed hardware shall be series 300 stainless steel
3. Impeller: Non-clogging type of ASTM A 536 ductile iron or bronze; statically, dynamically and hydraulically balanced.
4. Pump Shaft: Stainless steel of sufficient strength and size to safely transmit the maximum torque developed by the drive unit.
5. Pump(s) shall be suitable for long term submergence in sewage. Grinder pump(s) shall be U.L. Listed to Standard 778 and CSA Listed to Standard 108.

- B. Grinder: Mounted immediately below pumping elements and constructed so as to eliminate clogging and jamming under normal operating conditions including starting. The mechanism shall consist of a radial cutter threaded and locked on the motor shaft by a washer in conjunction with a counter sunk flat head cap screw, and a matching shredding ring. Unit shall create sufficient vortex action to scour tank free of deposits or sludge banks which would impair the operation of the pump. Components and construction as follows:
1. Direct drive with single, one piece stainless steel motor shaft.
 2. Shredder ring, radial cutter, and impeller shall be 440C stainless steel hardened to a minimum Rockwell C55.
 3. The shredding ring shall be reversible to provide twice the cutting life.
 4. Pump and grinder assembly balanced to operate without objectionable noise or vibration over the entire range of recommended operating pressures.
- C. Motor:
1. Two HP minimum, of 240 volt, single phase, 60 Hertz, 3,450 RPM, totally submersible design, constructed with open winding and designed to operate in clean dielectric oil for cooling winding. Air cooled stators and grease packed bearings not acceptable.
 2. Motor shaft of stainless steel and designed for extremely difficult pumping service. For oil cooled motors, motor shaft and housing sealed with two mechanical shaft seals with an oil chamber between the seals. The seals shall have carbon and ceramic seal faces.
 3. Motors shall comply with Standards of IEEE and NEMA in all respects except where requirements exceed these Standards.

2.3 SEMI-POSITIVE DISPLACEMENT GRINDER PUMPS

A. Semi-Positive Displacement Grinder Pump Component Construction:

1. Pump: The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with a single mechanical seal.
2. Double radial O-ring seals are required at all casting joints to minimize corrosion and create a protective barrier.
3. All pump castings shall be cast iron, fully epoxy coated to 8-10 mil Nominal dry thickness, wet applied. 3. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. This material shall be suitable for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance.

4. Buna-N is not acceptable as a stator material because it does not exhibit the properties as outlined above and required for wastewater service.
5. Pump(s) shall be suitable for long term submergence in sewage. Grinder pump(s) shall be U.L. Listed to Standard 778 and CSA Listed to Standard 108.

B. Grinder:

1. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft.
2. The grinder impeller (cutter wheel) assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable.
3. The grinder impeller shall be a one-piece, 4140 cutter wheel of the rotating type with inductively hardened cutter teeth. The cutter teeth shall be inductively hardened to Rockwell 50 – 60c for abrasion resistance.
4. The shredder ring shall be of the stationary type and the material shall be white cast iron. The teeth shall be ground into the material to achieve effective grinding. The shredder ring shall have a staggered tooth pattern with only one edge engaged at a time, maximizing the cutting torque. These materials have been chosen for their capacity to perform in the intended environment as they are materials with wear and corrosive resistant properties.
5. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as to minimize clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:
 - a. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
 - b. The maximum flow rate through the cutting mechanism must not exceed 4 feet per second. This is a critical design element to minimize jamming and as such must be adhered to.
 - c. The inlet shroud shall have a diameter of no less than 5 inches. Inlet shrouds that are less than 5 inches in diameter will not be accepted due to their inability to maintain the specified 4 feet per second maximum inlet velocity which by design prevents unnecessary jamming of the cutter mechanism and minimizes blinding of the pump by large objects that block the inlet shroud.
 - d. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.

- e. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects," such as paper, wood, plastic, glass, wipes, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4" diameter stainless steel discharge piping.

C. Electric Motor:

1. As a maximum, the motor shall be a 1 HP, 1725 RPM, 240 Volt 60 Hertz, 1 Phase, capacitor start, ball bearing, air-cooled induction type with Class F installation, low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds.
2. The motor shall be press-fit into the casting for better heat transfer and longer winding life.
3. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application.
4. Non-capacitor start motors or permanent split capacitor motors will not be accepted because of their reduced starting torque and consequent diminished grinding capability.
5. The wet portion of the motor armature must be 300 Series stainless.
6. To reduce the potential of environmental concerns, the expense of handling and disposing of oil, and the associated maintenance costs, oil-filled motors will not be accepted.
7. The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

2.4 PIPING AND APPURTENANCES

A. Discharge Piping and Fittings:

1. Size: 1 1/4-inch minimum diameter on the Simplex Unit and 1 1/2-inch minimum diameter on the Duplex Unit.
2. A 3 foot section of schedule 40 stainless steel discharge pipe shall be installed between the basin discharge fitting and the low pressure lateral. The pipe section diameter shall match the discharge fitting diameter.
3. Material: ASTM D 1785 Schedule 80 manufactured from Class 12454-B Rigid PVC Compounds (PVC 1120), NPT couplings, pipe and fittings.

4. Material Option: ASTM D 2241, SDR 21.
 - a. Pressure Class 200 psi.
 - b. Pipe Joints: Push-on or compression type, joint performance ASTM D 3139, rubber gasket suitable for domestic sewage service ASTM F 477.
- B. Valves: Include a check valve, gate or ball valve, anti-siphon valve and hydraulically sealed discharge flange in pump discharge piping.
 1. Provide valves of the same type by the same manufacturer; suitable for the intended service.
 2. Markings factory cast on the bonnet or body of each valve indicating manufacturer's name or mark, year of valve casting, size of valve, directional flow arrow and designation of working water pressure.
 3. Valve pressure-temperature ratings of not less than the design criteria applicable to system components.
 4. Valves shall open to the left (counterclockwise).
 5. Provide extension stems with bronze bushed stem guides where required. Provide a top support and one intermediate support unless the unsupported stem length exceeds four feet, in which case provide an additional support every two feet of valve stem length.
 6. Valve ends as indicated on the Drawings and unless indicated otherwise shall conform to the following:
 - a. Screw End: Threaded in accordance with ANSI B2.1.
 7. Check Valve: Ball or flapper type check valve designed for a minimum water working pressure of 150 pounds per square inch and factory tested to double that pressure before shipment. Check valve bodies to provide excess area through the valves to assure full delivery of line capacity. Include with each Unit one separate check valve for installation in the discharge line between the Grinder Pump and the sewer main. The separate check valve diameter shall be the same diameter as the low pressure lateral (1 1/4" minimum). Valve to be as specified with the exception of the joint. a. Double union type manufactured from PVC 12454-B conforming to ASTM D1784 with Viton O ring seals.
 8. Gate Valve:
 - a. General:
 - 1) Design working water pressure at 200 psi.
 - 2) Valves of rising stem pipe.
 - 3) Valve stuffing box of such design that valve can be packed under pressure when in fully open position.
 - 4) Solid bronze with tapered split wedge disc.

- 5) Physical properties of brass pressure containing parts shall conform to ASTM B 62.
 - 6) Stems fabricated of ASTM B 371, Alloy A (rolled silicon brass), ASTM B 584 Copper Alloy No. 876 (silicon bronze + silicon brass), or other material equally resistant to dezincification.
9. Ball Valve: Two piece 316 stainless steel body, full port, blowout proof stem, 316 stainless steel trim and ball, 200 psi rated, with PTFE gaskets and seats.
 10. Anti-Siphon Function: The pump shall be constructed with a positively primed flooded suction configuration. As added assurance that the pump cannot lose prime even under negative pressure conditions in the discharge piping system, the discharge piping system must include an anti-siphon capability. The design shall provide for a maximum bypass, under normal operating conditions, of no more than 1 GPM.
 11. Hydraulically Sealed Discharge Flange: The hydraulically sealed discharge flange shall allow the pump to be removed periodically and shall result in a watertight seal when the pump is replaced. Fittings of threaded style, 150 lb. galvanized malleable iron conforming to ANSI B 16.3.

C. Controls:

1. The electric power cord to the pump shall be SO type construction suitable for submersion in sewage. The cord is to be sealed by use of a cord grip, with individual conductors additionally sealed into the cord cap assembly with epoxy sealing compound. Seal the cord cap into the motor housing with a Buna-N O- ring, providing a completely watertight electrical connection.
2. Sealed float-type mercury switches shall control sump level and high-level alarm signal. For corrosion and shock resistance the mercury tube switches are factory sealed in a solid polypropylene float, with internal weight. The float power and support wire shall have a heavy Neoprene jacket. Provide an intrinsically safe UL approved relay to be wired to each float type mercury switch.
3. Support the float switches by the cord that is connected to the junction box. Provide a junction box to be drilled and tapped for the four - 3/4-inch diameter conduits for wiring to Pump Control Panel. Provide junction box labeled for Explosion-Proof application and conforming to the requirements under Article 500 of NEC for Class 1, Division 1, Group D, Hazardous Location.
4. Non-Fouling Level Control can be used as an alternate level sensing system for control of the pumps as approved by the Engineer.
5. (Simplex) Provide three mercury switches; one for pump start, one for pump stop, and one to signal high-level sump alarm. On sump level rise, lower mercury switch shall first be energized, then upper level switch shall next energize and start pump. With pump operating, sump level shall lower to low switch turn-off setting and pump shall stop. If level continues to rise when pump is operating, alarm switch shall energize. Level switches adjustable for level setting, from the surface.

6. (Duplex) Provide four mercury switches; one for lead pump start, one for lag pump start, one for both pumps stop and one to signal high-level sump alarm. On sump level rise, lower mercury switch shall first be energized, then upper level switch shall next energize and start lead pump. With lead pump operating, sump level will lower to low switch turn-off setting and pump shall stop. Alternating relay shall index on stopping of pump so that lag pump shall start on next operation. If sump level continues to rise when lead pump is operating, override switch shall energize and start lag pump. Both lead and lag pump shall operate together until low level switch turns off both pumps. If level continues to rise when both pumps are operating, alarm switch shall energize. If one pump should fail for any reason, the second pump shall operate on the override control, and if level rises above override control, signal alarm switch shall energize. Level switches adjustable for level setting, from the surface.
7. Include in the pumping system sensors to determine thermal overload and hydraulic seal failure conditions in addition to high sump level.
8. Control Panel: A wall mounted control panel shall be supplied with each station. All control panels shall be UL Listed to meet Standard 508. Each panel shall be constructed with a padlockable NEMA 4X fiberglass enclosure and utilize stainless steel hardware. Panel factory equipped with an oxidation inhibitor and wall mounting brackets.
 - a. Provide a circuit breaker for total panel and individual breakers for pumps and alarms so that alarms remain energized when pump breaker is tripped.
 - b. (Simplex) Hardware includes start and run capacitors, start relay, circuit breaker (quick-make/quick-break action on manual operation) with bi-metallic ambient compensated overload relay with heaters to protect both start and run windings, H-O-A switch and indicator lights. Provide individual circuit breaker for alarm system.
 - c. (Simplex) Provide terminal strip for float control wires and a 120 volt AC control circuit, if applicable.
 - d. (Duplex) Hardware includes two sets of start and run capacitors, start relay, circuit breaker (quick-make/quick-break action on manual operation) with bimetallic ambient compensated overload relay with heaters to protect both start and run windings, H-O-A switch and indicator lights.
 - e. (Duplex) Provide one alternating relay and terminal strip for float control wires, if applicable.
 - f. Panel so designed to be wall or post mounted.
 - g. High Water Alarm Devices(s): Each control panel shall include a visual and audible, with silence, high water alarm device. Alarm circuit shall be separately fused from motor control circuit. The visual alarm shall be a red fluted lens mounted to the top of the enclosure in such a manner as to maintain rain-proof integrity. The 90db audible device shall be capable of being de-activated by means of a NEMA 4X silence button mounted on the exterior of the enclosure. Visual alarm will remain on as long as a high water condition exists in the basin. Both visual and audio alarms will automatically reset when the high water condition subsides.
 - h. (Duplex) Pump running lights required on outside of panel.
9. Provide electrical surge protection device as part of the unit package.

- D. Lifting Accessories: Provide stainless steel guide rails, supports, chains and shackles for raising and lowering the pumping equipment.
- E. Spare Parts: Provide manufacturer recommended, Engineer approved spare parts.
- F. Acceptable Manufacturers:
 - 1. Barnes Pumps, Inc.
 - 2. Hydromatic Pumps
 - 3. Myers
 - 4. Environmental One
 - 5. Or Equal

2.5 MISCELLANEOUS MATERIAL

- A. Bedding and Backfill: per requirements of Section 02221.
- B. Cast-in-Place Concrete: per requirements of Division 3 – Concrete.
- C. Pipe Connections: Per requirements of Section 02725.
- D. Preservative Treated Post: Nominal dimension 6 x 6, surfaced four sides (grade stamp S4S) and grade stamped indicating product compliance with PS-20-70 according to the American Softwood Lumber Standard, and preservative treated as follows:
 - 1. Preservative treatment by the pressure impregnation process for Ground Contact in accordance with the American Wood Preserver's Association AWPAC P-5.
 - 2. Preservative injected into the wood at 0.60 pounds per cubic foot of wood. Preservative density determined by assay in accordance with AWPAC Standard C-1.
- E. Underground Cable, Type UF: Multi-conductor cable with each conductor of annealed uncoated copper and individual color coded PVC insulation. Conductors assembled flat with grounding wire and encased in gray sunlight resistant PVC approval imprinted jacket. Standards compliance as follows:
 - 1. UL listed as Type NMC Cable per Standard 719 for Nonmetallic-Sheathed Cables.
 - 2. UL listed as sunlight resistant Type UF cable per Standard 493 for underground Feeder and Branch-Circuit Cables.
 - 3. Conforming to National Electrical Code, Article 339.
 - 4. ROMEX and BX Cable not permitted for use in this Project.
 - 5. Warning Tape: Printed polyethylene, magnetic tape of three inches width minimum, color coded red and labeled in one inch lettering with the word electric.

F. Wire and Cable Connections (Exposed Locations):

1. Wire Nuts: Preinsulated UL Listed hand or tool installed solderless connectors of the spring-lock type or compression type for making splices of solid COPPER wire.
2. Split Bolt Connectors or Compression Type Connectors: UL Listed connectors for making parallel or butt splices of stranded COPPER wire. Use companion preformed plastic insulating covers or tape insulation conforming to NEC requirements.
3. Screw-Lock Connectors: UL Listed connectors for making terminal connections or solid COPPER wire. Contractor option to use UL Listed crimp type ring tongue connectors.

G. Waterproof Splice Kit (Buried and Waterproof Locations): Molded rubber composition and designed to create a watertight seal on the cable jacket as well as the splice.

1. Acceptable Manufacturers:

- a. 3M
- b. Or Equal

H. Rigid Metal Conduits: Fabricated of mild steel piping, galvanized or sherardized inside and outside, and protected against corrosion by a dichromate rinse or a zinc chromate coating. Each conduit shall bear the UL label, be defect free, furnished in 10 ft. lengths minimum, and of the following type:

1. Rigid Metal Conduit and Fittings: Product meeting requirements of NEC.

I. Rigid PVC Conduit: High impact PVC (polyvinyl chloride) Conduit and Fittings conforming to NEMA standards, UL rated and Labeled and made from compounds conforming to ASTM D 1784. Additionally, PVC conduit shall have material strengths of 5500 psi tensile, 11,000 psi flexural and 8600 psi compression; all at 78 degrees F. Provide schedule 40 conduit and fittings, except where required by NEC use schedule 80.

J. Grounding Materials: Provide materials conforming to UL requirements for such use as NEC Article 250. Basic materials as follows:

1. Ground Rods: ¾-inch by ten foot copperweld type.
2. Ground Conductors: Code gauge stranded copper unless otherwise indicated.
3. Ground Clamps: Multi-bolt type, (clamps for pipe, lugs for bars) saddle clamp or compression type for wire.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine units for defects that will adversely affect installation or cause latent defects in completed work. Inform Engineer of defects. Do not proceed with installation until defects have been corrected.
- B. Refer to manufacturer's instruction and installation manual before proceeding with installation of units.
- C. Verify other construction work is complete to the extent that substrates on which electrical apparatus is to be installed is ready to receive same.
- D. Verify direction of motor rotation in equipment before making final connections to electrically operated equipment.

3.2 PREPARATION

- A. Field Measurement:
 - 1. The Drawings are generally indicative of the Work but are not an exact representation of all conditions involved; therefore, set units, piping, etc. to suit actual field measurements.
 - 2. Submit details of proposed departures necessitated by field conditions or other causes to the Engineer for approval.
- B. Keep pipe and unit interiors cleared of debris as construction progresses.
- C. Earthwork: Perform earthwork for unit installation as specified in Section 02221 and according to the following:
 - 1. Make excavations for units to a nearly vertical plane and not to exceed the nominal dimensions of the concrete anchor outside diameter.
 - 2. If rock excavation is required, take rock out to limits specified previously.
 - 3. 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 unit. Make limits of cut not to exceed one-foot beyond excavation limit as specified previously.

3.3 INSTALLATION

- A. Install units in strict accordance with manufacturer's instruction and installation manual, and at locations and in accordance with Details indicated on the Drawings.

1. Install a check valve between the unit and the main sewer piping in accordance with the Detail Drawings.
- B. Install units on a six inch deep compacted layer of aggregate meeting requirements of First Class Bedding. Install First Class Bedding material as backfill up to highest pipe connection.
- C. Anti-Flotation Anchor Installation: Form and pour concrete anchors in accordance with requirements of Division 3 - Concrete. Use Class B concrete. Prefabricated anchors, as qualified previously in this Section, are acceptable.
- D. Underground Systems: Install underground electric cable in accordance with of the NEC, in accordance with previous requirements of this Section, and the following requirements exceeding NEC:
 1. Earthwork: Perform earthwork for buried electric cable as specified for piping under Section 02221.
 2. Provide two feet minimum cover over cable unless indicated otherwise on the Drawings.
 3. Make electrical cable penetrations through the tank absolutely watertight.
- E. Grounding: Perform grounding of electrical systems and metal enclosures in accordance with NEC.
 1. In addition to grounding and bonding requirements of NEC as referenced in the preceding paragraph, the following shall also apply:
 - a. Use approved grounding connectors only. Clean the surfaces involved in the made-grounds before connecting and finish the installation with touch-up painting or other protective coating to prevent corrosion.
- F. Control Panel Installation: Fasten control panel and cable to exterior of the building or post (for post mounted) using fasteners suitable for anchoring into the particular type of surface, and fasten in accordance with current accepted trade practices. Only screw-type corrosion-resistant fasteners are acceptable.
 1. Install control panel four feet above existing grade, measured to the bottom of the panel.
 2. If post mount installation, provide post of sufficient length to permit three feet of embedment in ground and the four foot clearance requirement stated above.

3.4 FIELD QUALITY CONTROL

- A. General: Upon completion of installation of the grinder pump units, including but not limited to control panel mounting, electrical work installation and connections, pressure service lateral installation, and unit backfilling, each being performed in a manner satisfactory to the Engineer, advise the unit manufacturer that the units have been installed and are ready to be inspected and tested.
1. In cooperation with the unit manufacturer, determine a mutually acceptable schedule for inspection and testing of installed units.
 2. Conduct the Performance Test specified herein prior to the property Owner's electrical wiring and plumbing connections to the grinder pump units.
 3. Conduct tests as specified herein so that each unit installed in the Project is tested to the unit manufacturer's and Engineer's satisfaction. Provide documentation of such manufacturer's acceptance test in the form of a letter to the Property Owner and Township attesting to this test requirement.
 4. Provide tools, materials, water, temporary power, apparatus, and instruments necessary for unit testing. Conduct the specified tests in the presence of and to the satisfaction of the unit manufacturer and the Engineer.
- B. Performance Test: Demonstrate (with the Personnel of the Township observing), to the satisfaction of the Engineer and manufacturer, the mechanical performance of each unit when operated in accordance with the design intent indicated by the Drawings and described in this Section of the Specifications.
1. Connect 120V temporary power source to the alarm circuit at the control panel.
 2. Fill the tank with sufficient water to test the high level audible and visual alarms at the control panel.
 3. Connect 240V temporary power source to the power circuit at the control panel and run the unit through a minimum of three operation cycles to check pump operation and shut-off.
 4. If the demonstrations are satisfactory to the Engineer, the test will be considered concluded. If deficiencies are found, they shall be corrected as follows and the test repeated until the Engineer determines that the unit has performed satisfactorily.
 - a. Unit manufacturer to correct pump, internal piping and control panel deficiencies.
 - b. Installer shall correct installation deficiencies.
- C. Watertightness Test, Fiberglass Tank: Perform both an exfiltration and an infiltration test of each unit in the Project.
1. Fill the completely installed units above the highest tank wall penetration (including electrical) with clear water. Allow a one hour stabilization period and then commence a three consecutive day exfiltration test.

2. Measure and record the water level, with the Engineer observing, both at the beginning and end of the test period.
 3. An acceptable exfiltration test will be when no water leakage in the closed unit is detectable by the measurements.
 4. Conduct an infiltration test of the completely installed units over a three consecutive day time period with the Engineer observing.
 5. An acceptable infiltration test will be when no water enters the closed unit.
- D. Perform precast manhole test as specified in Section 02601.
- E. Electrical Systems Test: Unless waived in writing by the Engineer, perform tests and trials in the presence of a duly authorized representative of the Engineer. When the presence of such representative is so waived, furnish to the Engineer sworn statements, in duplicate, of the tests made and the results thereof.
1. Inspection: Have the work inspected by an authorized inspection agency, and such other agencies having jurisdiction, for compliance with National Electrical Code and obtain certificates of approval, acceptance, and compliance with code regulations. Work shall not be deemed complete until such certifications have been delivered to the Township.
 2. Testing: Test materials, supplies and parts and assemblies thereof, entering into the Work, in conformity with the best currently approved method for the particular type and class of work.
 - a. Render the entire installation free from short circuits and improper grounds. Test feeder cable disconnected from the power source. Then test the entire power circuit and the panel with the pumping equipment operating. In no case, shall the insulation resistance be less than one hundred thousand ohms.
 - b. Perform initial electrical system tests using meggers, ammeters, voltmeters, insulation resistance testers, and high-pot testers prior to placing electrical systems into complete operation.
 - 1) Use meggers with an adjustable 2.5/5.0 KV range which will permit reading of 0.05 to 100,000 Megohms. The minimum testing voltage obtained by adding 1000 volts to twice the rated voltage of the cable, device, apparatus or equipment. In no case shall the insulation resistance be less than one Megohm. However, the recommended insulation resistance measurements of each test shall conform to IEEE and ANSI Standards.
 - c. Correct failures in a manner satisfactory to the Engineer or his authorized representative.

END OF SECTION 11304

SPECIFICATIONS
for
MAKING CONNECTIONS
to the
NEW HANOVER TOWNSHIP
SEWER SYSTEM

I. DEFINITIONS

- A. Building Sewer: All sewer pipe and sewer appurtenances extending from the sewage drainage system of any structure to the Lateral of a sewer.
- B. Commercial Facility: Any structure intended to be used wholly or in part for the purpose of carrying on a trade, business, or profession or for social, amusement, religious, educational, charitable or public uses.
- C. Housing Unit: Any structure intended to be occupied as a whole by one family or an apartment intended to be occupied by one family or any other one-family living unit, containing plumbing for kitchen or for toilet facilities.
- D. Improved Property: Any property upon which there is erected a structure intended for continuous or periodic habitation, occupancy or use by human beings or animals and from which structure sanitary sewage and/or industrial wastes shall be or may be discharged.
- E. Industrial Facility: Any structure intended to be used wholly or in part for the manufacturing, fabricating, storing, or warehousing, processing, cleaning, laundering or assembling of any project, commodity or article.
- F. Industrial Waste: Any solids, liquids or gaseous substance or form of energy rejected or escaping from any industrial, manufacturing, trade or business process or from the development, recovery or processing of natural resources and distinct from Sanitary Sewage.
- G. Lateral: That part of the sewer system extending from a sewer to the curb line or, if there shall be no curb line, to the property line or if no such lateral shall be provided, then lateral shall mean that portion of, or place in, a sewer which is provided for connection of any building.
- H. Owner: Any Person vested with ownership, legal or equitable, sole or partial, of any Improved Property.
- I. Permit: A plumbing permit for a Lateral connection to the New Hanover Township Sewer System as issued by New Hanover Township and approved by the New Hanover Township Plumbing Inspector.
- J. Person: Any individual, partnership, association, society or corporation and any other entity capable of connecting to or using the New Hanover Township sewer system.
- K. Sanitary Sewage: The normal water-carried household and toilet wastes from any improved property.
- L. Sewage Drainage System: All sewer pipe and sewer appurtenances situated inside the walls of the structure to be served by a Lateral connection.
- M. Sewer System Superintendent: Any person who may, from time to time, be placed in general charge of the New Hanover Township sewer system.

II. ADMINISTRATIVE PROVISIONS AND RESPONSIBILITIES OF THE OWNER

- A. Permission for connecting to the Township sewers must be obtained from New Hanover Township through application made by the property Owner or his agent. Blank forms for applications will be furnished by the Township.
- B. No repairs, alterations or additions to any connection to the Township sewer may be made until application has been made to and permission has been granted by New Hanover Township. The application for a Permit shall be supplemented by any plans, specifications, or other information considered pertinent in the judgment of the Township.
- C. No connection shall be made until the New Hanover Township Municipal Authority tapping fee and the New Hanover Township connection charge have been paid to the Township, or other fees in lieu of.
- D. All new laterals shall be inspected by the Township Plumbing Inspector and/or such inspector as he may assign. Construction of the Service Connection and/or Lateral may not proceed until the Plumbing Inspector has been notified and has authorized the construction to proceed.
- E. Wherever the surface of any public street, sidewalk or cartway is disturbed for construction of any Service Connection or Lateral, it shall be restored, at the cost of the Owner of the Improved Property being connected, in a manner satisfactory to the Township. All construction within the right-of-way of a public street of the Township shall be in compliance with the ordinances of the Township and all construction within the right-of-way of a County or State highway shall be in compliance with Montgomery County or Pennsylvania Department of Transportation requirements and specifications respectively.
- F. All Permits issued for construction will require that streets or roads under construction remain passable for vehicular traffic during the period of construction. Every excavation for a Service Connection or Lateral shall be guarded adequately with barricades and lights to protect all Persons from damage and injury.
- G. If a Building Sewer, Service Connection or Lateral becomes clogged, the opening, repair, or replacement of same shall be the responsibility of the property Owner.
- H. All costs and expenses for the installation and connection of the Building Sewer, Service Connection, and the Lateral shall be borne by the Owner. The Owner shall indemnify the Township from any loss or damage that may result directly or indirectly from the installation of the Building Sewer, Service Connection or the Lateral.
- I. The Owner of an Improved Property, on which the principal building is situated 150 feet or less from the Township sewer system, shall, upon direction from the Township, connect to the sewer system. If the Owner of such Improved Property fails to connect to the sewer system within 60 days' notice from the Township, or such longer time designated by the Township, the Township may enter upon such Improved Property and construct the sewer connection. The Township may collect the costs and expenses of connection from the Owner of such Improved Property, in the manner approved by applicable State law.

- J. Before commencing any phase of the Service Connection or Lateral construction, the contractor shall obtain a Permit and shall notify the Township as to when the construction will commence. At the time of final inspection, and before the Service Connection and Lateral are approved, he shall give to the inspector an as-built drawing of the Service Connection and Lateral installation, which shall include:
 - 1. The plan view of the new Service Connection and Lateral.
 - 2. Locations of all cleanouts and other special fittings.
 - 3. Point of connection to the sewer system.
 - 4. Accurate measurements of the Service Connection and Lateral length and the depth at the point of connection to the sewer system.
- K. At least twenty-four (24) hours' notice of the time when such connection will be made must be given to the Township prior to inspection.
- L. Any Service Connection or Lateral that is in violation of these specifications or of any other part of the Township Plumbing Code shall be relaid in the proper manner at the expense of the Owner.

III. GENERAL REQUIREMENTS OF LATERALS

- A. No more than one (1) Lateral per excavation ditch will be permitted. Each Lateral and Service Connection to the sewer must be made within the owner's property lines and/or the Authority's right of way or the public right-of-way
- B. Lateral connections shall be laid to a straight line and grade. The minimum grade for a 4-inch I. D. pipe shall be $\frac{1}{4}$ -inch to the foot. Where physical conditions preclude the installation of pipe at a grade of $\frac{1}{4}$ -inch or more to the foot, a minimum grade of $\frac{1}{8}$ -inch to the foot may be used, but only with the prior approval of the Township. For 6-inch I. D. or larger pipe, the minimum grade shall be $\frac{1}{8}$ -inch to the foot.
- C. Before commencing any phase of the construction for a Lateral and Service Connection, the plumbing contractor shall locate and expose, where applicable, the existing wye or stub provided for the connection to connect the Township sewer. If no Service Connection is provided, the contractor shall locate and expose the Township sewer main at the point where the Service Connection is to be made. Upon exposing the wye, stub, or main, as applicable, the contractor shall then verify that there is a $\frac{1}{4}$ -inch per foot fall by obtaining the differential elevation. If the elevations are such that the connection cannot be made at $\frac{1}{4}$ -inch per foot fall, he shall contact the Township Plumbing Inspector for permission to install the line at a minimum grade of $\frac{1}{8}$ -inch per foot fall. Under no circumstances is the trench between connections to be dug before it is ascertained that the minimum fall can be obtained. For a 6-inch I.D. pipe and larger, installation at $\frac{1}{8}$ -inch per foot is acceptable without contacting the Plumbing Inspector. No cap, stopper or plug shall be removed or punctured until permission has been granted by the Plumbing Inspector.

- D. A separate and independent Building Sewer, Lateral, and Sewage Drainage System shall be provided for every building. Notwithstanding the above, it is the intention of this Section to require a separate and distinct Permit, Building Sewer, Lateral, and Service Connection for each individual building or Housing Unit whether constructed as a single-detached unit or as one of a pair of row houses or as one of a group of town houses or buildings or as one of any other multiple dwelling unit.
- E. Separate and independent Sewer Laterals and Sewage Drainage Systems shall be provided for each separate and distinct store, office or industrial facility within any multi-occupant building, where such unit has or may have separate sanitary facility or facilities to discharge liquid waste to the sewer system. So called "shell buildings" which may have moveable interior walls, which are used to establish separate commercial units shall have multiple Laterals and Sewage Drainage Systems of sufficient size and location as approved by the Township Plumbing Inspector. Regardless of the foregoing, it is the intention of this section to require that any commercial user which discharges or will discharge Industrial Waste to the Township sewer system shall have a separate sewer system Lateral and Sewage Drainage Systems for such discharge. Such separate Lateral and Sewage Drainage System shall not receive waste discharged from any other separate and distinct Industrial or Commercial units.
- F. The Owner of a Commercial or Industrial Facility which discharges or will discharge Industrial Waste to the Township sewer system shall install an Industrial Waste sampling and observation manhole on the Lateral. The sampling manhole shall be located outside of the building between the building and the Township sewer main at a location acceptable to and approved by the Township Plumbing Inspector. The sample manhole must be accessible at all times to authorized representatives of new Hanover Township. The sampling manhole must be designed in accordance with the new Hanover Township Specifications for a Standard Type, "A" manhole or the Type "B" manhole, as applicable. Details of the standard manholes are attached.
- G. Old Laterals and Sewage Drainage Systems may be used to serve new buildings only when approved by the Township. At its discretion, the Township may require the examination or testing of old Laterals and Sewage Drainage Systems, at the expense of the Owner, prior to approving or disapproving the Lateral and Sewage Drainage System use.
- H. When a new sewer Lateral and Sewage Drainage System is to be installed for an existing building, such Lateral must be connected to the existing Lateral or Building Sewer on the building side of the septic tank/cesspool serving the building. New connections to the sewer shall not be placed through a cesspool, privy vault, sinkhole, septic tank, drainfield, or similar receptacle but must be placed on solid ground on the building side of the cesspool. Ductile iron water main pipe (Class 50) with mechanical joints may be used to span a cesspool, provided the cesspool is pumped and backfilled to grade at the expense of the Owner of such improved property.

IV. BASEMENT

- A. Floor drains will not be permitted to be connected to the Building Sewer, Lateral or Sewage Drainage System.
- B. Sump pumps intended for basement dewatering and basement floor drains (where basements experience significant groundwater flooding) may not be connected to the sewer system.
- C. No Person shall make temporary or permanent connection of roof downspouts, exterior foundation drains, areaway drains, or other sources of surface runoff or groundwater to the Township's sewer system, either directly or indirectly.

V. PIPE AND FITTING REQUIREMENTS

- A. All Lateral connections to the Township sewer must be made into the Sewage Drainage System or wye left for that purpose. Where no Sewage Drainage System or wye has been provided, the sewer shall be tapped with an opening to fit a 45° saddle and a cast iron wye saddle shall be applied to the opening. The saddle shall be mated to the sewer using a suitable rubber gasket and shall be securely fastened by bolts supplied for that purpose. When the opening into the pipe has been cut too large to fit the saddle, the pipe in the Township sewer must be replaced by a wye branch of the proper size. This construction must be inspected and approved by the Township Plumbing Inspector before the remaining portions of the Sewage Drainage System and Lateral may be laid.
- B. Whenever a wye branch has been broken while removing its cap preparatory to making a connection, the protruding branch must be removed and a cast iron wye applied as specified in paragraph A of this Section. When an existing Sewage Drainage System stub is broken, the wye and the broken section of pipe must be replaced.
- C. Connections shall be constructed in accordance with the rules and regulations of the Township Plumbing Code. The Lateral shall be constructed of one of the following materials:
 - 1. PVC Ring-Tite pipe and fittings conforming to ASTM D 2241 SDR-35.
 - 2. Laterals passing under any stream or creek shall be constructed of ductile iron water main pipe. Federal Specifications W.W.P. 421 Class 52 with mechanical joints. Ductile iron pipe shall require an epoxy coating on the interior of the pipe.
- D. All Laterals and Sewage Drainage Systems shall be constructed with the required fittings and appurtenances described in this Section. A detail showing the relative positioning of the fittings along a typical lateral is attached hereto as Standard Detail 23 and 24.
- E. No sewer pipe shall be reduced in size between the house and the sewer, except for one 6-inch by 4-inch reduction at the edge of the right-of-way or inside the curb line, as approved by the Township.
- F. All pipe shall be a minimum of 4-inches inside diameter. Pipe sizes for apartments and commercial buildings must be approved by the Township. Joints shall be permanently water tight.

- G. All Lateral connections to Sewage Drainage System stubs will be made with an adapter acceptable to the Township.
- H. A minimum of three feet of earth cover over the invert of the Lateral shall be provided to protect the pipe from frost or freezing. Concrete encasement shall be provided where cover is less than three feet.
- I. All changes in grade and direction shall be made with pipe fittings. No fitting exceeding 45° will be permitted. When two or more bends are used, a length of pipe (minimum 3 feet) shall be placed between them. Pipe bends greater than 45° are prohibited. In lieu of a 90° bend, two 45° fittings separated by a minimum of 3 feet of straight pipe shall be used. Details showing the required pipe fittings for a deep Sewage Drainage System and a shallow Sewage Drainage System are attached hereto as Standard Detail 23.
- J. Cleanouts shall be provided in each sanitary sewer Lateral at 50 foot intervals so as to permit complete rodding with a 50-foot long cable or tape. Cleanouts shall be constructed using a tee or wye fitting in the run and riser pipe brought to a minimum of 4-inches above grade with a screw type ferrule and shall be water tight.
- K. A cleanout shall be provided for each sanitary sewer Lateral at a point 2-foot from the basement wall of the building to be served.
- L. A main trap and air vent are required per Standard Detail 24.
- M. If, for any reason, construction is delayed or stopped, the pipe connected to the sewer main must be temporarily capped with a waterproof stopper until construction resumes.
- N. Wherever, in the opinion of the Engineer and/or Plumbing Inspector, the trenching conditions require either a specific type of pipe, joint material or encasement in concrete, such materials as he may direct shall be installed.

VI. TRENCH AND PIPE BEDDING REQUIREMENTS

- A. All excavation for a Sewage Drainage System or a Lateral installation shall be adequately guarded with barricades and lights so as to protect the public from hazard. Streets, sidewalks, parkways, and other public property disturbed in the course of the work shall be restored in a manner satisfactory to the Township.
- B. In all trenches (both earth and rock trenches), "First Class Bedding" shall be provided as a foundation for all pipe. The bedding material shall consist of crushed stone conforming to the Commonwealth of Pennsylvania Department of Transportation grading and quality requirements for AASHTO #8 coarse aggregate. The crushed stone shall be placed on the bottom of the trench to a minimum depth of 4-inches, along the sides of the pipe to a depth of one-half the pipe diameter, and over the pipe to a minimum depth of 1-foot. A detailed description and drawing of: "First Class Bedding" is contained in the New Hanover Township regulations for the Standard Construction and Material Specifications for Wastewater Collection System Extensions.
- C. When the bottom of the trench has been dug too deep, it shall be refilled to grade with a minimum of 4-inches of Pennsylvania AASHTO #8 coarse aggregate.

- D. Unsuitable material encountered in excavation, such as ashes, muck and unstable soils, shall be removed. Stabilization of the Lateral shall be achieved by over-excavating the trench to a depth of two times the pipe diameter below the grade line of the Lateral and then backfilling the trench to the gradeline of the pipe with AASHTO #8 stone tamped in place so as to provide a solid and continuous bearing foundation for the pipe.
- E. All groundwater which may be found in the trenches, and any other water which may get into them from any source whatsoever, shall be pumped or bailed out so that the trench shall be completely dry during pipe laying and backfilling. Water shall be kept away from any mortar or concrete work until it has thoroughly set. When water is encountered, no less than 6-inches of AASHTO #8 coarse stone shall be used as foundation for the pipe.
- F. No spring water, groundwater, trench water, stormwater, or surface water of any nature whatsoever shall be allowed to enter the sanitary sewer system during construction.

VII. BACKFILLING

- A. No work shall be covered or concealed in any way until inspected and approved by the Township. Use of a new Lateral connection to the sewer system will not be permitted until after the entire Lateral and Sewage Drainage System have been air tested and have been proved satisfactory.
- B. When the Sewage Drainage System and Lateral construction line have been approved by the Township inspector and the joints have set properly, the trench may be backfilled. AASHTO #8 coarse aggregate shall be carefully hand tamped around the pipe to a distance of 1-foot over the pipe. Coarser material, free of stones, may then be backfilled and tamped by hand or machine in 6-inch layers to a point 2-feet above the top of the pipe. Coarser material, free of stones larger than 8-inches, may then be used for backfill. Care shall be exercised not to disturb the pipe.
- C. When the Lateral or Sewage Drainage System crosses a driveway or walkway, AASHTO #57 backfill shall be provided and thoroughly tamped by hand or machine in the trench from a point 2-feet above the sewer to the top of the trench.
- D. Following connection of the building to public sewers, all septic tanks, holding tanks, seepage pits and cesspools must be pumped out by a licensed, approved sewage pumper and filled with sand or earth on the same day or before the contractor leaves the job. All building sewer lines to such systems shall be disconnected and the hole in the foundation filled.

VIII. CLEAN-UP

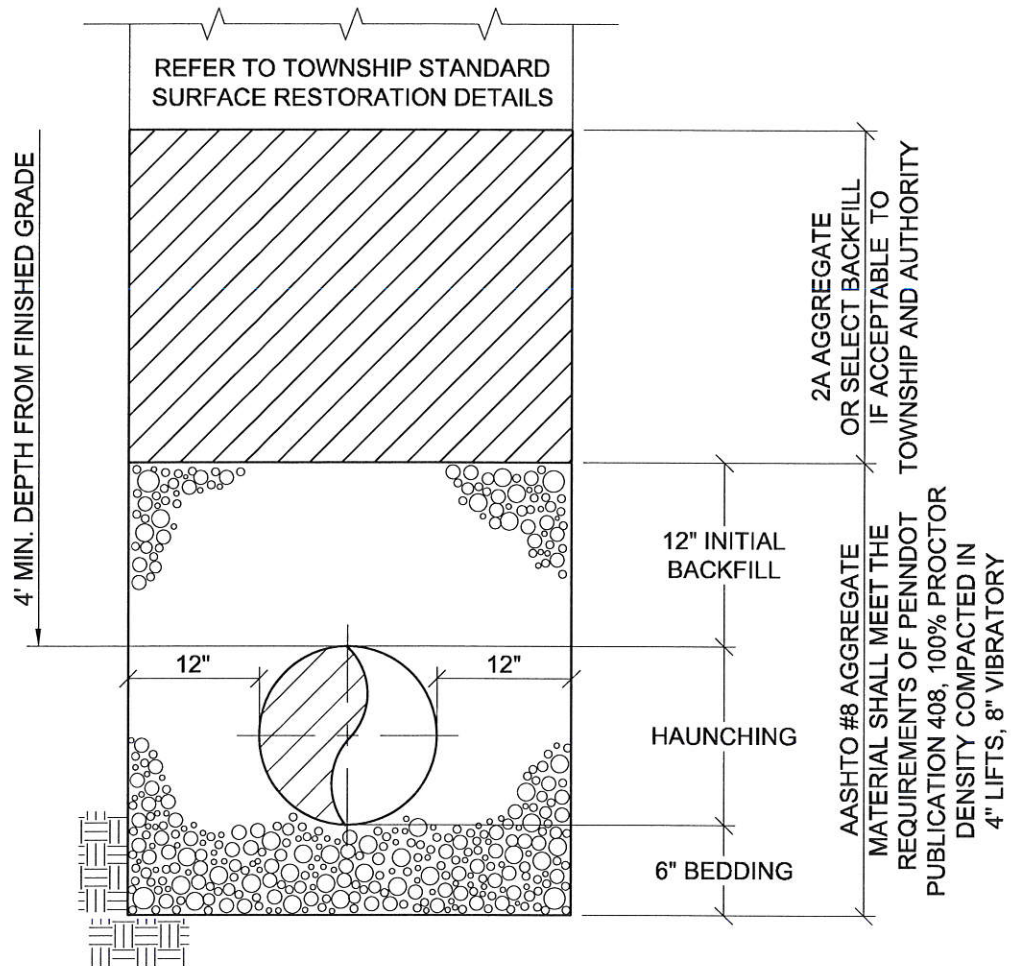
- A. Removal of debris, which was stored within the public rights-of-way, including road, cartway, or sidewalk, shall be removed within 24-hours of completion of the Sewage Drainage System or Lateral work.

- B. Any concrete sidewalk or curb removed for the purpose of making sewer connection must be temporarily restored within 48-hours, and permanent replacement within 30-days from the time installation has been approved. Replacement materials shall conform to Township specifications.

IX. REGISTRATION AND QUALIFICATIONS

- A. All persons, firms or corporations engaging in the installation of sewer Laterals, Sewage Drainage Systems or connections to the Township sewer system, shall, during each calendar year, register with the Township.
- B. Each applicant shall, at the time of registration, furnish a certificate of insurance for the entire period of registration.

STANDARD CONSTRUCTION DETAILS



Reading (Corporate Office) www.entecheng.com
 4 South Fourth Street | P.O. Box 32 | Reading, PA 19603-0032
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Pottsville p: 570.628.5655 | Mountaintop p: 570.868.0275 | Lititz p: 717.626.6666 | Pittsburgh p: 412.264.2800

NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL TYPICAL BACKFILL TRENCH RESTORATION DETAIL

DATE:

FEB. 2014

SCALE:

N.T.S.

DRAWING NO.

PREPARED BY
ZM

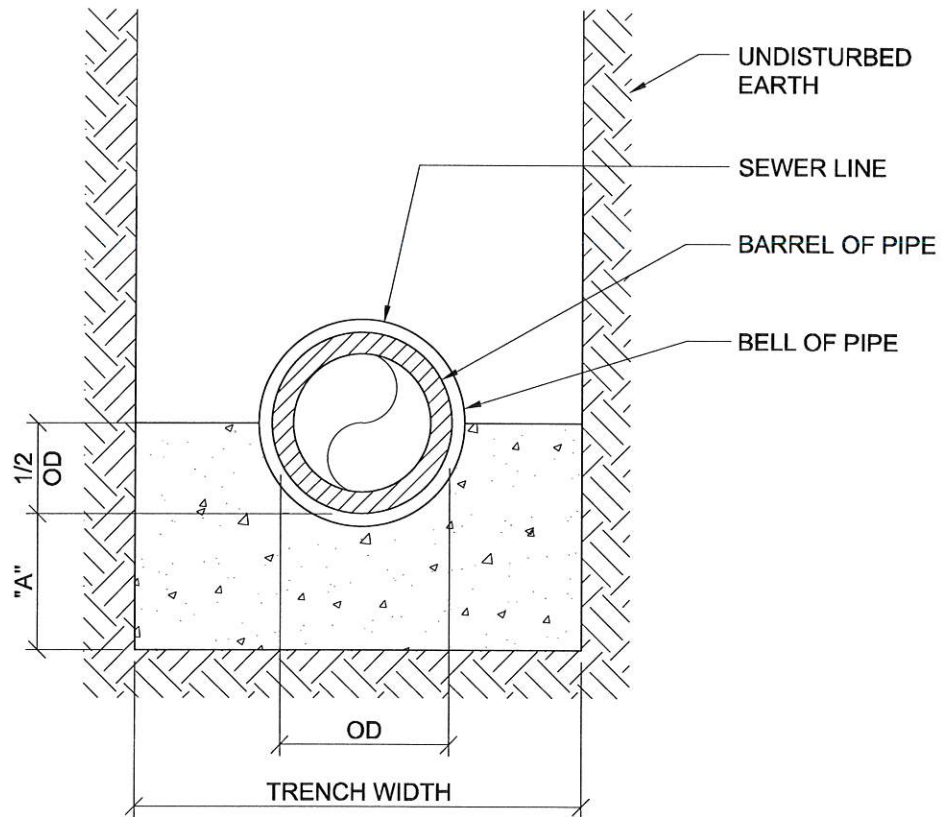
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PROJECT NO.
4602.15

S-1



PIPE SIZE	"A"
4" - 48"	6"
54" - 84"	10"

NOTES:

1. ALL CONCRETE SHALL HAVE MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI AT THE END OF 28 DAYS.



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

**STANDARD DETAIL
CONCRETE CRADLE DETAIL**

DATE:
FEB. 2014

SCALE:
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DRAWING NO.

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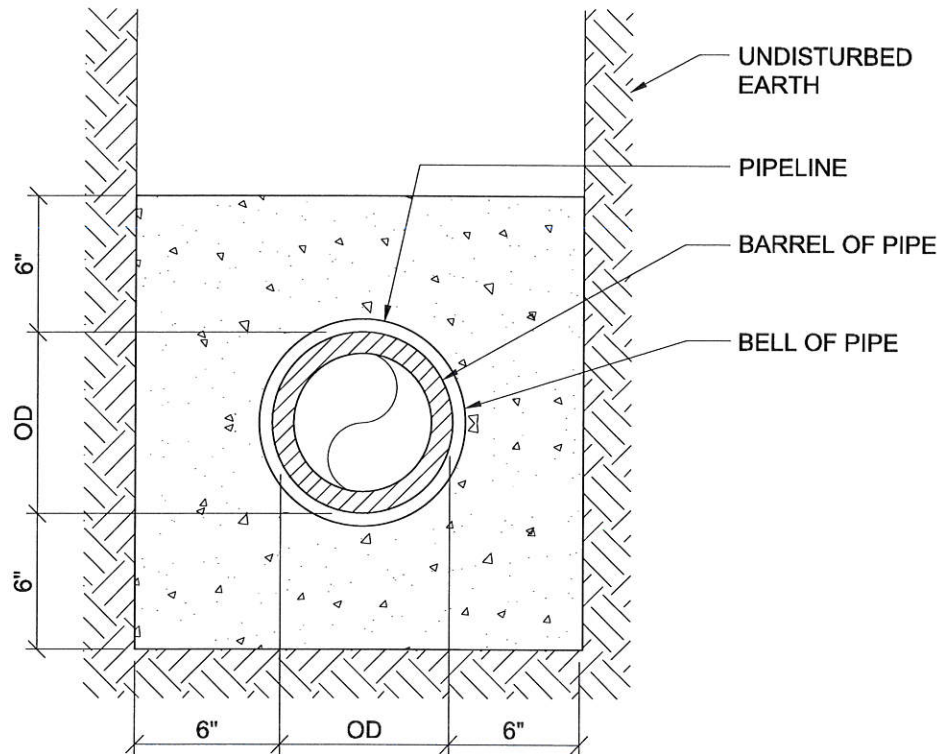
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PROJECT NO.
4602.15

S-2



NOTES:

1. ALL CONCRETE SHALL HAVE MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI AT THE END OF 28 DAYS.

Entech Engineering - Printed: Jun. 2, 2014 H:\4602.15\CD\Sewer Details\S-3.dwg



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

**STANDARD DETAIL
CONCRETE ENCASEMENT DETAIL**

DATE:
FEB. 2014

SCALE:
N.T.S.

DRAWING NO.

S-3

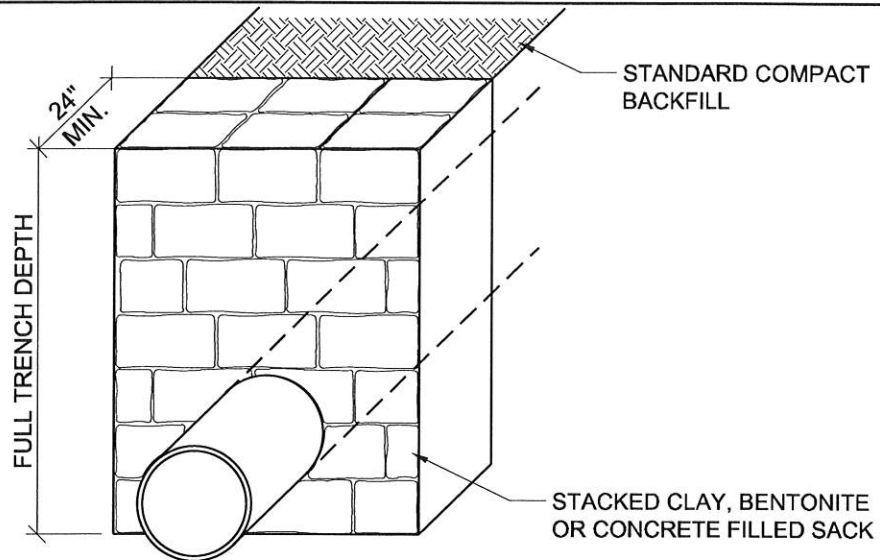
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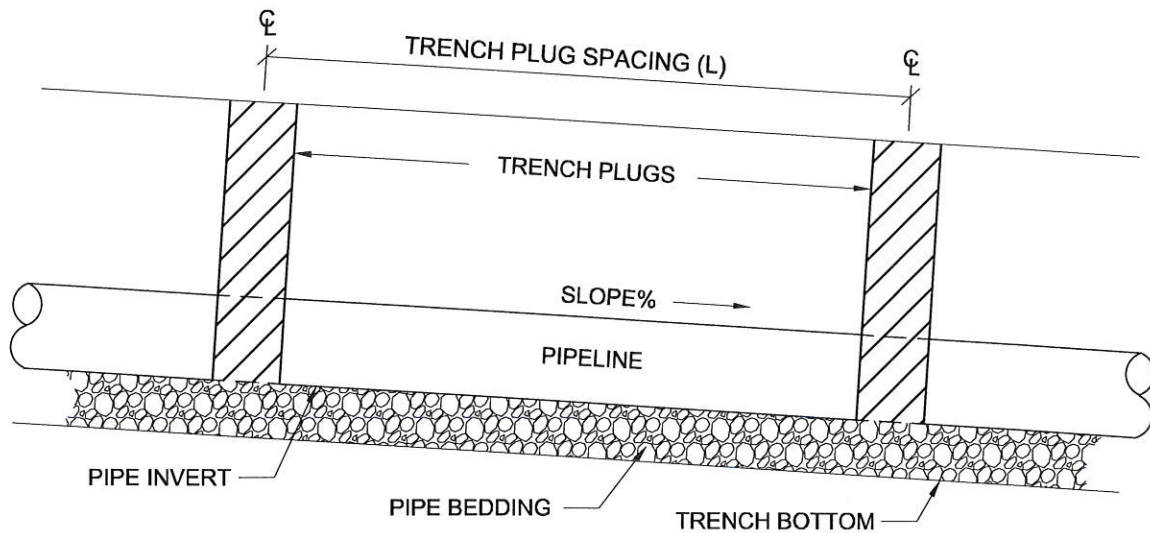
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PROJECT NO.
4602.15



SECTION VIEW



ELEVATION

MAXIMUM SPACING AND MATERIAL FOR TRENCH PLUGS		
TRENCH SLOPE (%)	SPACING L (FT)	PLUG MATERIAL
< 5	1,000	* CLAY, BENTONITE, OR CONCRETE FILLED SACK
5 - 15	500	* CLAY, BENTONITE, OR CONCRETE FILLED SACK
15 - 25	300	* CLAY, BENTONITE, OR CONCRETE FILLED SACK
25 - 35	200	* CLAY, BENTONITE, OR CONCRETE FILLED SACK
35 - 100	100	* CLAY, BENTONITE, OR CONCRETE FILLED SACK
> 100	50	CEMENT FILLED BAGS (WETTED) OR MORTARED STONE

* TOPSOIL MAY NOT BE USED TO FILL SACKS.

IMPERVIOUS TRENCH PLUGS ARE REQUIRED FOR ALL STREAM, RIVER, WETLAND, OR OTHER WATER BODY CROSSING.



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL

TYPICAL TRENCH PLUG INSTALLATION DETAIL

DATE:

FEB. 2014

SCALE:

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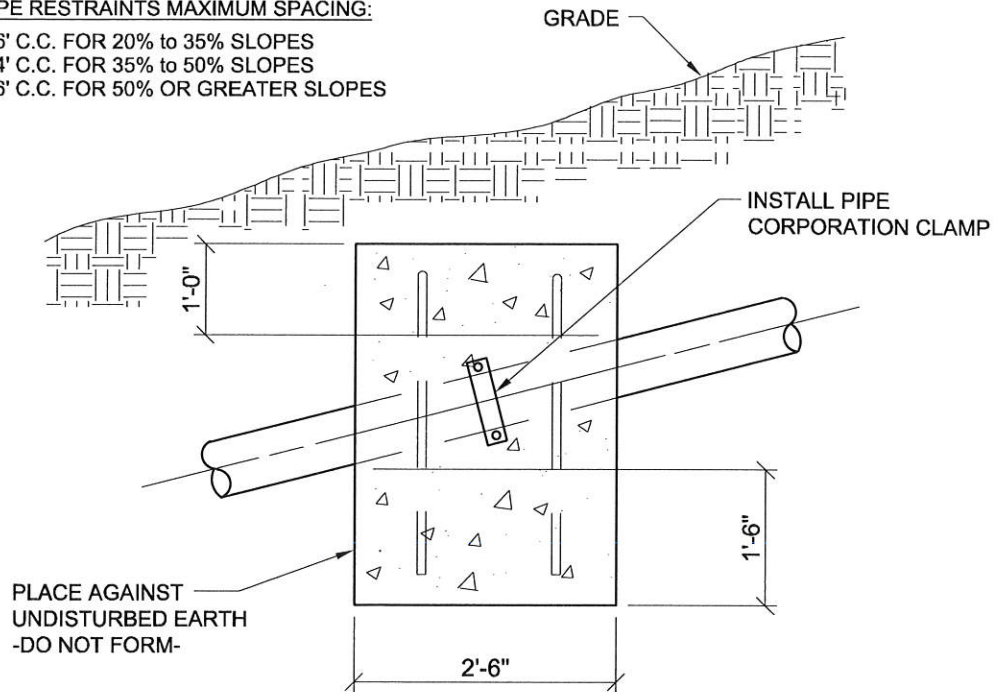
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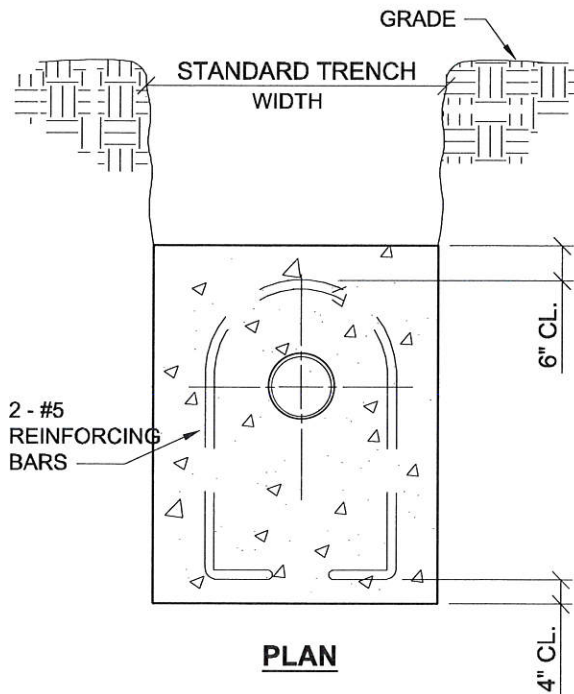
PROJECT NO.
4602.15

S-4

PIPE RESTRAINTS MAXIMUM SPACING:
 36' C.C. FOR 20% to 35% SLOPES
 24' C.C. FOR 35% to 50% SLOPES
 16' C.C. FOR 50% OR GREATER SLOPES



ELEVATION



PLAN

NOTES:

1. ALL CONCRETE SHALL HAVE MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI AT THE END OF 28 DAYS.



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL

TYPICAL PIPE SLOPE RESTRAINT DETAIL

DATE:

FEB. 2014

SCALE:

N.T.S.

DRAWING NO.

PREPARED BY
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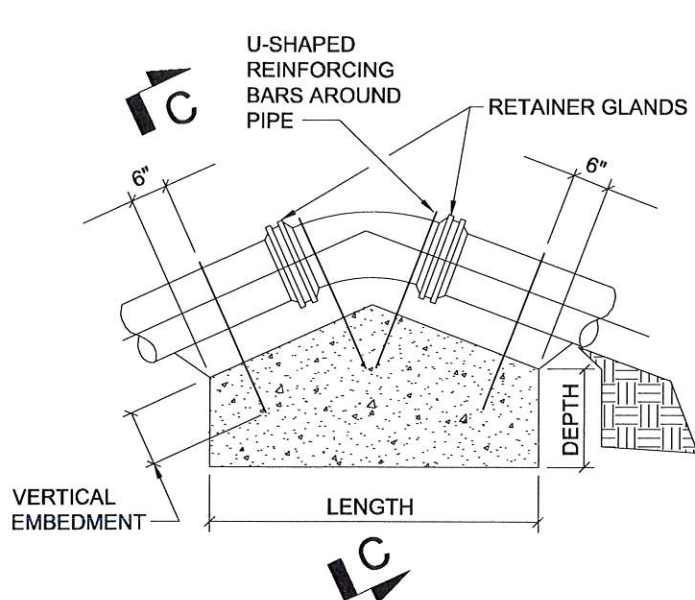
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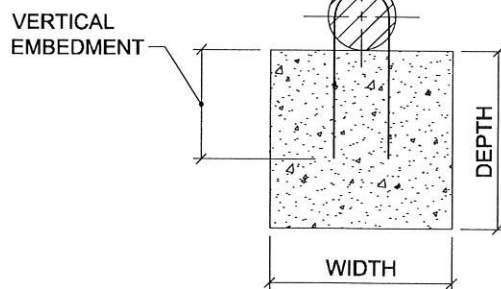
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PROJECT NO.
4602.15

S-5



EACH U-SHAPED BAR SHALL BE CONSIDERED AS ONE BAR FOR COMPUTING CROSS SECTIONAL AREAS



SECTION C-C

VERTICAL THRUST UPWARD

PIPE SIZE	6" AND 8"			10" AND 12"			14" AND 16"		
DEGREE BEND OR DEFLECTION	11 1/4°	22 1/2°	45°	11 1/4°	22 1/2°	45°	11 1/4°	22 1/2°	45°
LENGTH	3.00	4.00	6.00	4.50	6.00	8.00	6.00	8.00	11.00
WIDTH	3.00	3.00	3.00	3.00	3.00	4.00	3.50	3.50	5.00
DEPTH	2.00	3.00	4.00	3.00	4.50	5.00	3.50	5.00	5.00
SQ. IN. REINFORCING	0.17	0.33	0.65	0.37	0.74	1.46	0.66	1.32	2.60

BAR NO.	5	6	7	8	9	10	11
CROSS-SECTION IN. ² PER BAR	0.31	0.44	0.60	0.79	1.00	1.27	1.56
VERTICAL EMBEDMENT	15"	19"	26"	35"	44"	56"	68"

UPWARD THRUSTS SCHEDULE OF DIMENSIONS 150 P.S.I. WORKING PRESSURE

NOTE:

REFER TO NOTES ON HORIZONTAL THRUST BLOCKING DETAIL



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL VERTICAL THRUST BLOCKING DETAIL

DATE:
FEB. 2014

SCALE:
N.T.S.

DRAWING NO.

S-6

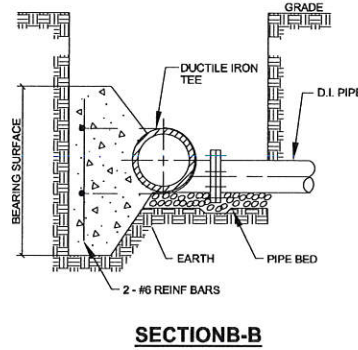
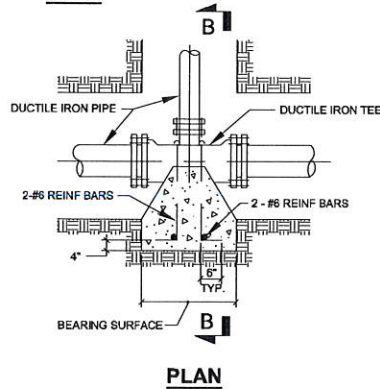
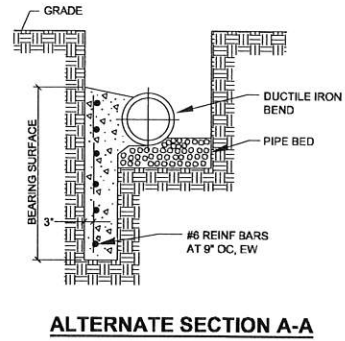
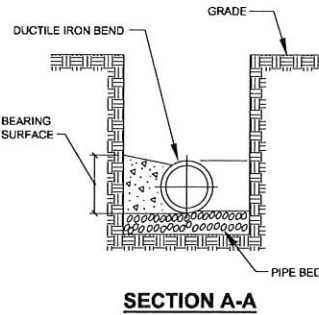
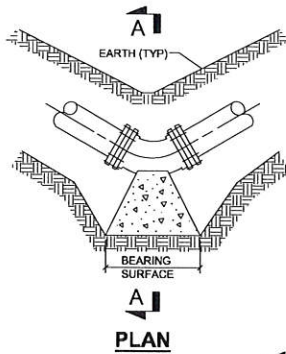
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PROJECT NO.
4602.15



MINIMUM SQUARE FEET OF BEARING SURFACE REQUIRED FOR HORIZONTAL THRUST BLOCKING AND VERTICAL THRUSTS DOWNWARD									
PIPE SIZES ➡		6" AND 8"				10" AND 12"			
TYPE OF BEARING MATERIAL AND ALLOWABLE LOADS	DEGREE BEND OR DEFLECTION				DEGREE BEND OR DEFLECTION				
	11 1/4°	22 1/2°	45°	90°	11 1/4°	22 1/2°	45°	90°	
SAND 1 TON/SQ FT SOFT CLAY 1 TON/SQ FT	1.50	3.00	6.00	12.00	3.00	6.00	12.00	24.50	
SAND & GRAVEL 2 TON/SQ FT	1.00	1.50	3.00	6.00	1.50	3.00	6.00	12.00	
CLAY 3 TON/SQ FT	1.00	1.00	2.00	4.00	1.00	2.00	4.00	6.00	
SOFT ROCK 5 TON/SQ FT	1.00	1.00	1.00	2.50	1.00	1.00	2.50	5.00	
ROCK 20 TON/SQ FT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	

MINIMUM SQUARE FEET OF BEARING SURFACE REQUIRED FOR HORIZONTAL THRUST BLOCKING AND VERTICAL THRUSTS DOWNWARD									
PIPE SIZES ➡		14" AND 16"				18" AND 20"			
TYPE OF BEARING MATERIAL AND ALLOWABLE LOADS	DEGREE BEND OR DEFLECTION				DEGREE BEND OR DEFLECTION				
	11 1/4°	22 1/2°	45°	90°	11 1/4°	22 1/2°	45°	90°	
SAND 1 TON/SQ FT SOFT CLAY 1 TON/SQ FT	5.50	11.00	21.50	43.00	8.50	16.50	33.00	66.00	
SAND & GRAVEL 2 TON/SQ FT	2.50	5.50	11.00	21.50	4.00	8.50	16.50	33.00	
CLAY 3 TON/SQ FT	2.00	3.50	7.00	14.00	3.00	5.50	11.00	22.00	
SOFT ROCK 5 TON/SQ FT	1.00	2.00	4.50	8.50	1.50	3.50	6.50	13.00	
ROCK 20 TON/SQ FT	1.00	1.00	1.00	2.00	1.00	1.00	1.50	3.50	

SCHEDULE OF DIMENSIONS

NOTES:

1. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI AT THE END OF 28 DAYS.
2. ALL REINFORCING STEEL SHALL BE GRADE 60 DEFORMED BARS.
3. INSTALL CONCRETE THRUST BLOCKS AT EACH ELBOW, TEE AND CAPPED OR VALVED END FITTINGS LOCATED IN THE HORIZONTAL/ VERTICAL PLANE.
4. PAINT ALL EXPOSED STEEL WITH TWO COATS OF ASPHALT PAINT.
5. NO COUPLING OR JOINTS SHALL BE COVERED WITH CONCRETE.
6. ALL-THREADS WITH PIPE STRAPS MAY BE USED IN PLACE OF REINFORCING BARS.
7. ALL THRUST BLOCKS SHOWN ARE INTENDED AS A GUIDE AND SHALL WITHSTAND THE REQUIRED PRESSURE.
8. RETAINER GLANDS REQUIRED ON ALL MECHANICAL JOINT FITTINGS.
9. CERTAIN SITUATIONS MAY WARRANT THE USE OF TIE RODS, AUTHORIZED BY THE AUTHORITY ONLY.
10. PIPING SHALL BE WRAPPED WITH POLYETHYLENE PRIOR TO PLACEMENT OF CONCRETE.
11. FOR SOIL BEARING VALUES LESS THAN 1 TON / SQ. FT., CONSULT WITH AUTHORITY ENGINEER FOR RECOMMENDATION.



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

**STANDARD DETAIL
HORIZONTAL THRUST BLOCKING DETAIL**

DATE:

FEB. 2014

SCALE:

N.T.S.

DRAWING NO.

PREPARED BY
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PROJECT NO.
4602.15

S-7

HORIZONTAL BENDS

NOMINAL PIPE DIA.	LENGTH OF PIPE RESTRAINT REQUIRED PER FITTING IN FEET							
	11.25°	22.5°	45°	90°	TEE	CROSS	CAP/VALVE	REDUCER
4	1	3	5	13	11	11	14	-- --
6	2	4	8	18	17	17	19	6" to 4" 10
8	2	5	10	24	23	23	25	8" to 6" 11
10	3	6	12	29	28	28	31	10" to 8" 11
12	3	7	14	35	34	34	37	12" to 10" 11
16	4	9	19	45	46	46	49	16" to 12" 21

VERTICAL BENDS

NOMINAL PIPE DIA.	LENGTH OF PIPE RESTRAINT REQUIRED PER FITTING IN FEET							
	VERTICAL UP BEND ANGLE				VERTICAL DOWN BEND ANGLE			
	11.25°	22.5°	45°	90°	11.25°	22.5°	45°	90°
4	1	3	5	13	3	5	11	27
6	2	4	8	18	4	8	16	39
8	2	5	10	24	5	10	21	51
10	3	6	12	29	6	12	26	62
12	3	7	14	35	7	15	31	74
16	4	9	19	45	10	19	41	98

NOTES:

1. LENGTHS ARE BASED ON THE DUCTILE IRON PIPE RESEARCH ASSOCIATION PIPE RESTRAINT CALCULATOR VERSION 3.3 (05/09/2003), ASSUMING THE FOLLOWING: TRENCH - TYPE 5, SOIL - CLAY 1, BURY DEPTH 4', PRESSURE 150 PSI, AND SAFETY FACTOR 1.5
2. LENGTHS ARE PROVIDED FOR DUCTILE IRON PIPE WITHOUT POLYETHYLENE WRAP. POLYETHYLENE WRAP WILL REQUIRE ADDITIONAL RESTRAINT LENGTH TO BE DETERMINED ON AN AS NEEDED BASIS BY NHTA ENGINEER.
3. REDUCER RESTRAINT LENGTHS SHOULD BE ADDED IF GREATER REDUCTION IS REQUIRED (I.E. 16" TO 8" = 21+11+11 = 43 FEET)



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL PIPE JOINT RESTRAINT DETAIL

DATE:
FEB. 2014

SCALE:
N.T.S.

DRAWING NO.

S-8

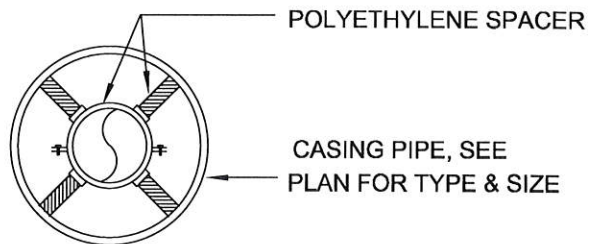
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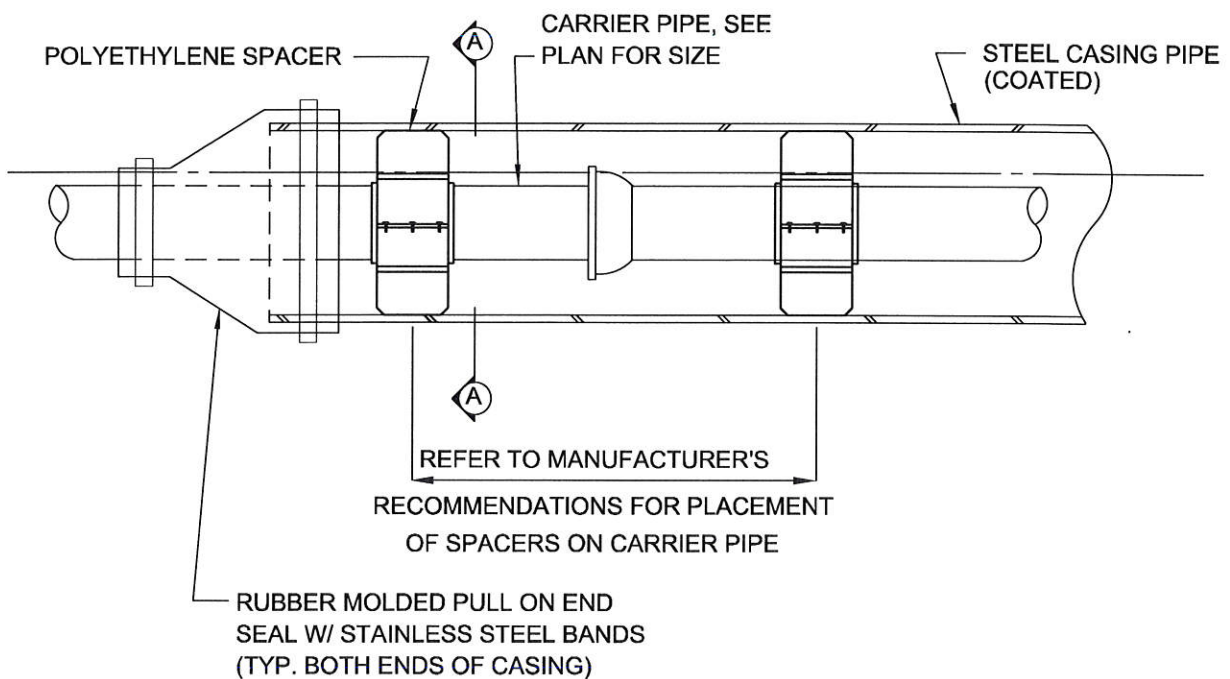
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PROJECT NO.
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SECTION A-A



NOTES:

1. DESIGN ENGINEER IS RESPONSIBLE FOR PROPER SIZING OF THE CASING PIPE TO HOUSE CARRIER PIPE AND TO WITHSTAND LOADING DEMANDS.



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL GRAVITY AND FORCE MAIN PIPE CASING DETAIL

DATE:
FEB. 2014

SCALE:
N.T.S.

DRAWING NO.

S-9

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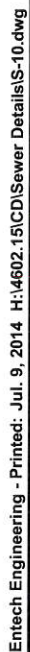
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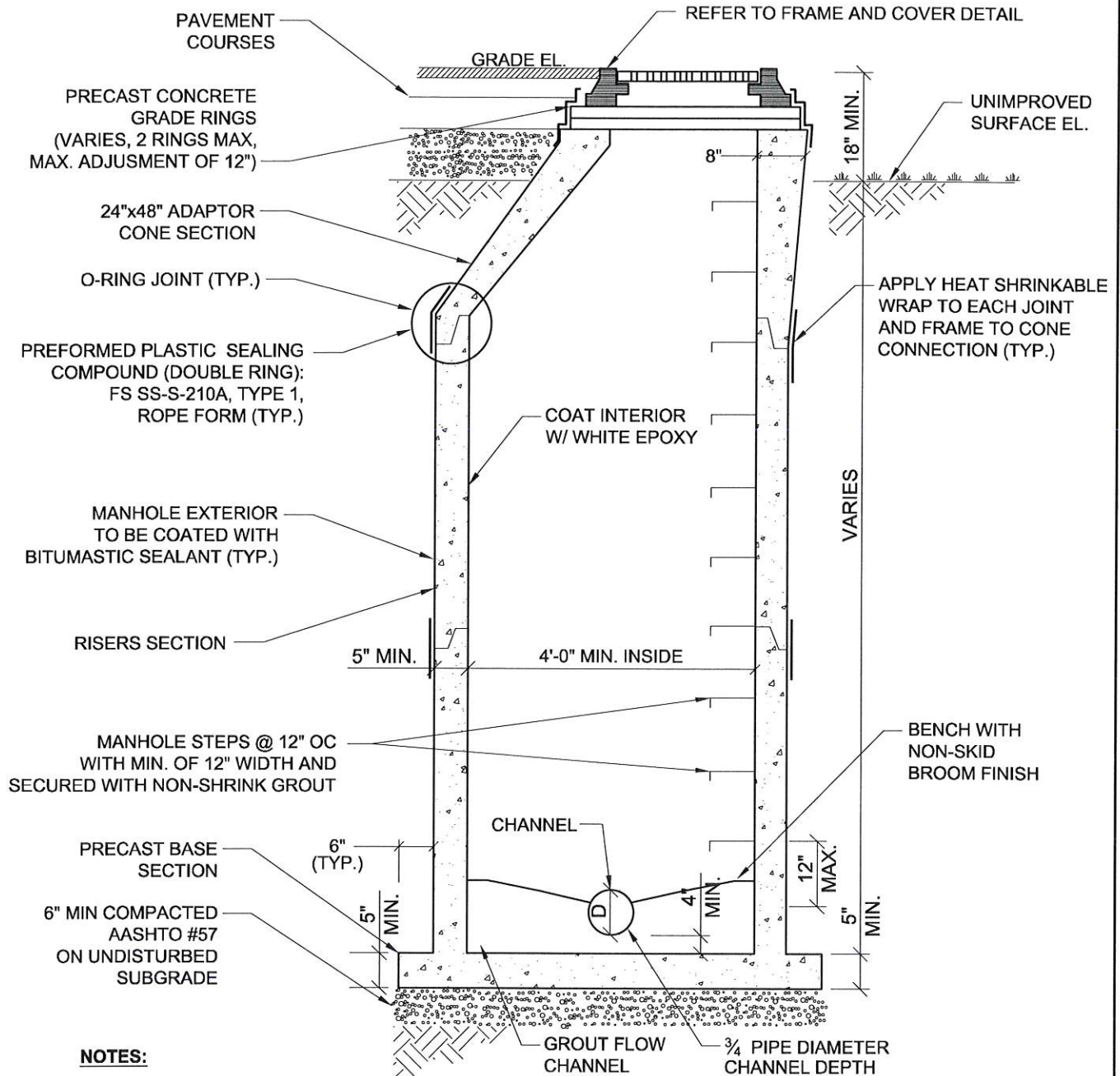
PROJECT NO.
4602.15

1. ALL SPECIFIC INFORMATION REQUIRED AT EACH APPLICABLE LOCATION WILL BE FURNISHED BY THE ENGINEER.



PROJECT NO.
4602.15

S-10



NOTES:

1. ALL PIPE TO MANHOLE CONNECTIONS SHALL BE MADE WITH A CAST-IN-PLACE GASKET. (TYP.) (A-LOK OR APPROVED EQUAL)
2. MANHOLES EXCEEDING A DEPTH OF 16 FEET SHALL PROVIDE PRE-CAST LANDING PLATFORM.
3. THE 48"Ø MANHOLE SHALL BE USED ON PIPE SIZES 8" TO 18"
4. FINISH GRADE SHALL BE FLUSH WITH TOP OF COVER, UNLESS OTHERWISE NOTED. MANHOLES INSTALLED OUTSIDE OF PAVED AREAS SHOULD BE RAISED A MINIMUM OF 18" ABOVE GROUND ELEVATION.



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL MANHOLE DETAIL

DATE:

FEB. 2014

SCALE:

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DRAWING NO.

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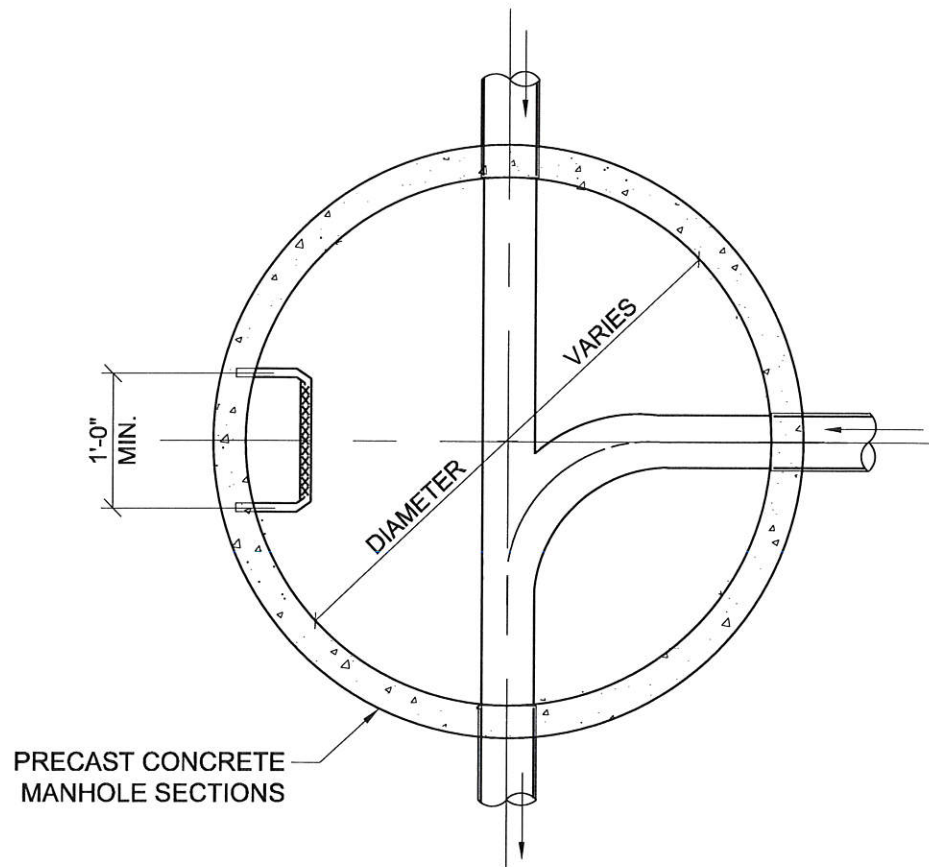
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- -

PROJECT NO.
4602.15

S-11



NOTES:

1. THE BENCH SHALL SLOPE TO INVERT CHANNEL AT THE RATE OF 1" PER FOOT (MIN.)
2. THE DEPTH OF THE INVERT CHANNEL SHALL BE NOT LESS THEN $\frac{3}{4}$ OF THE DIAMETER OF THE PIPE.

PRECAST MANHOLE DIAMETER REQUIREMENT TABLE

MANHOLE DIAMETER	45° DEFLECTION MAXIMUM SIZE OF PIPE	90° DEFLECTION MAXIMUM SIZE OF PIPE
48"	18"	18"
60"	36"	27"
72"	42"	30"

NOTE: MANHOLES GREATER THAN 20 FEET DEEP SHALL BE A MINIMUM OF 5 FOOT DIAMETER.



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL

TYPICAL MANHOLE BASE CHANNEL CONFIGURATION DETAIL

DATE:

FEB. 2014

SCALE:

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DRAWING NO.

S-13

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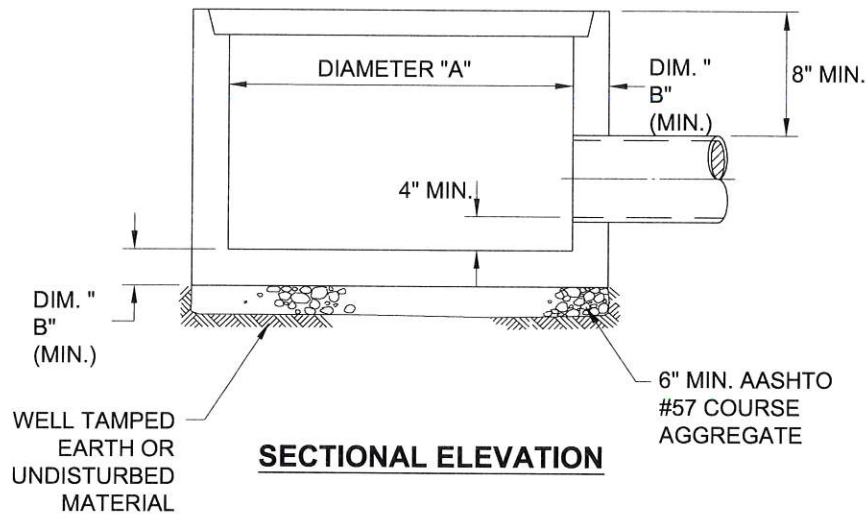
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PRECAST REINFORCED CONCRETE MANHOLE BASE SCHEDULE OF DIMENSIONS	
DIA. "A"	DIM. " B"
4'-0"	5"
5'-0"	6"
6'-0"	7"
7'-0"	8"
8'-0"	9"
10'-0"	10"



NOTES:

1. ORIENTATION AND DIAMETER OF PIPE OPENINGS SHOWN FOR ILLUSTRATION PURPOSES ONLY. SEE PLANS FOR LOCATION AND DIAMETER.
2. PRECAST REINFORCED CONCRETE MANHOLE BASE TO CONFORM TO ASTM SPECIFICATION C-478.
3. REINFORCING STEEL TO CONFORM TO ASTM SPECIFICATION A-185.



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STANDARD DETAIL

PRECAST REINFORCED CONCRETE MANHOLE BASE DETAIL

DATE:

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SCALE:

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4602.15

S-14

PREFORMED PLASTIC SEALING
COMPOUND (DOUBLE RING):
FS SS-S-210A, TYPE 1,
ROPE FORM (TYP.)

O-RING JOINT (TYP.)

APPLY HEAT SHRINKABLE
WRAP TO EACH SECTION
JOINT (TYP.)

MANHOLE EXTERIOR
TO BE COATED WITH
BITUMASTIC SEALANT (TYP.)

6" TYP.

GROUT FLOW CHANNEL

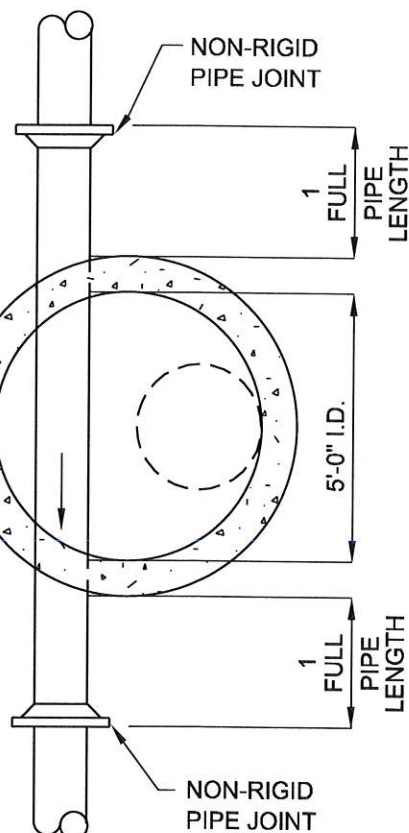
6" MIN.

SLOPE

SLOPE

6" MIN.

SECTION



PLAN

MIN. 6" AASHTO # 57
COARSE AGGREGATE(EXTEND
TO LIMITS OF EXCAVATION)

NOTES:

1. THE BENCH SHALL SLOPE TO INVERT CHANNEL AT THE RATE OF 1" PER FOOT (MIN.)
2. THE DEPTH OF THE INVERT CHANNEL SHALL BE NOT LESS THAN $\frac{3}{4}$ OF THE DIAMETER OF THE PIPE.
3. THE 48"Ø MANHOLE SHALL BE USED ON PIPE SIZES 8" TO 18"
4. FINISH GRADE SHALL BE FLUSH WITH TOP OF COVER, UNLESS OTHERWISE NOTED. MANHOLES INSTALLED OUTSIDE OF PAVED AREAS SHOULD BE RAISED A MINIMUM OF 18" ABOVE GROUND ELEVATION.
5. ALL PIPE TO MANHOLE CONNECTIONS SHALL BE MADE WITH A CAST-IN-PLACE GASKET. (TYP.) (A-LOK OR APPROVED EQUAL)
6. REFER TO FLAT TOP MANHOLE DETAIL FOR UPPER SECTION REQUIREMENTS.



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

**STANDARD DETAIL
SAMPLING MANHOLE DETAIL**

DATE:

FEB. 2014

SCALE:

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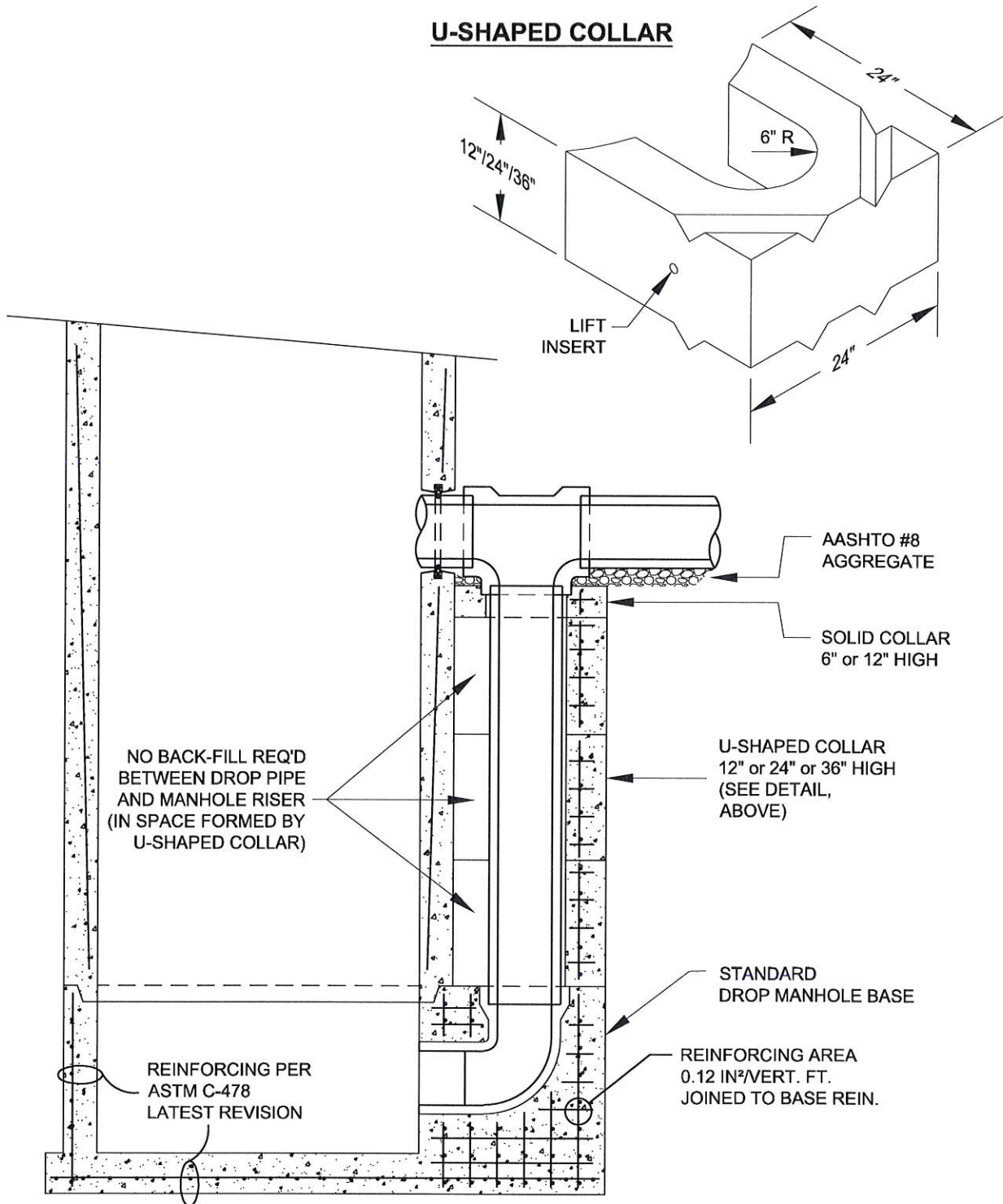
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S-15

U-SHAPED COLLAR



NOTES:

1. DROP MANHOLE AND A MINIMUM OF ONE DOWNSTREAM MANHOLE SHALL REQUIRE PVC LINING (DURA PLATE 100 OR EQUAL).



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STANDARD DETAIL OUTSIDE DROP MANHOLE DETAIL

DATE:

FEB. 2014

SCALE:

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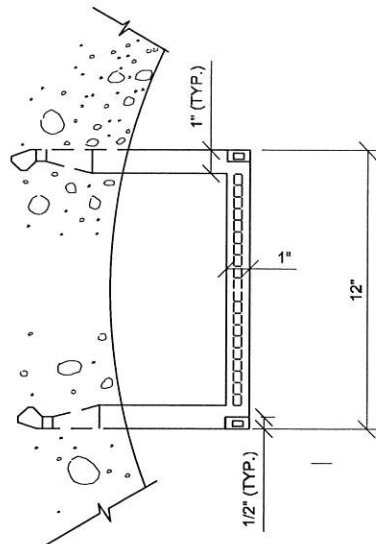
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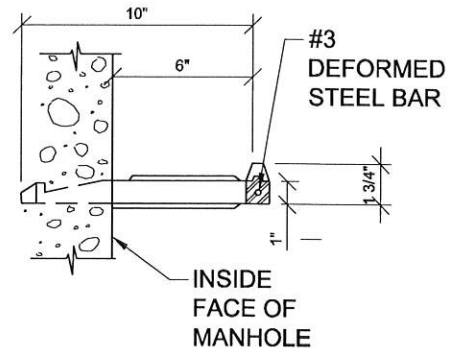
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S-16

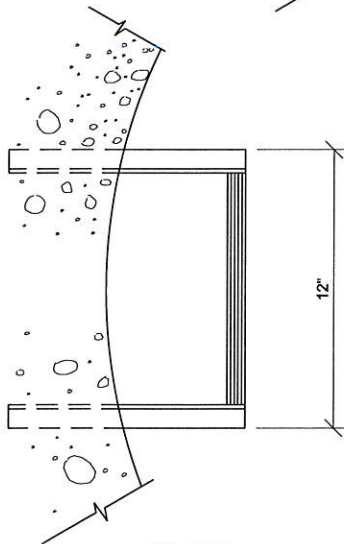


PLAN



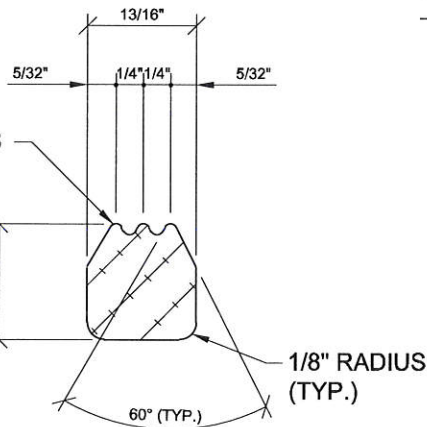
SECTIONAL ELEVATION

REINFORCED PLASTIC

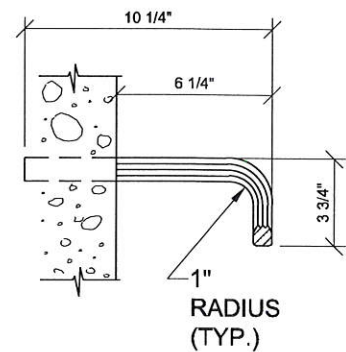


PLAN

3/64" RADIUS (TYP.)



TYPICAL SECTION THRU ALUMINUM MANHOLE STEP



SECTIONAL ELEVATION

NOTE:
PROVIDE A HEAVY COAT OF BITUMINOUS PAINT ON ALUMINUM SURFACES IN CONTACT WITH CONCRETE.

6061-T6 ALUMINUM ALLOY



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2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

**STANDARD DETAIL
MANHOLE STEPS DETAIL**

DATE:

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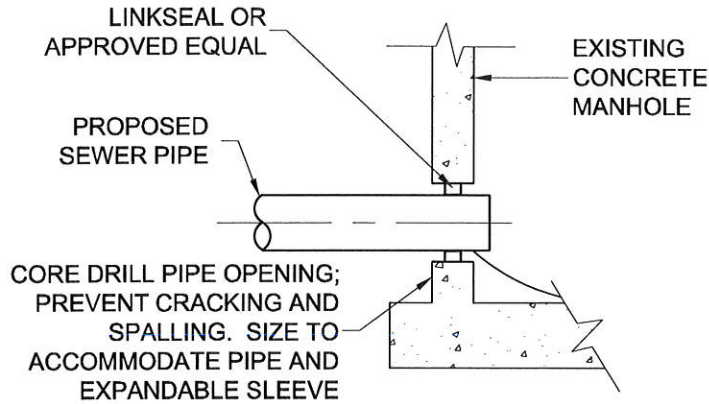
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S-17



NOTES:

1. PROPOSED SEWER PIPE INVERT ELEVATION SHALL BE 0.2' HIGHER THAN EXISTING SEWER INVERT OUT ELEVATION.
2. PROPOSED SEWER PIPE SHALL BE LOCATED A MINIMUM OF 8" ABOVE OR BELOW EXISTING MANHOLE JOINT.
3. AFTER CONNECTION OF PIPE TO MANHOLE, REMOVE CONCRETE CHANNEL AS REQUIRED AND RECONSTRUCT CHANNEL.
4. KEEP GROUNDWATER, SURFACE WATER AND DEBRIS FROM ENTERING EXISTING FACILITIES.
5. MAINTAIN EXISTING FLOW DURING CONSTRUCTION.
6. DROPS OVER 2 FT WILL REQUIRE AN OUTSIDE DROP CONNECTION.
7. SEAL EXTERIOR PIPE PENETRATION WITH NON-SHRINK GROUT.
8. MODULAR SEAL REQUIRES STAINLESS STEEL HARDWARE.



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NEW HANOVER TOWNSHIP AUTHORITY

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STANDARD DETAIL

TIE-IN TO EXISTING MANHOLE DETAIL

DATE:

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S-19

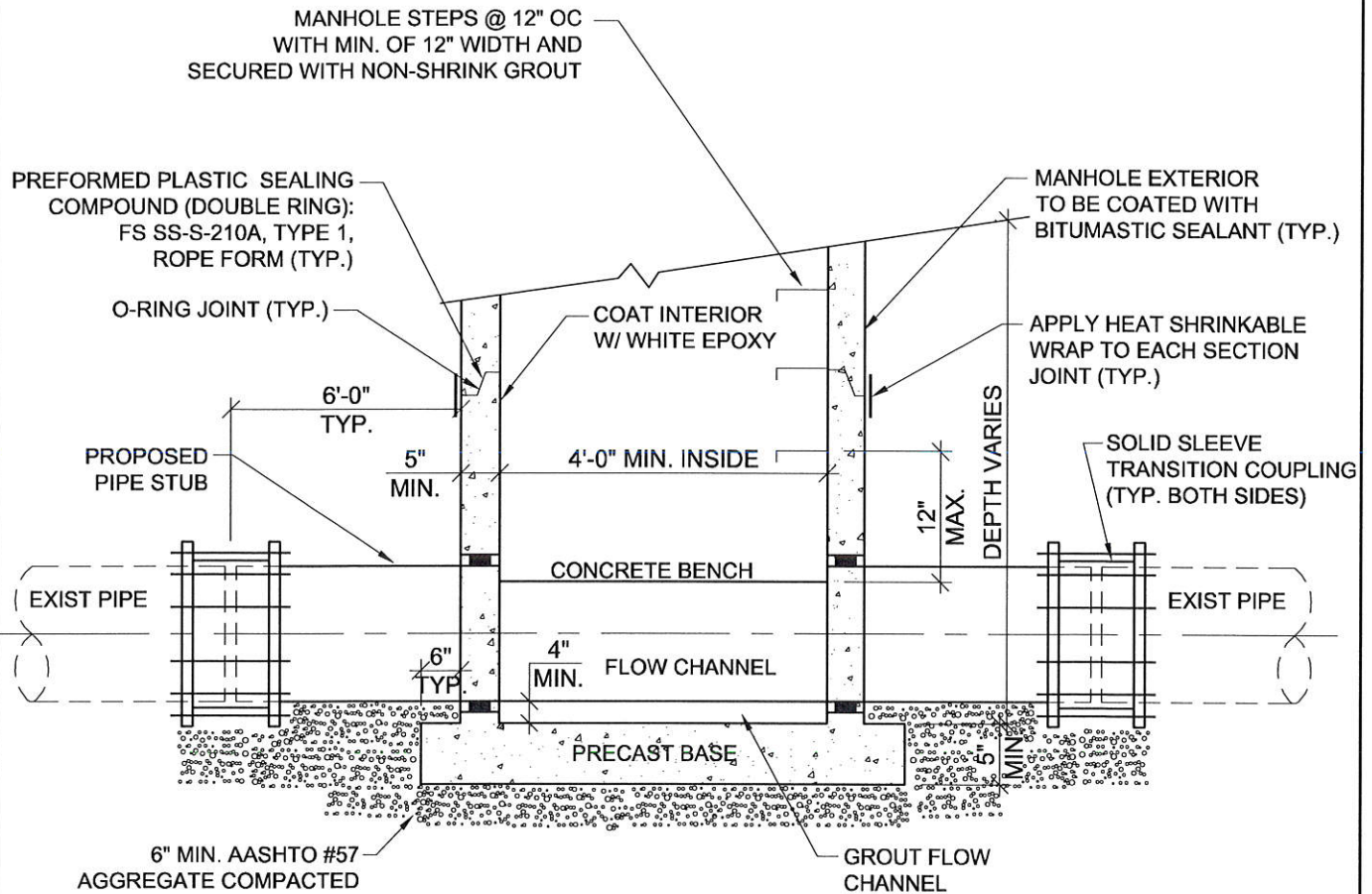
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NOTES:

1. THE BENCH SHALL SLOPE TO INVERT CHANNEL AT THE RATE OF 1" PER FOOT (MIN.)
2. THE DEPTH OF THE INVERT CHANNEL SHALL BE NOT LESS THEN $\frac{3}{4}$ OF THE DIAMETER OF THE PIPE.
3. THE 48"Ø MANHOLE SHALL BE USED ON PIPE SIZES 8" TO 18"
4. FINISH GRADE SHALL BE FLUSH WITH TOP OF COVER, UNLESS OTHERWISE NOTED. MANHOLES INSTALLED OUTSIDE OF PAVED AREAS SHOULD BE RAISED A MINIMUM OF 18" ABOVE GROUND ELEVATION.
5. ALL PIPE TO MANHOLE CONNECTIONS SHALL BE MADE WITH A CAST-IN-PLACE GASKET. (TYP.) (A-LOK OR APPROVED EQUAL)
6. REFER TO APPROPRIATE MANHOLE DETAILS FOR UPPER SECTION REQUIREMENTS.
7. SOLID SLEEVE TRANSITION COUPLINGS SHALL INCLUDE A DUCTILE IRON MECHANICAL JOINT SOLID SLEEVE WITH MEGA-LUG GLANDS AND TRANSITION GASKETS (IF REQUIRED).



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL INSERTION MANHOLE DETAIL

DATE:

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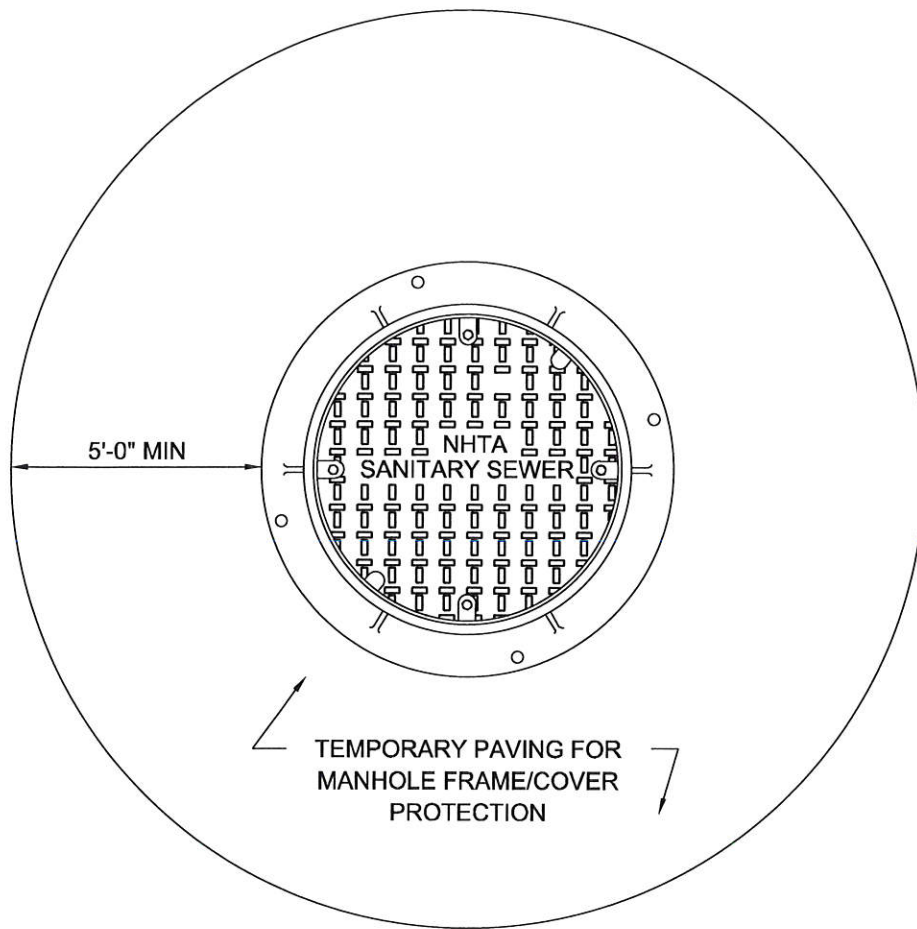
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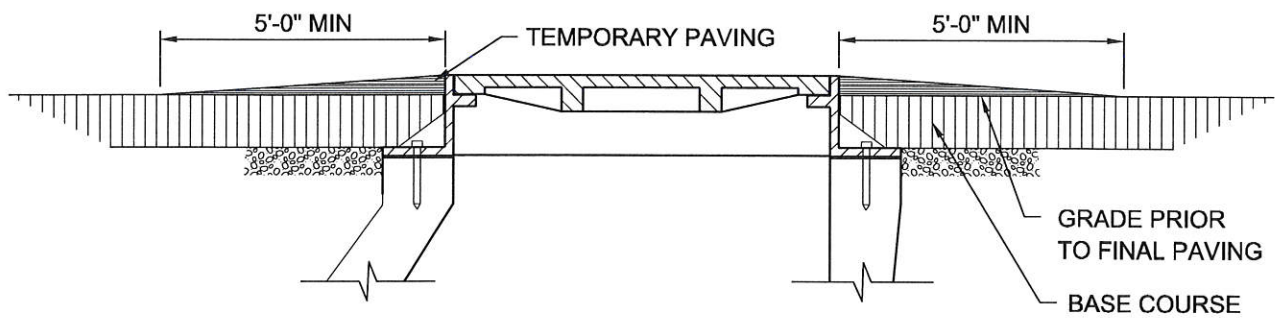
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S-20



TEMPORARY PAVING FOR
MANHOLE FRAME/COVER
PROTECTION

PLAN



SECTION



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STANDARD DETAIL

MANHOLE FRAME / COVER PROTECTION DETAIL - (TEMPORARY PAVING)

DATE:

FEB. 2014

SCALE:

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S-22

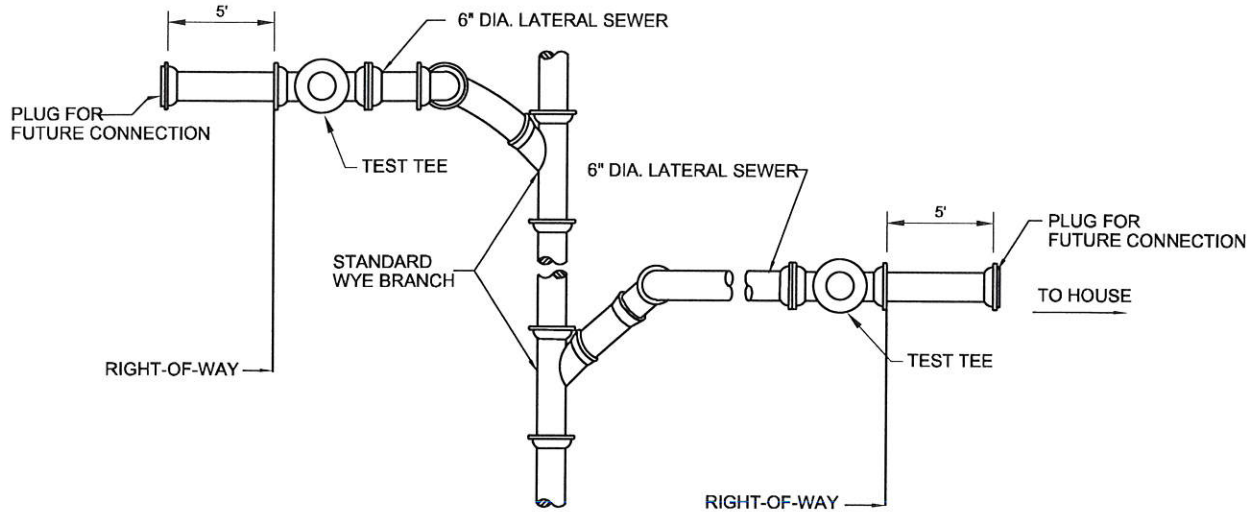
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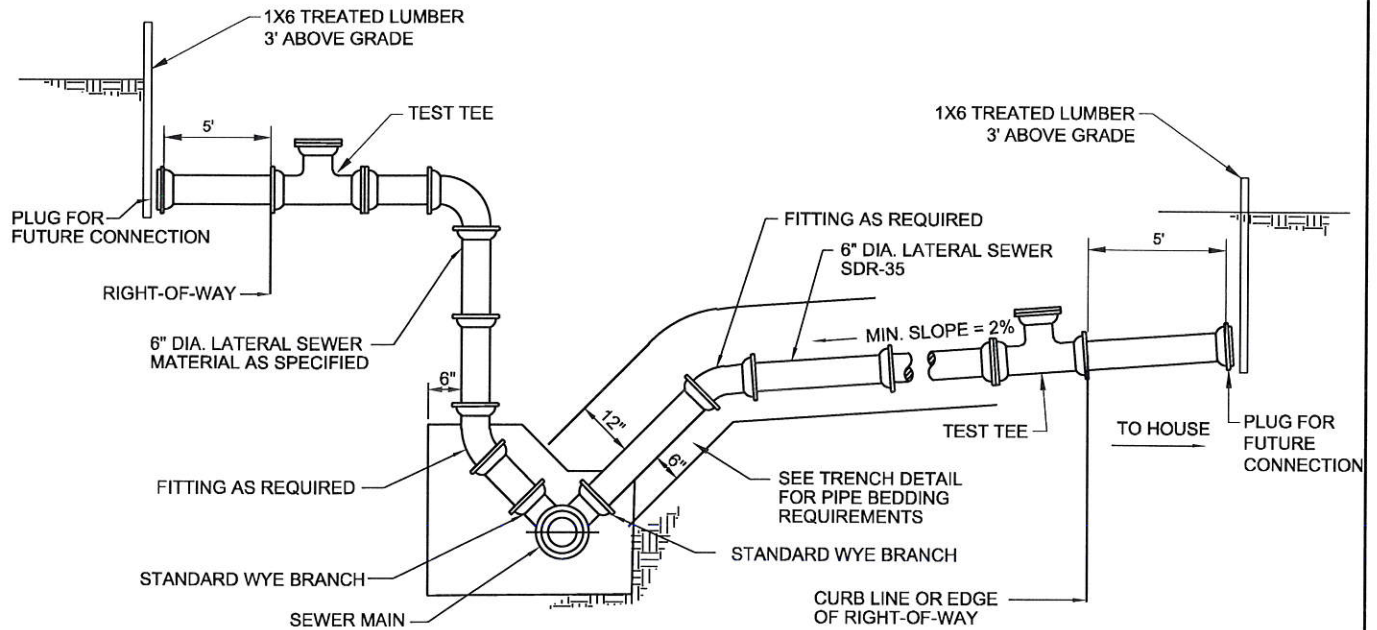
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PLAN



ELEVATION

NOTES:

1. WHERE TEST TEE IS NOT REQUIRED, SERVICE CONNECTION SHALL BE EXTENDED TO THE RIGHT-OF-WAY LINE AND PLUGGED.



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2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

**STANDARD DETAIL
LATERAL DETAIL**

DATE:

FEB. 2014

SCALE:

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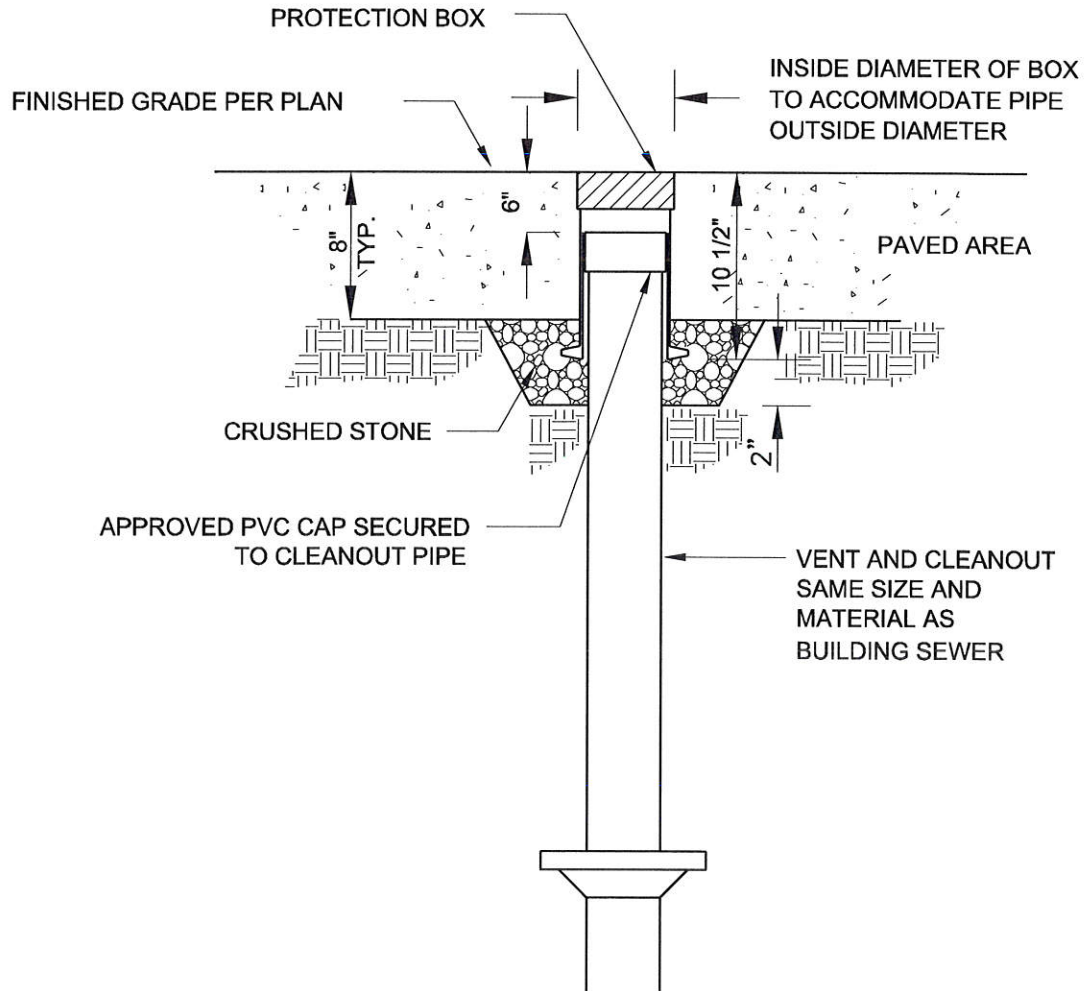
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PROJECT NO.
4602.15

S-23

NOTES:

1. PROTECTION BOX TO BE SET
FLUSH WITH PAVING SURFACE
2. PROTECTION BOX AND COVER TO BE
SUITABLE FOR TRAFFIC LOADING
3. IF PROTECTION BOX IS INSTALLED OVER A VENT, THEN INSERT
DISH WILL BE REQUIRED TO LIMIT INFLOW INTO THE VENT.



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL

TRAP AND VENT PROTECTION BOX DETAIL

DATE:
FEB. 2014

SCALE:
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DRAWING NO.

S-25

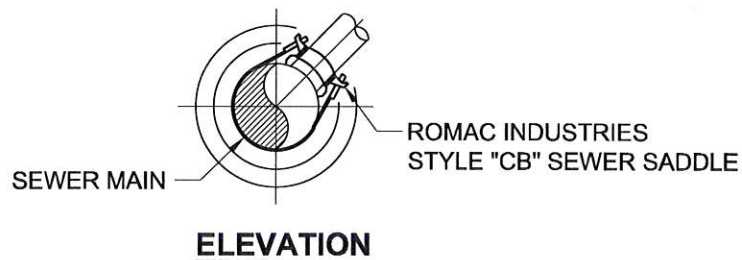
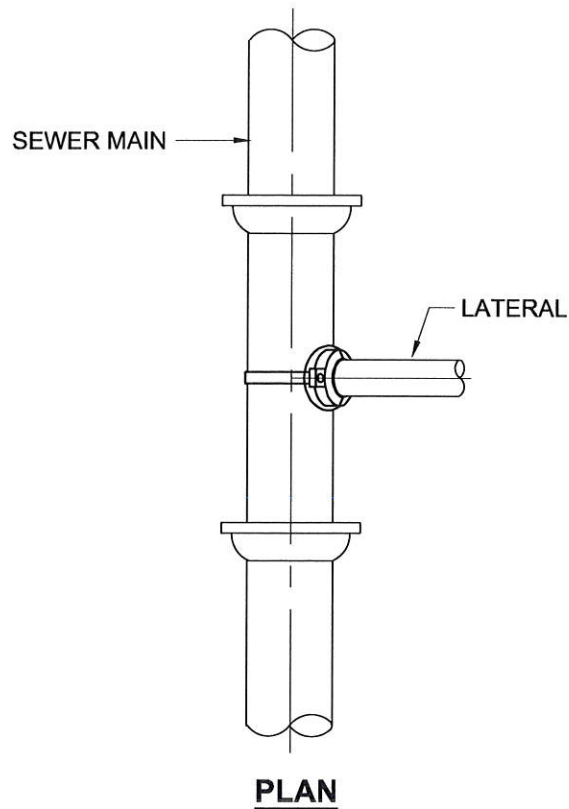
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PROJECT NO.
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NOTE:

STAINLESS STEEL HARDWARE REQUIRED.



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL

BREAK-IN LATERAL CONNECTION DETAIL

DATE:

FEB. 2014

SCALE:

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S-26

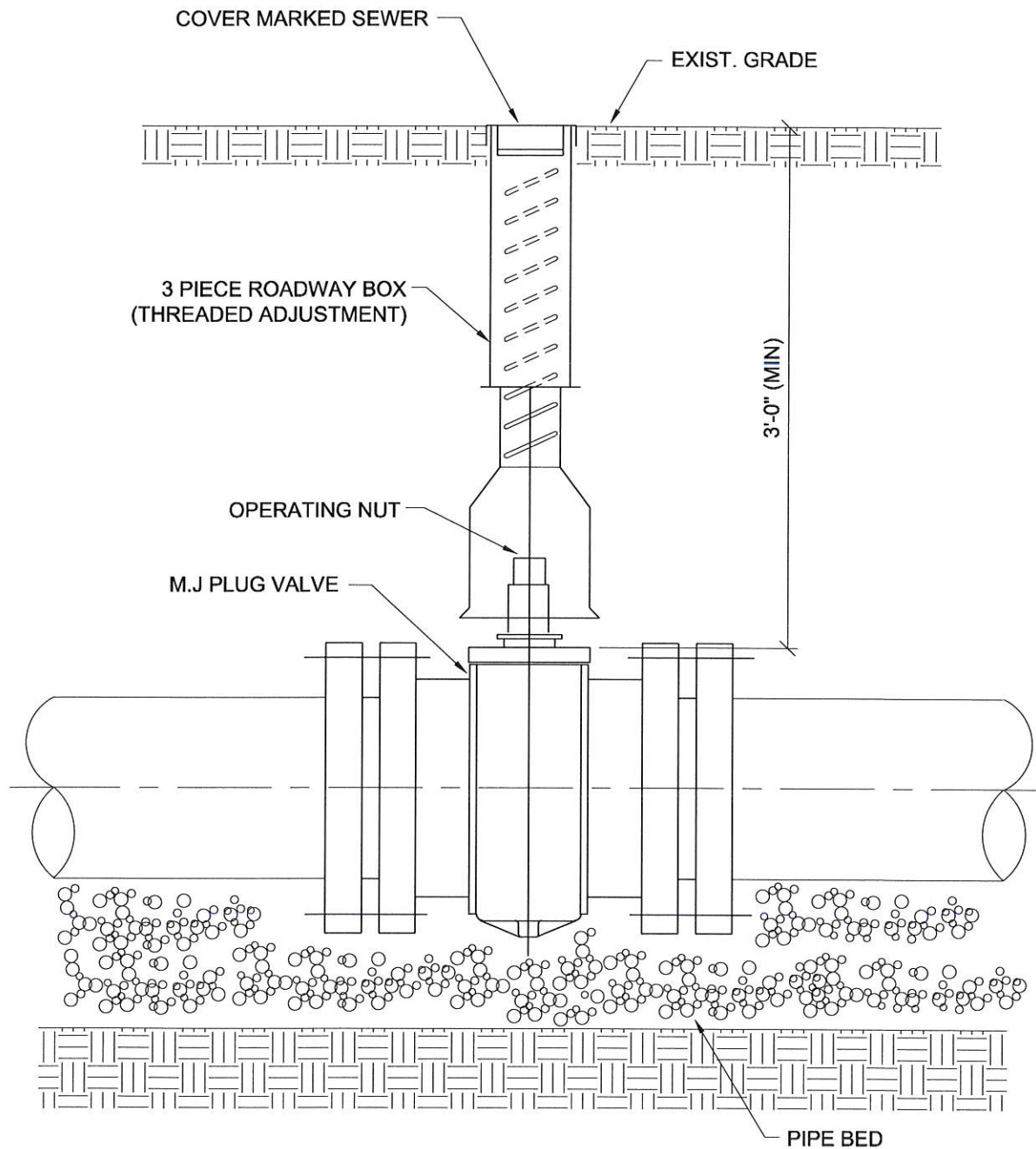
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NEW HANOVER TOWNSHIP AUTHORITY

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STANDARD DETAIL

PLUG VALVE & VALVE BOX INSTALLATION DETAIL

DATE:

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S-27

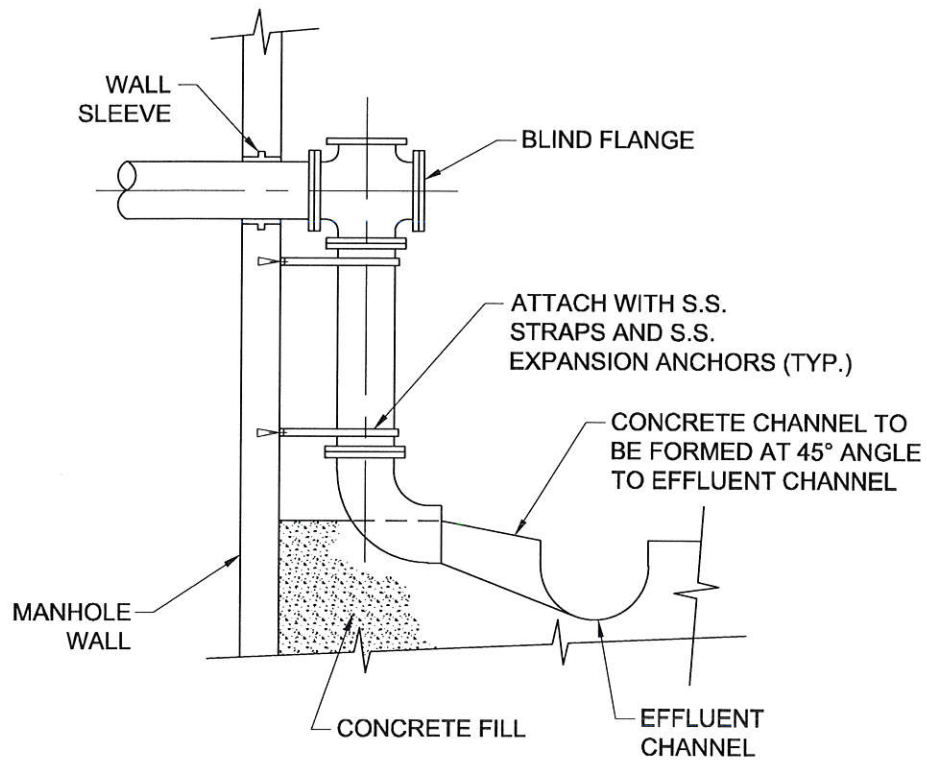
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SECTIONAL VIEW



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NEW HANOVER TOWNSHIP AUTHORITY

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STANDARD DETAIL

LOW PRESSURE DROP CONNECTION DETAIL

DATE:

FEB. 2014

SCALE:

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S-28

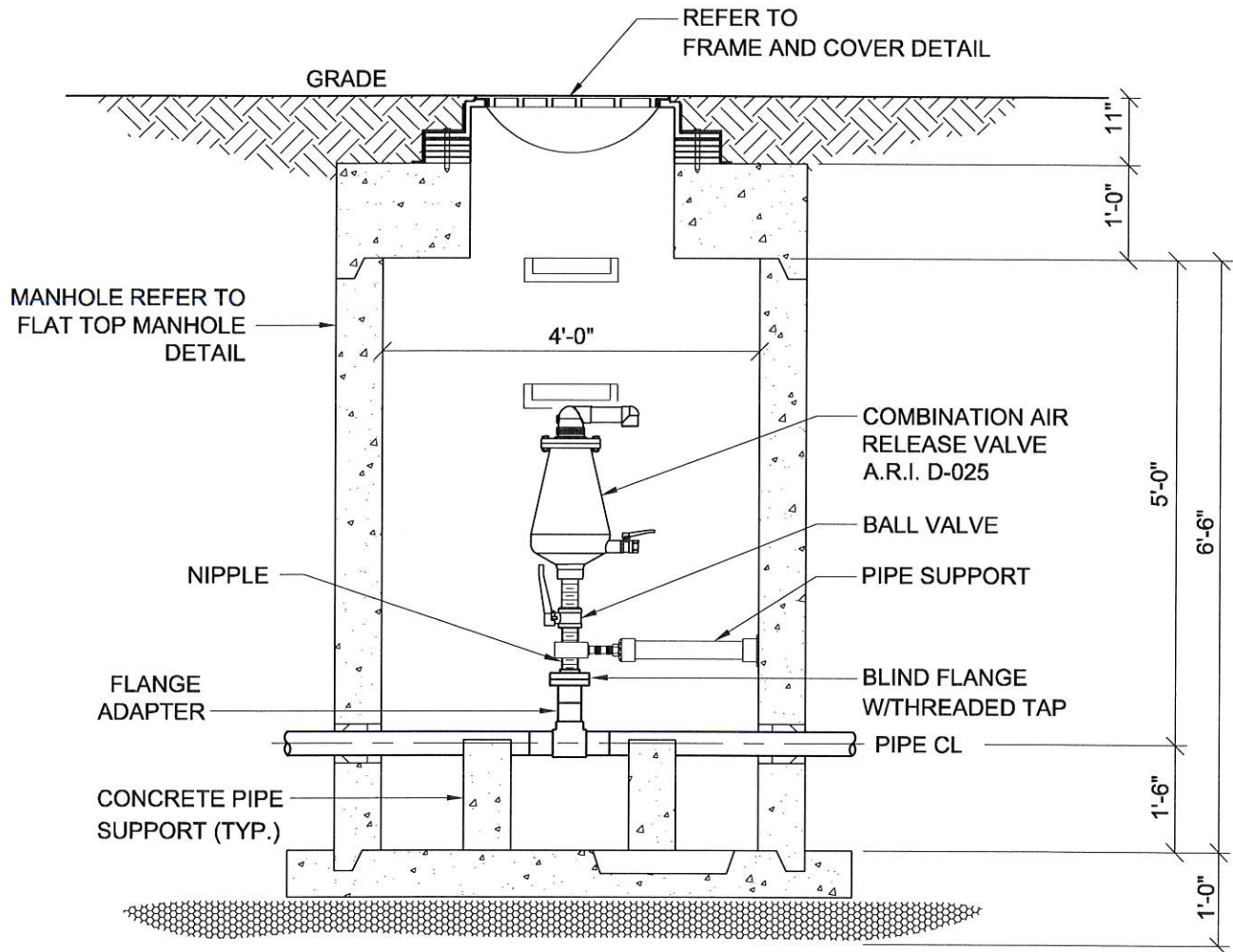
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NOTE:

ALL FITTINGS SHALL BE STAINLESS STEEL.



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

**STANDARD DETAIL
AIR RELEASE VALVE MANHOLE DETAIL**

DATE:

FEB. 2014

SCALE:

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S-29

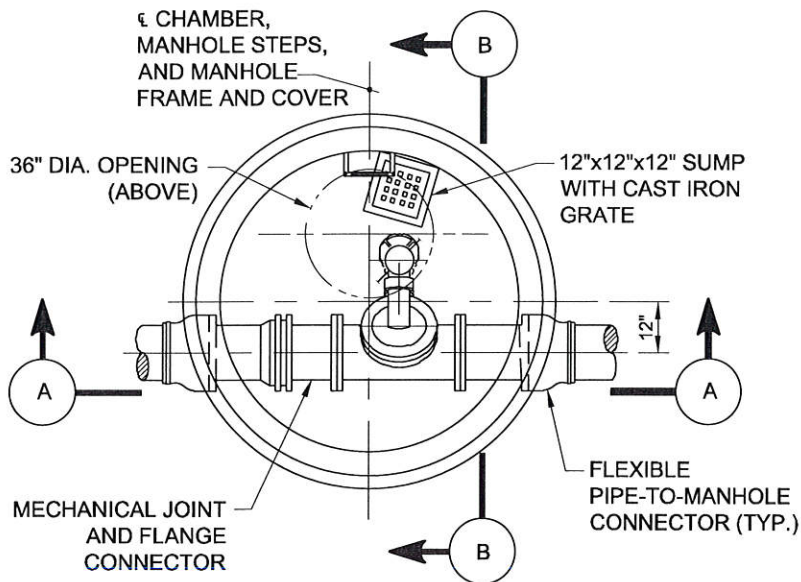
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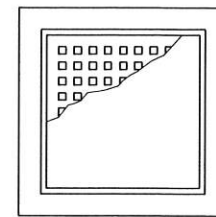
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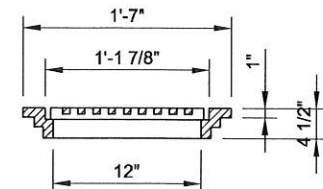
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SECTIONAL PLAN

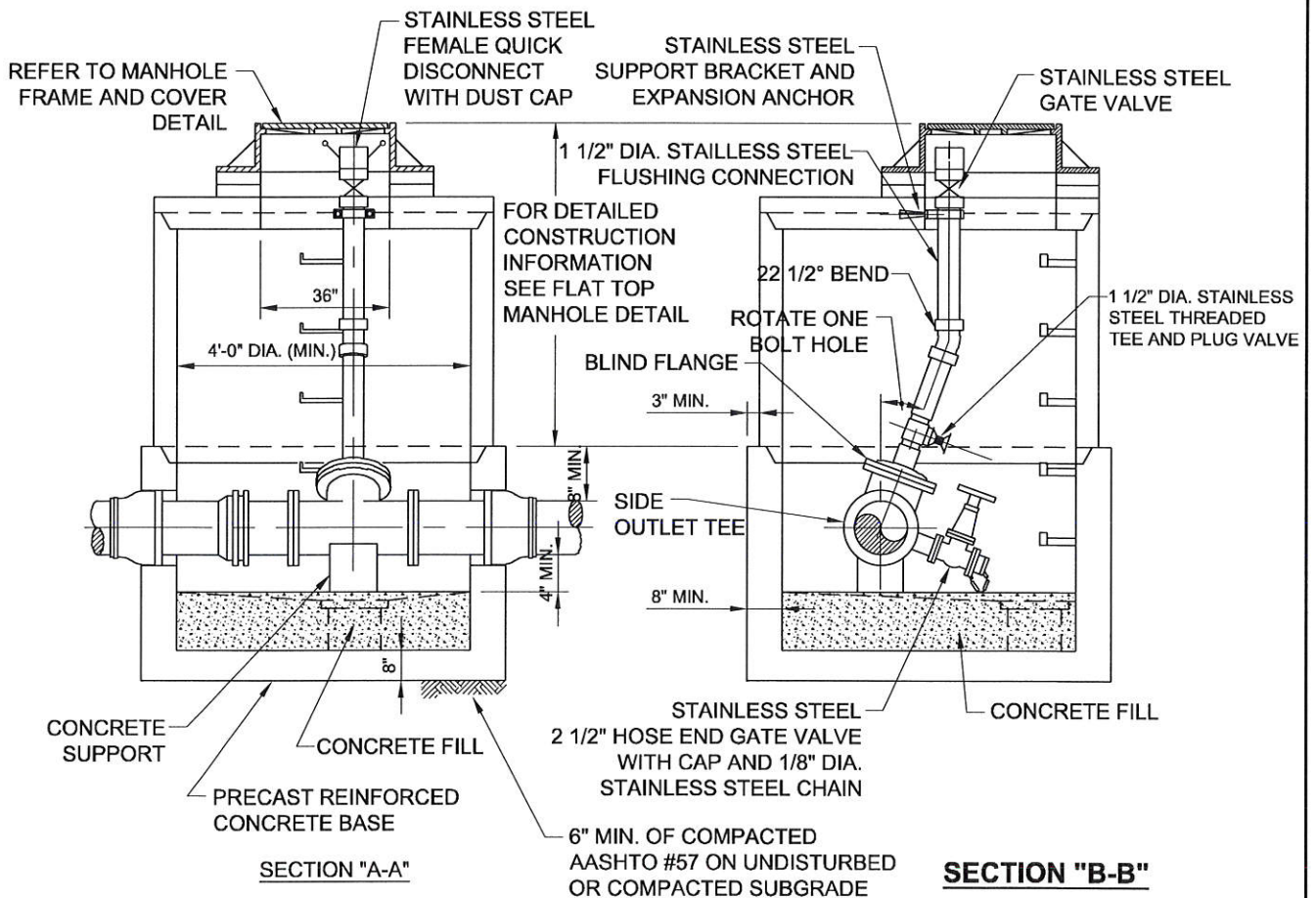


PLAN



SECTIONAL ELEVATION

SUMP FRAME AND GRATE



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2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL

IN-LINE FLUSHING/CLEANOUT CHAMBER DETAIL

DATE: **FEB. 2014**

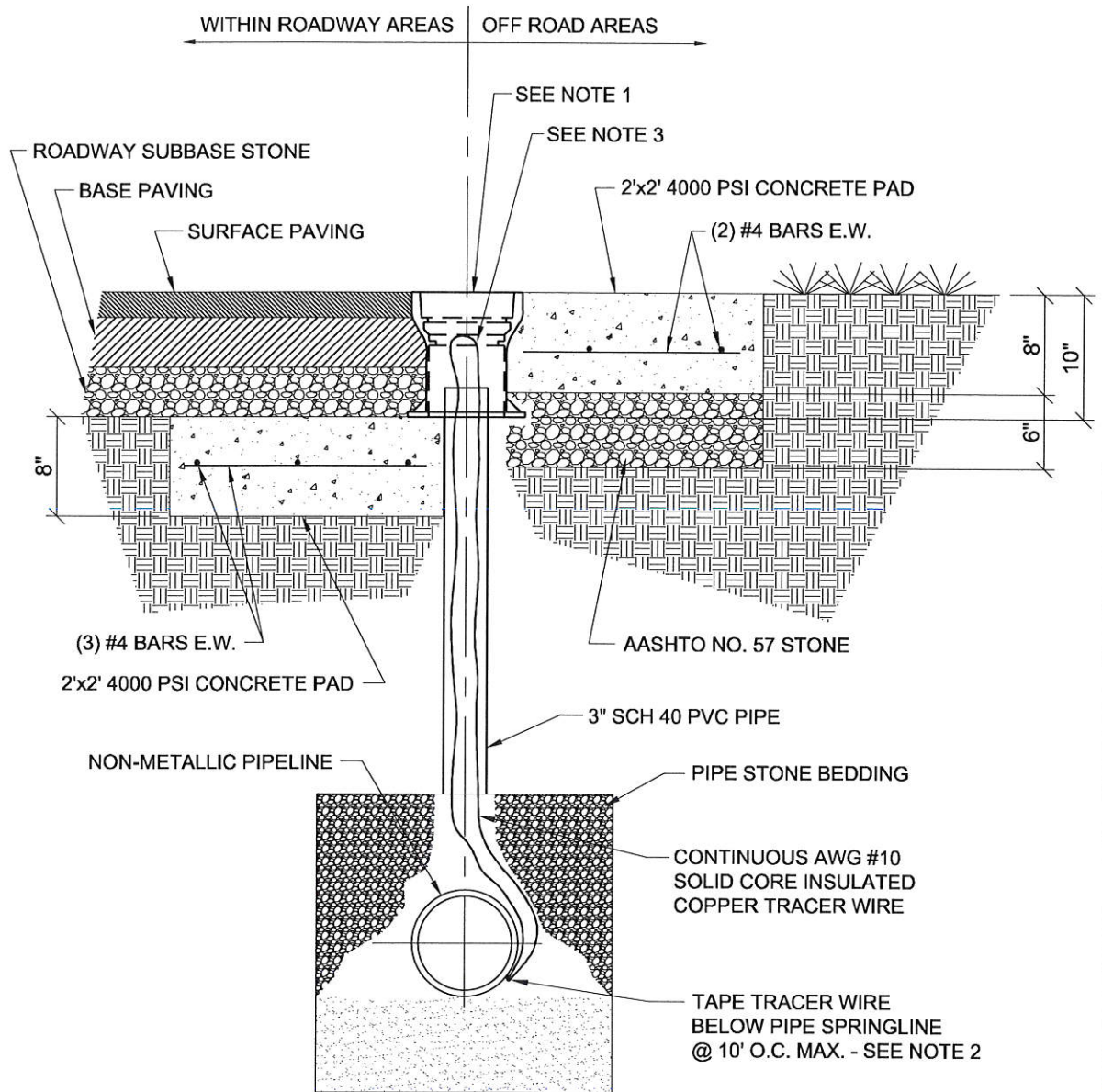
SCALE: **N.T.S.**

DRAWING NO.

REV. / DATE

PROJECT NO. **4602.15**

S-30



NOTES:

1. C.I. BOX TOP SECTION SHALL BE A SLIP MODEL WITH A 5 1/4" DROP LID MARKED "SEWER".
2. DO NOT SPLICE TRACER WIRE UNDERGROUND.
3. PROVIDE 3 FEET OF LOOPED WIRE WITHIN TEST STATION BOX.
4. SPACE TEST STATIONS 500 FEET MAX. AND AT ALL CHANGES IN FORCE MAIN OR LOW PRESSURE MAIN DIRECTION.
5. PROVIDE METALLIC CAUTION TAPE CENTERED ON FORCE MAIN 12" BELOW FINISHED GRADE.



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

**STANDARD DETAIL
TRACER WIRE TEST STATION DETAIL**

DATE:

FEB. 2014

SCALE:

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DRAWING NO.

PREPARED BY
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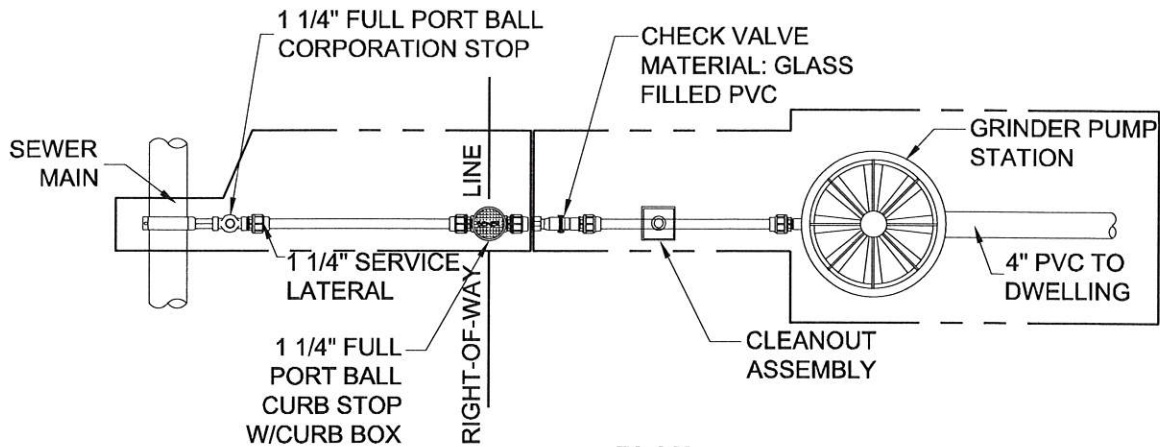
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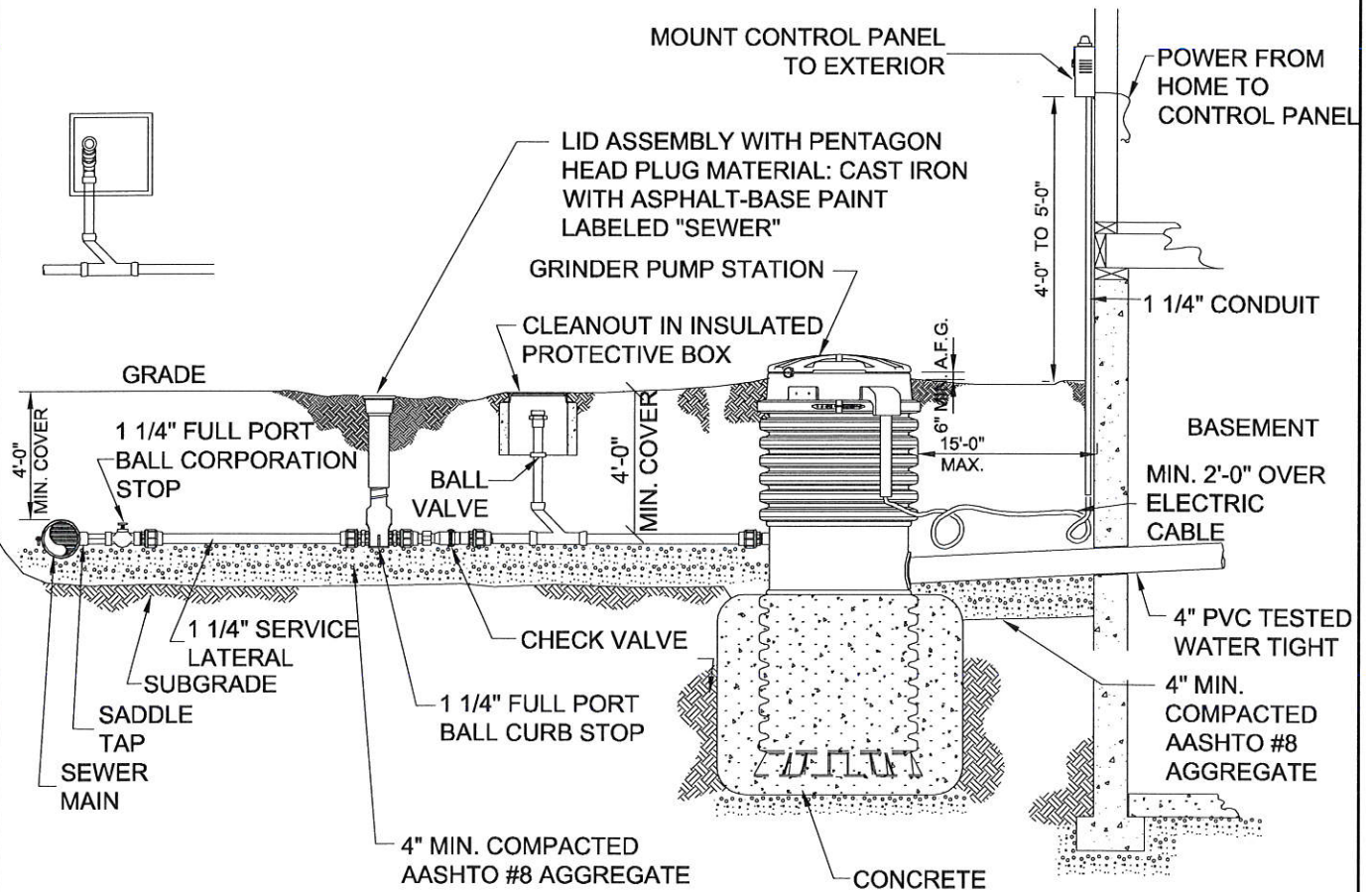
REV. / DATE
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PLAN



ELEVATION

NOTES:

1. IF GRINDER PUMP IS INSTALLED INDOORS, IT WILL NEED PRE-APPROVAL FROM NHTA.



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STANDARD DETAIL

TYPICAL GRINDER PUMP INSTALLATION DETAIL

DATE:

FEB. 2014

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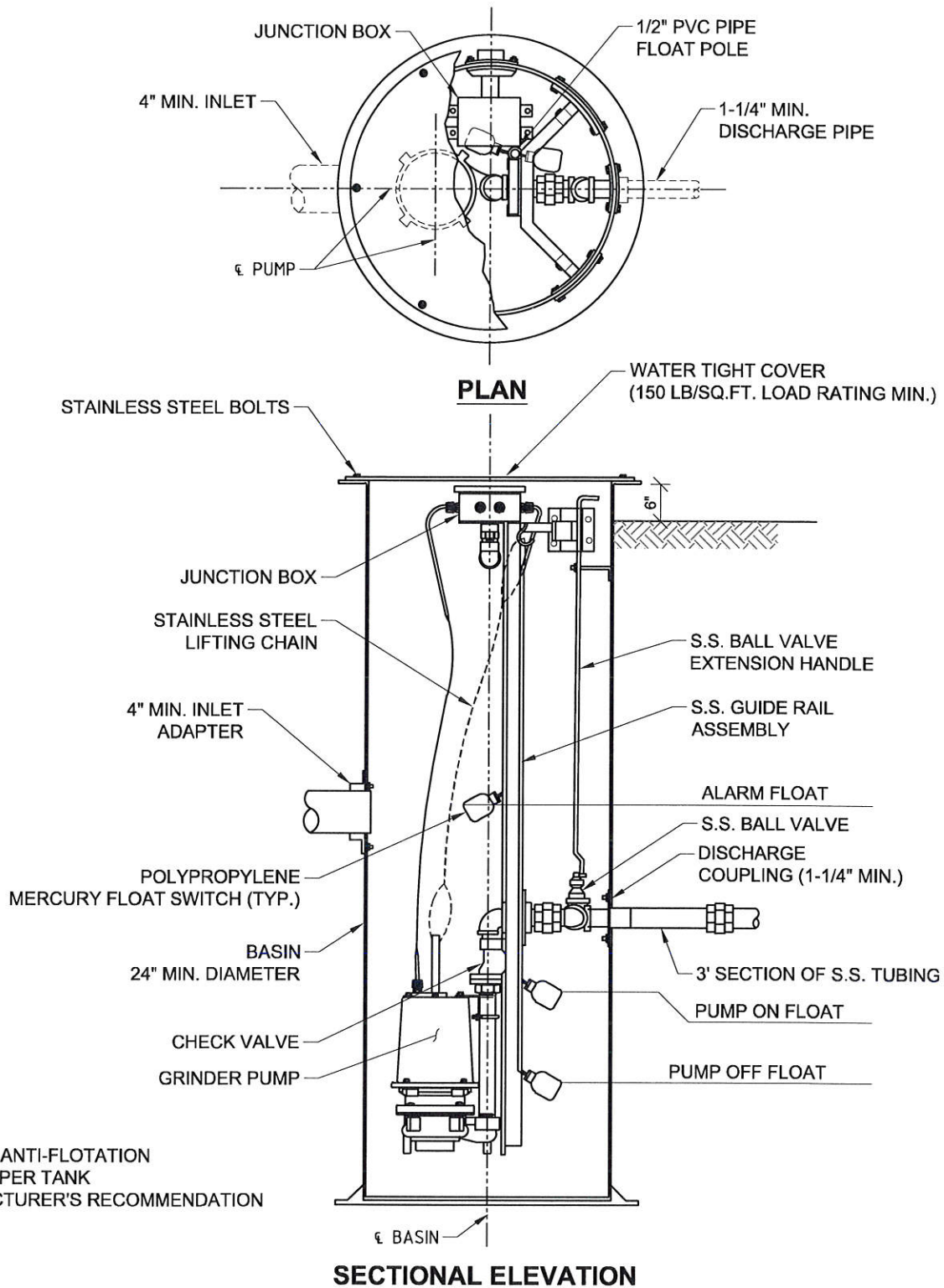
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2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL

SIMPLEX GRINDER PUMP STATION DETAIL

DATE:

FEB. 2014

SCALE:

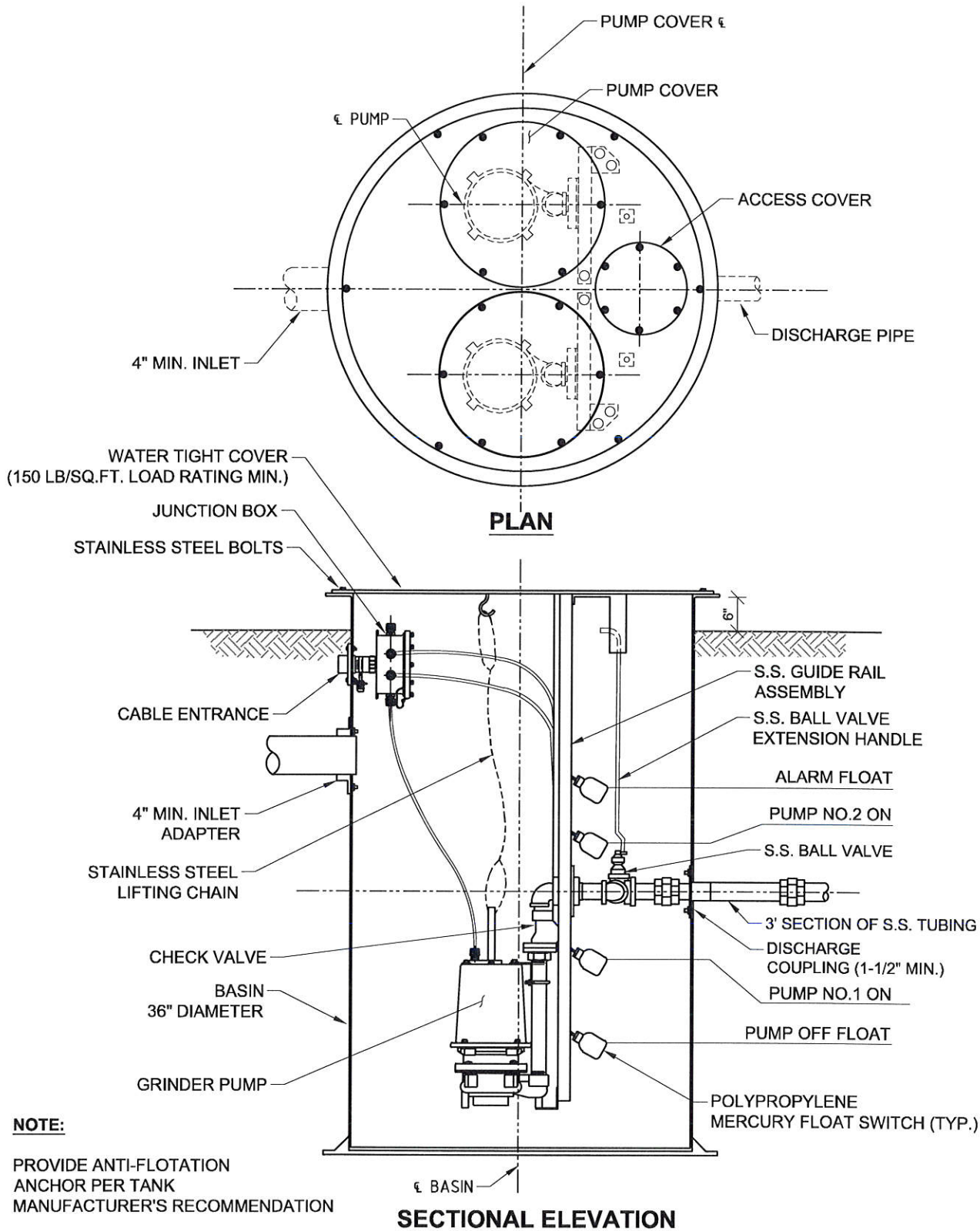
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PREPARED BY **ZM** CHECKED BY **JDB** APPROVED BY **CMH**

NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL

DUPLEX GRINDER PUMP STATION DETAIL

DATE:
FEB. 2014

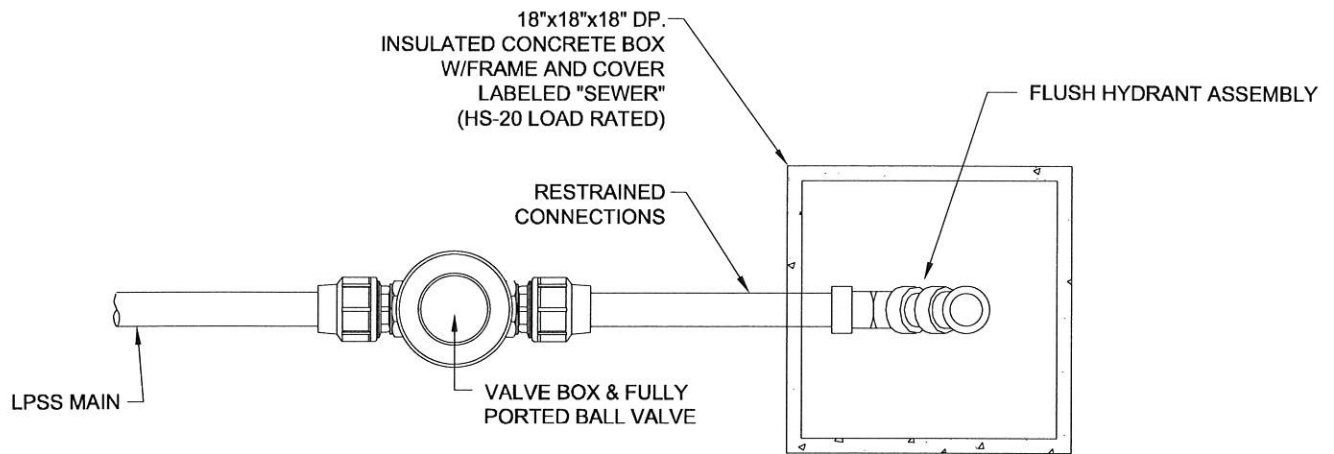
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DRAWING NO.

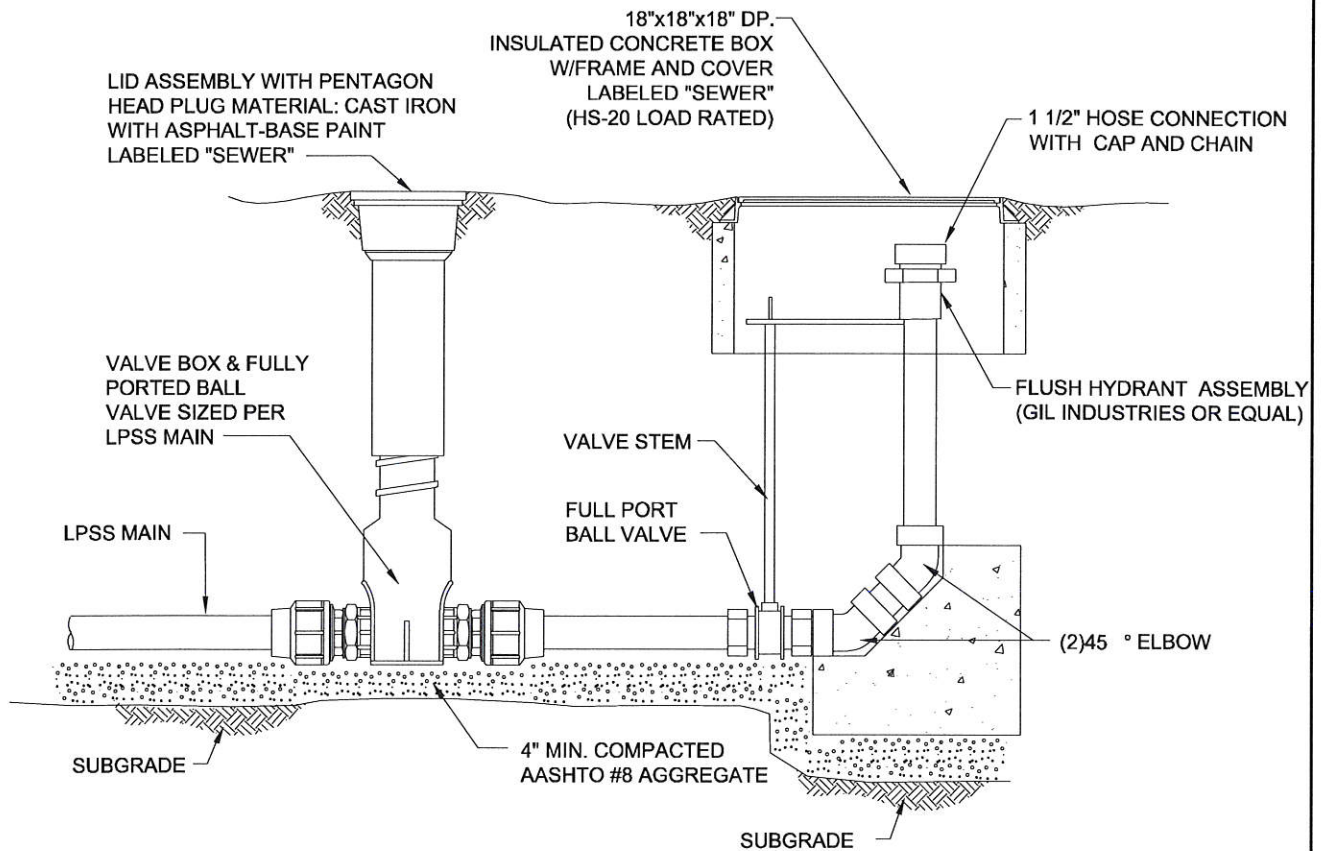
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PLAN VIEW



SECTION VIEW



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL

TERMINAL CLEANOUT ASSEMBLY DETAIL

DATE:

FEB. 2014

SCALE:

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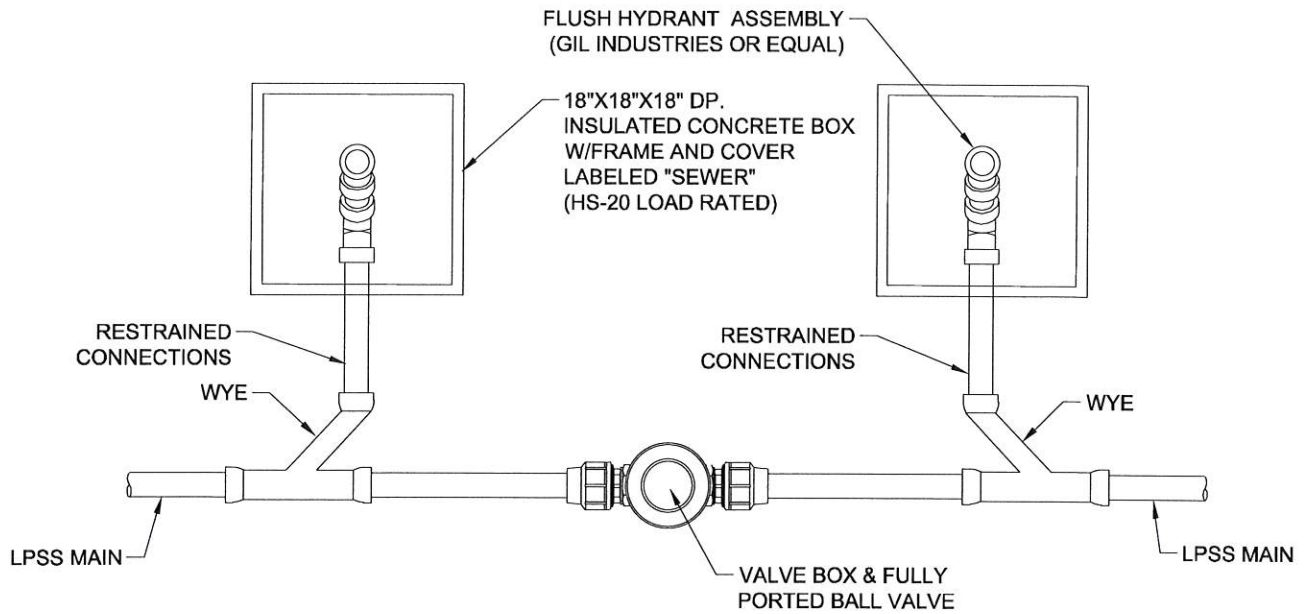
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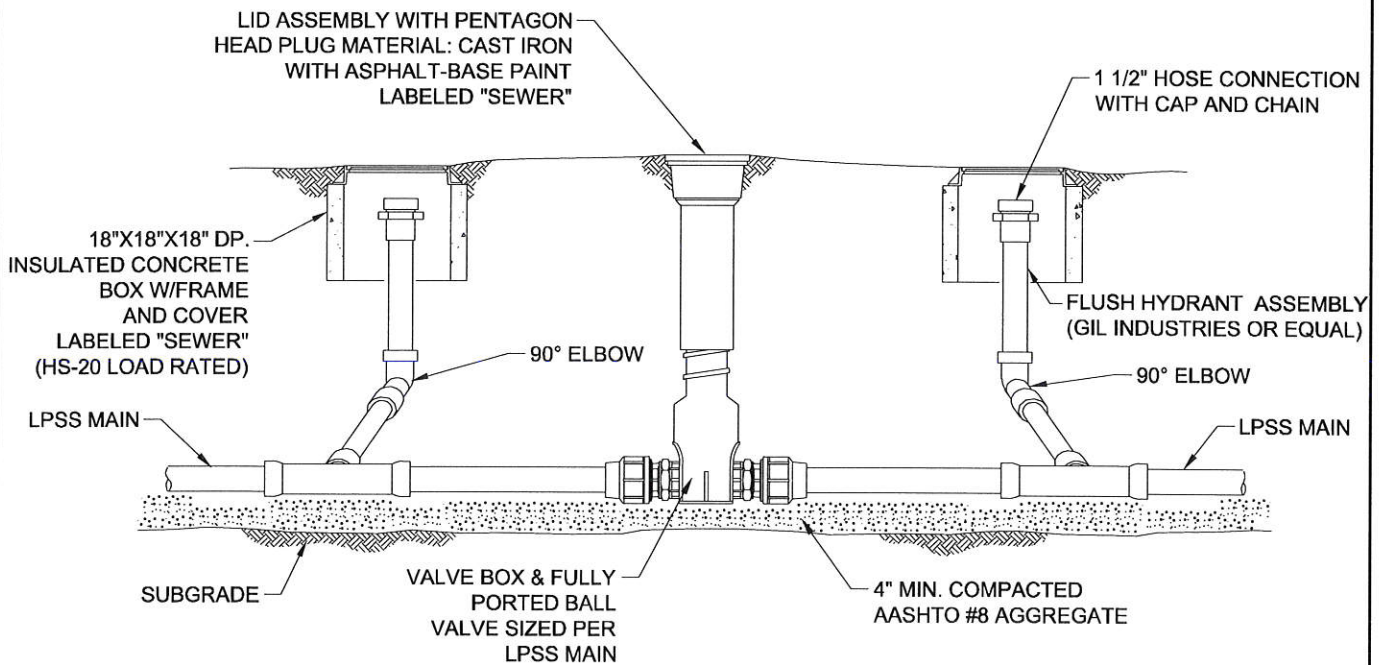
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PLAN VIEW



SECTION VIEW



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL INTERMEDIATE CLEANOUT ASSEMBLY DETAIL

DATE:

FEB. 2014

SCALE:

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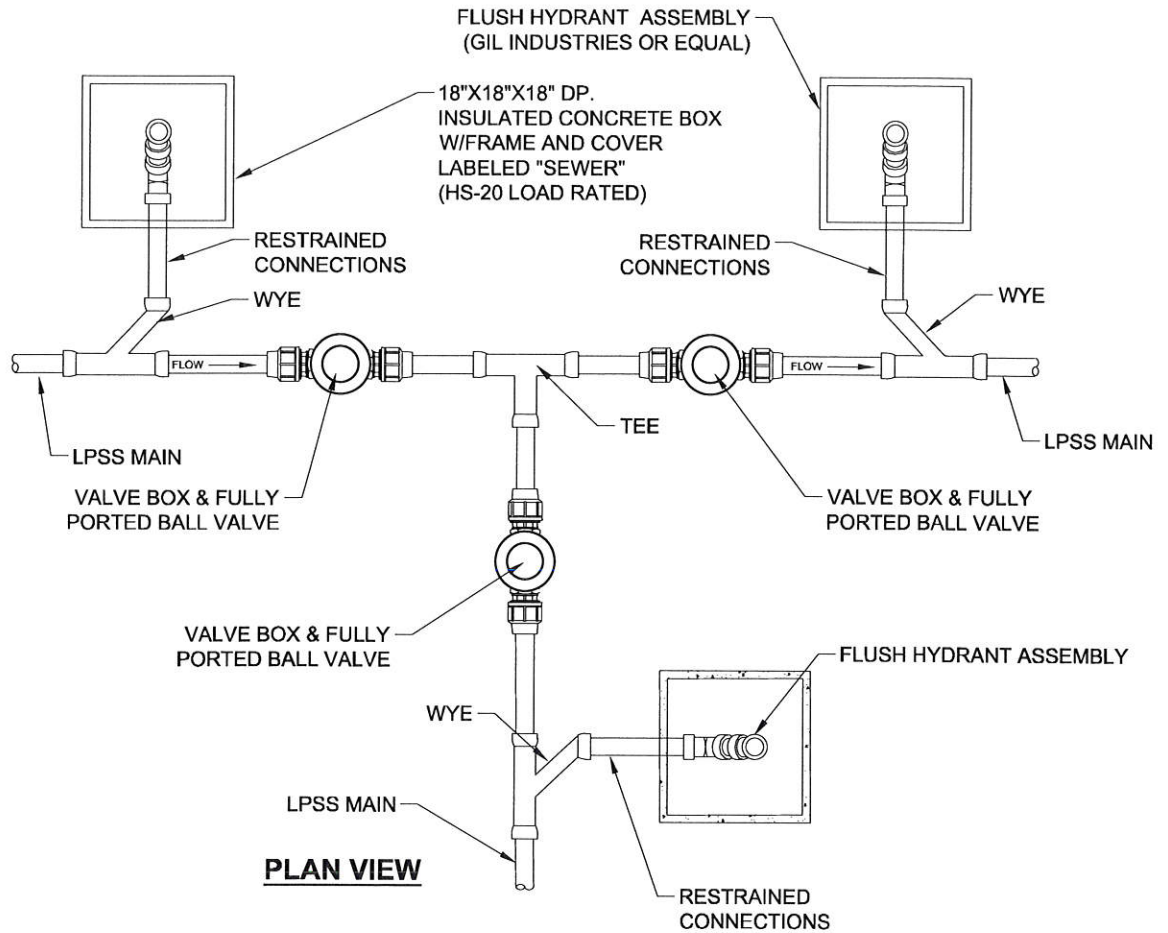
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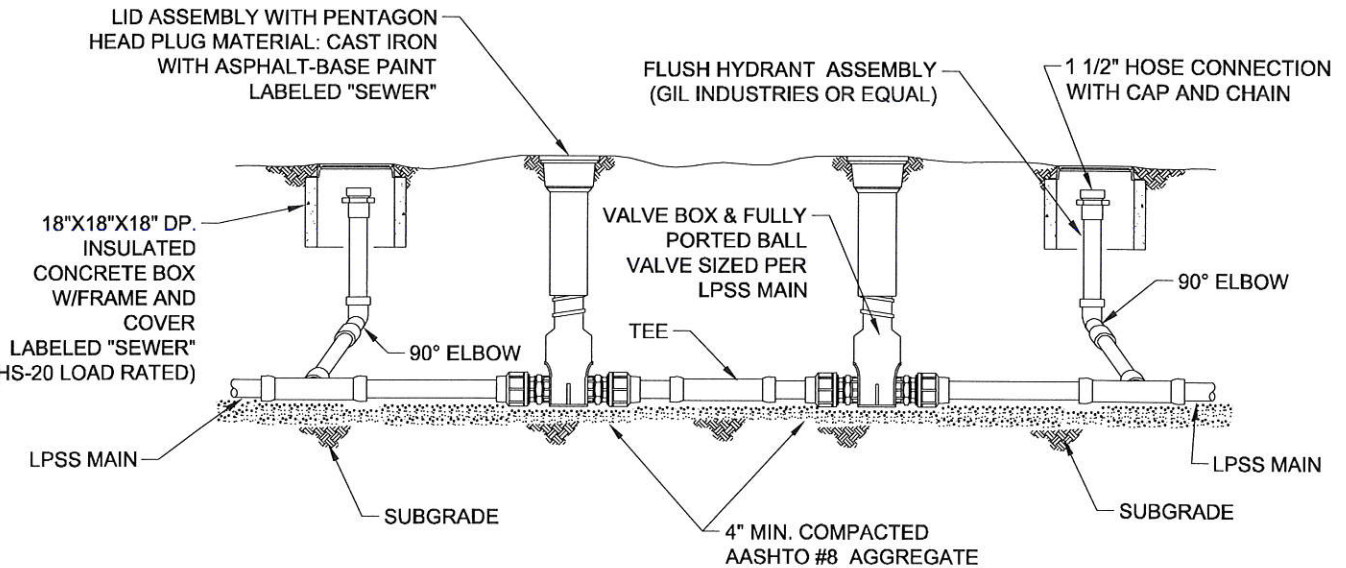
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PLAN VIEW



SECTION VIEW



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NEW HANOVER TOWNSHIP AUTHORITY

2990 FAGLEYSVILLE RD. GILBERTSVILLE, PA 19525

STANDARD DETAIL

3 WAY BRANCH CLEANOUT ASSEMBLY DETAIL

DATE:

FEB. 2014

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S-37