TECHNICAL SPECIFICATIONS
FOR CONSTRUCTION OF SEWER MAINS
AND APPURTENANCES TO BE CONNECTED
TO THE PUBLIC SEWER SYSTEM

UPPER UWCHLAN TOWNSHIP
MUNICIPAL AUTHORITY

December 1999
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(Revised May 2005)
(Revised June 2005)
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(Revised February 2021)
(Revised May 2021)

ARRO Project No. 17000.00

Based upon field conditions there may be exceptions to the specifications. The requirements can be modified on a case-by-case basis with the approval of Upper Uwchlan Township Municipal Authority and its representatives.

Upper Uwchlan Township Municipal Authority
140 Pottstown Pike
Chester Springs, Pennsylvania 19425

Technical Specifications for Construction of
Sewer Mains and Appurtenances to be Connected to the Public Sewer System
Upper Uwchlan Township Municipal Authority

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SECTION 1 – GENERAL CONDITIONS

1.1 Scope

A. These Technical Specifications cover the requirements for extensions of and connections to the Authority Public Sewer System. All extensions and connections shall be completed in accordance with the Rules and Regulations of the Authority and these Technical Specifications. The work shall include furnishing of all plans, labor, new materials, equipment, supplies, transportation, fuel, and power, and performing all work as required by the Rules and Regulations and Technical Specifications, including such detail drawings as may be required to prosecute the work. The work shall be executed in the best and most workmanlike manner by qualified, careful, and experienced workmen.

B. The Authority reserves the right to establish special supplemental requirements for any given extension or connection based upon unique features of the specific project, recent changes in standard operating and construction practices which may not be reflected within the Rules and Regulations and the Technical Specifications, or for any other legal or administrative reasons which the Authority may identify.

C. The Developer is the party who is ultimately accountable to the Authority for all work and responsible for all work regardless if the work is performed by the Developer's Consultant or Contractor. This condition is implied throughout these Technical Specifications.

D. The Developer, Consultant, and Contractor shall obtain a copy of these Technical Specifications from the Authority and comply with these documents.

1.2 Definitions

A. The following definitions shall be applicable in these Technical Specifications:

1. *Authority:* Upper Uwchlan Township Municipal Authority.

2. *Building*: A building is a structure built, erected, and framed of component structural parts designed for the housing, shelter, enclosure, or support of persons, animals, or property of any kind.

3. *Building Sewer*: That part of a sewer system extending from a structure to the sewer lateral. The term may also be referred to as "service line."

4. *Cellar Drain*: A protected and trapped drain for the purpose of conveying spent waters from the basement of a dwelling, factory, laboratory, workshop, or other

Building, but excluding any drainage resulting from rain water, springs, wells, or other ground or surface water or building leakage.

5. *Construction Details*: Those details that have been prepared by the Engineer and approved by the Authority, and are included in these Technical Specifications to show general and typical construction requirements. The term may also be referred to as "Standard Details."

6. *Consultant*: Any individual, partnership, or corporation providing consulting services to the Developer.

7. *Contractor*: Any individual, partnership, or corporation performing sewer construction work for the Developer.

8. *Developer*: Any equitable owner, landowner, agent of such landowner, or tenant with the permission of such landowner, who makes or who causes to make a subdivision of land and/or a land development, or who constructs or causes to be constructed a sanitary sewer extension or sanitary sewerage facilities.

9. *Developer's Construction Drawings*: Those drawings prepared by the Developer or his consultant and approved by the Authority to show the detailed design of the specific project including plan layout and design details.

10. *Engineer*: The appointed Engineer that represents the Authority. The term may also include a construction observer employed by the Engineer.

11. *Extender*: Shall mean the Developer and/or the Contractor.

12. *Lateral*: That part of the sewer system extending from a sewer main, located in the street right-of-way or off-street easement, to the structure-side of the building sewer serving an improved property. If there are to be no improvements on the property, the "lateral" shall mean that part of the sewer system extending from said sewer main to the right-of-way or easement line for future connection to the building sewer, if and when said property is improved.

13. *Natural Outlet*: Any outlet into a watercourse, ditch, pond, lake or other body of surface or groundwater.

14. *Or Equal*: Equality of equipment or products versus those specified, as determined by and at the sole discretion of the Engineer. The term may also be referred to as "or approved equal."

15. *Professional Engineer*: An individual licensed and registered under the laws of the Commonwealth of Pennsylvania to engage in the practice of engineering.

16. *Professional Land Surveyor*: An individual licensed and registered under the laws of the Commonwealth of Pennsylvania to engage in the practice of surveying.

17. *Service Line*: Shall mean any pipe extended from the lateral sewer to the building.

18. *Subdivision*: The division or redivision of a lot, tract, or parcel of land by any means into two or more lots, tracts, parcels, or other divisions of land.

19. *Vent Pipe*: Shall mean any pipe extended vertically from a sewer to provide ventilation for the building sewer or lateral.

20. *Work*: Labor, services, materials, and equipment as required for the successful completion of the project.

1.3 Fittings and Coordination of Work

The Developer shall be responsible for the proper fitting of all work and for the coordination of the operations of all trades, subcontractors, or material men engaged upon this project. The Developer shall be prepared to guarantee to each of his subcontractors the locations and measurements, which may be required for the fitting of their work to all surrounding work.

1.4 Superintendence by Contractor

At all times during which work is being performed under or affecting this project, the Contractor shall keep a competent superintendent acceptable to the Authority constantly on the site from the commencement of work until the completion thereof, who shall be constantly in touch with work and in all interlocking contracts affected thereby. The superintendent shall, in the absence of the Contractor, see that the instructions of the Engineer are carried out and all directions given such superintendent shall be as binding as if given to the Contractor.

The Developer shall have available at all times, including non-working hours, weekends, and holidays, an emergency maintenance crew and a person of authority and responsibility to act in cases of emergency, such as flooding, cave-ins, or other unsafe conditions, resulting from construction activities. The Developer shall submit to the Authority all the names, addresses, and telephone numbers of the emergency crew supervisor(s) prior to beginning construction operations. The Developer shall be responsible for costs resulting from such emergency work.

The Developer is responsible for all costs incurred for any emergency work performed by the Authority or others on the Developer's behalf.

1.5 Permits, Licenses, and Taxes

The Developer shall give all notice required by and comply with all applicable laws, ordinances, and codes of Upper Uwchlan Township. All construction work and/or utility installations shall comply with all applicable ordinances and codes including all written waivers. Before installing any work, the Developer shall examine the Technical Specifications for compliance with applicable ordinances and codes and shall immediately report any discrepancy to the Authority. Where the requirements of the Technical Specifications fail to comply with such applicable ordinances or codes, the Authority may adjust the Technical Specifications to conform to such ordinances or codes (unless waivers in writing covering the difference have been granted by the governing body or department).

Should the Developer fail to observe the foregoing provisions and proceed with the construction and/or install any sewage facility varying with any applicable ordinance or code, including any written waivers (notwithstanding the fact that such installation is in compliance with the Technical Specifications), the Developer shall remove such work without cost to the Authority.

The Developer shall, at his own expense, secure and pay to the appropriate regulatory agencies the fees or charges for all permits required by the regulatory agencies.

Permits for the opening and/or occupation of Township or State roads shall be obtained by the Developer. All inspection fees and/or any charges shall be borne by the Developer, whether same is billed directly to him or to the Authority.

Whenever the proposed construction requires a sales, consumers use, or other similar tax, the Developer shall pay for the same.

No Authority permit will be waived for the Developer.

1.6 Protection of Work and Property

The Developer shall provide adequate protection against injury or loss arising in connection with the project for all his work and the property of the Authority. The Developer shall make good any such damage, injury or loss. The Developer shall adequately protect adjacent property as provided by law. The Developer shall provide facilities for protection required by public authority or local conditions as passageways, guard fences, lights, etc.

The Developer shall preserve and protect all trees, shrubs, and grass on or adjacent to the site which do not reasonably interfere with the construction as may be determined by the Authority or Engineer, and the Developer shall be responsible for all unauthorized cutting or damaging to trees and shrubs, including damage due to careless operation of equipment, stockpiling of materials or tracking of grass areas by equipment. The Developer shall remove only those trees designated by the Engineer to be removed.

1.7 Temporary Provision for Public Travel

The Developer shall perform his work in such a manner as to interfere as little as possible with the use of intersecting roads or adjoining property. No excavation shall be left open or other obstruction allowed to remain longer than is absolutely necessary; and the Developer shall provide all safeguards and temporary passageways that may be necessary for the convenience and protection of all persons using said property either day or night.

It shall be the duty of the Contractor, at all times, to maintain crossings, walks, sidewalks, and streets open to traffic and in a satisfactory condition, and to keep all fire hydrants, valves, fire alarm boxes, and letter boxes accessible for use, whenever it is necessary to maintain pedestrian traffic over open trenches, a timber bridge at least three feet in width and equipped with side railings shall be provided. When the excavated material will encroach upon sidewalks or private property, planking shall be placed in order to keep the sidewalk or private property clear of excavated material.

Maintenance and protection of traffic on Township Streets and State Highways shall be in strict accordance with PennDOT 408 Specifications, Section 900; Pennsylvania Title 67, Chapter 212, Publications 212 and 213. The Contractor shall modify the sign locations daily in order to protect that section of street to be disturbed during that same day.

No road shall be blocked for traffic for longer than one (1) hour in any direction unless approved in writing by the Township Supervisors or PennDOT. There shall be no lane restrictions in Township Streets or State Highways between the hours of 6:00 am and 9:00 am, and between the hours of 3:00 pm and 6:00 pm.

1.8 Shop Drawings, Product Data, and Samples

A. Requirements Included:

1. The Developer shall submit to the Authority for review: Shop Drawings, Product Data, Samples and Instruction Manuals for materials and equipment to be installed, as required in these Standard Specifications and Developer's Construction Drawings. The Developer shall check and verify all field measurements and shall submit with such promptness as to cause no delay in his own work four (4) copies, checked and approved by him, of all shop or setting drawings and schedules required for the work of the various trades. The Engineer shall check and approved, with reasonable promptness, such schedules and drawings only for compliance with the information given in the Standard Specifications. The Developer shall make any corrections required by the Engineer, file with the Engineer two copies and furnish such other copies as may be needed. The Engineer's approval of such drawings or schedules shall not relieve the Developer from responsibility for deviations from the Standard Specifications, unless the Developer has in writing called the Engineer's attention to such deviations at the time of submission and secured the Engineer's written approval, nor shall it relieve the Developer from responsibility for errors in shop drawings or schedules.

B. Shop Drawings:

1. Drawings shall be presented in a clear and thorough manner.

C. Product Data:

1. *Preparation*:

a) Clearly mark each copy to identify pertinent products or models.

b) Show performance characteristics and capabilities.

c) Show dimensions and clearances required.

d) Show wiring or piping diagrams and controls.

2. *Manufacturer's standard schematic drawings and diagrams*:

    a) Modify drawings and diagrams to delete information which is not applicable to the Work.

    b) Supplement standard information to provide information specifically applicable to the Work.

D. Samples:

1. Office samples shall be of sufficient size and quality to clearly illustrate:

    a) Functional characteristics of the product, with integrally related parts and attachment devices.

    b) Full range of color, texture, and pattern.

E. Manufacturer's Operating and Maintenance Instructions:

1. The Contractor shall initially submit one (1) copy of the manufacturer's operating and maintenance instructions for all equipment for the Engineer's approval. Information shall include description of equipment, operating instructions, troubleshooting techniques, schematic wiring diagrams, maintenance instructions, etc. Operating and maintenance instructions shall be sufficiently detailed as to be self-instructive.

2. Upon the Engineer's approval, four (4) sets of the approved operating and maintenance instructions, technical bulletins, diagrams, and other printed materials shall be furnished and delivered bound to the Authority, prior to the initial operations. Photocopied literature will not be acceptable.

3. The final Operation and Maintenance Manuals shall be provided, in their entirety, in portable document format (pdf) on compact disc(s). This includes information originally available in electronic formats as well as scanned versions of all information available only by hard copy. A copy of the CD(s) shall be included with each of the four (4) final bound hard copies.

F. Submission Requirements:

1. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Work or in the work of any other Contractor.

2. *Number of Submittals Required*:

    a) Shop Drawings: Submit four (4) copies.

    b) Product Data: Submit four (4) copies.

    c) Samples: Submit four (4) copies.

d) Instruction Manuals: Submit four (4) copies.

e) No more than four (4) copies of submittals shall be processed by the Engineer without direction from the Authority.

3. *Submittals Shall Contain*:

a) The date of submission and the dates of any previous submissions.

b) The Project title.

c) The names of:

1) Contractor.

2) Supplier.

3) Manufacturer.

d) Identification of the product, with the specification section number.

e) Field dimensions, clearly identified as such.

f) Relation to adjacent or critical feature of the Work or materials.

g) Applicable standards, such as ASTM or Federal Specification numbers.

h) Identification of revisions on resubmittals.

i) An 8 in. x 3 in. blank space for Contractor and Engineer stamps.

j) Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work.

G. Resubmission Requirements:

1. Make any corrections or changes in the submittals required by the Engineer and resubmit until approved.

2. *Shop Drawings and Product Data*:

a) Revise initial drawings or data, and resubmit as specified for the initial submittal.

b) Indicate any changes which have been made other than those requested by the Engineer.

3. Samples: Submit new samples as required for initial submittal.

H. Distribution:

1. Two (2) sets of shop drawings and product data which carry the Engineer's stamp will be returned to the Contractor.

2. Contractor shall distribute reproductions (if necessary) of shop drawings and copies of product data that carry the Engineer stamp of approval to:

a) Job site file.

b) Record documents file.

c) Other affected contractors.

d) Subcontractors.

e) Supplier or fabricator.

3. Distribute samples that carry the Engineer stamp of approval as directed by the Engineer.

I. Engineer's Duties:

1. Review submittals with reasonable promptness.

2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal.

3. Return submittals to Contractor for distribution, or for resubmission.

1.9 Use of Premises

The Developer shall confine his equipment, storage of materials, and construction operations to the project limits as prescribed by ordinances or permits, or as may be directed by the Authority, and shall not unreasonably encumber the site or public rights of way with his materials and construction equipment.

The Developer shall comply with all reasonable instructions of the Authority and the ordinances and codes of Upper Uwchlan Township regarding signs, advertising, traffic, fires, explosives, danger signals, and barricades. PennDOT flagging shall be required for all work on existing roads within the Township without exception.

1.10 Materials and Workmanship

Unless otherwise specifically provided, all workmanship, equipment, materials, and articles incorporated in the work shall be new and the best grade of the respective kinds of their purpose. Where equipment, materials, articles, or workmanship are referred to in the

Technical Specifications as "Equal to" any particular standard, the Engineer shall decide the question of equality.

Materials specified by reference to the number or symbols of a specific standard, such as an ASTM Specification, a Federal Specification or other similar standard, shall comply with the requirements in the latest revision thereof and any amendment or supplement thereto except as limited to type, class or grade, or modified in such reference. The standards referred to, except as modified in the Technical Specifications, shall have full force and effect as though printed herein.

1.11 Samples, Certificates, and Tests

The Developer shall submit all material or equipment samples, certificates, affidavits, etc., as called for in the contract documents or required by the Engineer, promptly. No such materials or equipment shall be manufactured or delivered to the site, except at the Developer's own risk, until the required samples or certificates have been approved in writing by the Engineer. Each sample submitted by the Developer shall carry a label giving the name of the Developer (or Contractor), the project for which it is intended, and the name of the producer. The accompanying certificates or letter from the Developer shall state that the sample complies with the Technical Specifications, shall give the name and brand of the product, its place of origin, the name and address of the producer, and all specifications or other detailed information which will assist the Engineer in passing upon the acceptability of the sample promptly. It shall also include a statement that all materials or equipment furnished for use in the project will comply with the samples and/or certified statements.

After actual deliveries, the Engineer will have such check tests made as he deems necessary in each instance and may reject materials and equipment and accessories for cause, even though such materials and articles have been given general approval. If materials, equipment or accessories, which fail to meet check tests, have been incorporated in the work, the Engineer will have the right to cause their removal and replacement by proper materials or to demand and secure such reparation by the Developer as is equitable.

1.12 Changes in Equipment and/or Materials

In these Technical Specifications and on accompanying drawings, there are specified and shown certain pieces of equipment and/or materials which are deemed most suitable for service anticipated. This is not done to eliminate other equipment and material equally as good and efficient. Should Contractor desire to use some other make of equipment or material, he shall submit to the Engineer a written request for such change and in same shall state advantage to the Authority. Determination as to whether or not such change will be permitted rests solely with the Engineer.

1.13 Warranty of Title

No material, supplies, or equipment for the work shall be purchased subject to any chattel mortgage or under a conditional sale or other agreement by which an interest therein or in any part thereof is retained by the seller or supplier. The Developer shall warrant good title to all materials, supplies, and equipment installed or incorporated in the work and upon

completion of all work, shall deliver the same together with all improvements and appurtenances constructed or placed thereon by him to the Authority free from any claim, liens, or charges. Neither the Developer nor any person, firm or corporation furnishing any material or labor for any work shall have the right to a lien upon any improvement or appurtenance thereon.

1.14 The Authority's Right to Do Work

If the Developer should neglect to prosecute the work properly, the Authority may, without prejudice to any other remedy he may have, make good such deficiencies and may deduct the cost thereof from the Developer's escrow funds.

1.15 Engineer's Status

The Engineer shall be the Authority's representative during the construction period. The Engineer will make periodic visits to the site to be generally familiarized with the progress and quality of the work and to determine in general if the work is proceeding in accordance with the Technical Specifications. The Engineer will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the work and will not be responsible for the Developer's failure to carry out the construction work in accordance with the Technical Specifications and construction drawings. During such visits and on the basis of observations while at the site, the Engineer will keep the Authority informed of the progress of the work of Contractor, and may condemn work as failure to adhere to the Technical Specifications and/or construction drawings. The Engineer shall have authority to reject the work whenever such rejection may be necessary in his reasonable opinion to ensure the proper completion of the project.

1.16 Safety and Health Regulations (OSHA)

The Developer and Contractor are responsible to and shall comply with the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL-91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL-91-54). All work must be in compliance with State and Federal occupational health and safety regulations. Neither the Engineer nor the Authority is responsible for enforcement of OSHA regulations.

1.17 Progress Schedule

The Developer shall submit for approval immediately after execution of the Contract, a carefully prepared Progress Schedule showing the proposed dates of starting and completing each of the various sections of work.

1.18 Location of Utilities

The Contractor will be held responsible for locating, in advance of the facilities to be built under this contract, all underground structures such as water and gas mains, water and gas services, storm sewers, and telephone and electric conduits, etc. that may be encountered during the constructing operation. He shall either dig test holes to determine the position of

the underground structures, or he shall arrange with the owners of such underground structures to assign a representative to mark the locations.

The existence and location of underground utilities as indicated on any plans of the Authority are 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.

A. The Contractor shall notify all utility companies in advance of construction to include requesting the utilities to be located in accordance with Pennsylvania One Call Act 287 of 1974 as amended by Act 50 of 2017 (1-800-242-1776) and cooperate with agents of these companies during the progress 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.

B. Whenever the Contractor, during the progress of the excavation, uncovers service pipes or lines, which because of injury or age are in poor condition, he shall immediately notify the proper utility owner 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 documented by the Contractor.

C. The Contractor shall sustain in their places and protect from direct or indirect injury all pipes, conduits, tracts, walls, buildings, and other structures or property in the vicinity of his work, whether above or below the ground, or that may appear in the trench.

1.19 Observation of Work

The Authority and/or Engineer may appoint such person(s) as they deem necessary to observe, at any time, materials and equipment furnished and work done. The Engineer shall be notified of the time and place of all work performed in sufficient time to allow arrangements for the assignment of construction observers. Neither the surveillance of the work nor the presence or absence of a construction observer shall relieve the Developer of any of his obligations of making his work conform to the intent of the Technical Specifications and construction drawings.

The Authority's construction observers shall be authorized to observe all work done and materials furnished. Such inspection may extend to all or any part of the work and to the preparation or manufacture of the materials to be used. Resident Project Representatives (RPR) will be stationed on the work to report to the Engineer as to the progress of the work and the manner in which it is being performed, to report whenever it appears that the materials furnished and work performed by the Contractor fail to fulfill the requirements of the Technical Specifications, and to call to the attention of the Developer/Contractor any such failure or other default, but no surveillance or any failure to observe, at any time or place, shall relieve the Contractor from any obligation to perform all work strictly in accordance with the requirements of the Technical Specifications. In case of any dispute arising between the Contractor and any RPR as to materials furnished or the manner of performing the work, the RPR shall have the authority to reject materials or suspend the work until the question at issue can be referred to and decided on by the Engineer. The

RPRs shall not be authorized to revoke, alter, enlarge, relax or release any requirements of the Technical Specifications, nor to approve or accept any portion of work, or to issue instructions contrary to the Technical Specifications. RPRs shall in no case act as foreman or perform other duties for the Contractor, nor interfere with the management of the work by the latter. Any instructions that the RPRs may give the Contractor shall in no way be construed as releasing the Contractor from fulfilling the terms of the Technical Specifications.

1.20 Use of Explosives

The use of mechanical surface impact equipment or drilling and hydraulic rock splitting equipment to remove rock shall be employed by the Contractor to the greatest extent possible. If no other means of rock removal are viable, the Contractor may employ the use of the explosives method (blasting).

Contractor shall take complete responsibility for rock removal by the explosives method including any and all damages or injuries resulting from blasting operations. Blasting shall not be permitted within a radius of 200 feet from any structure or building, or within a 300-foot radius from any gas pipeline, and in no case closer to any gas pipeline than is permitted by the gas utility company.

The Authority has the right to prohibit the use of explosives (blasting) on the Developer's or Owner's construction work.

1.21 Lines, Grades, and Construction Surveying

The Contractor/Developer shall be responsible for the stakeout for the construction of the project. The Contractor shall provide all surveying required to layout the construction work from horizontal and vertical reference points. The Contractor shall provide all engineering personnel, materials, equipment, and labor required to stakeout the baselines and/or centerlines and all offset lines and grades.

On jobs where the Contractor intends to use a laser, he shall either provide offset stakes at a minimum of 100' intervals and use them to spot check his grades or provide a level, rod, and level operator to spot check his grades.

1.22 As-Built Plans

Extender shall provide the Authority with one (1) set of reproducible (Mylar) and three (3) sets of paper prints of the as-built plans after the as-built plans have been reviewed and approved by the Authority. As-built plans shall also be delivered to the Authority on compact disc as follows:

A. Regardless of the projection and datum utilized for the approved subdivision and/or land development plan, as-built plans shall be projected in the State Plane Pennsylvania South Coordinate System, NAD83, utilizing the National Geodetic Vertical Datum of 1988 for consistency with Chester County and Authority GIS (Geographic Information System) data.

B. Digital spatial data shall be fully compatible with AutoCAD 2019 or earlier versions. Files must be provided in the AutoCAD data exchange (.dxf) format. ArcInfo data submission is acceptable in the .e00 format providing the data is determined to be acceptable. All submitted data is subject to review and approval prior to acceptance.

C. The data shall be provided in an uncompressed format on a standard compact disc compatible with the Windows 2019, and NT operating systems.

1.23 Requires Easement Width

The minimum easement width for sanitary sewers at a depth of eight feet (8') and over, as measured from finished grade to the bottom of pipe, shall be thirty feet (30'). The minimum easement width for sanitary sewers at a depth of less than eight feet (8'), as measured from finished grade to the bottom of pipe, shall be twenty feet (20'). The minimum easement width for a sewer line located within the same easement as one or more other sewer lines, or other utility or utilities, shall be thirty feet (30'); however, sufficient easement width shall be furnished to provide adequate separation distance between utilities as specified in Section 4 herein.

1.24 Testing

Testing of sanitary sewerage facilities shall be completed as described elsewhere in the Technical Specifications. The testing forms located in Appendix 1 of the Technical Specifications are incorporated herein by reference.

1.25 Standard Details

The Standard Details located in Appendix 2 of the Technical Specifications are incorporated herein by reference.

1.26 Soil Erosion and Sedimentation Pollution Control

The Authority is located in a specially protected high quality or exceptional value watershed. As such, extreme care should be exercised in all disturbance activities to prevent degradation to the waters of the Commonwealth, and upon completion or temporary cessation of earth disturbance activities, the project site shall be immediately stabilized with the appropriate temporary or permanent stabilization. Slopes greater than 3:1 shall utilize erosion control blanket stabilization.

1.27 Utility Easements

A. Utility easements shall be provided for all new sanitary sewers located outside of the roadway right-of-way. The Authority reserves the right to require additional easements for all sanitary sewers to provide adequate access for maintenance.

B. All utility easements shall be maintained by the individual property owners. No permanent structures or significant vegetation (shrubs, trees, etc.) shall be permitted within the easement.

1.28 Record Drawings

Developer shall provide the Authority with one (1) set of Mylar record (as-built) drawings as well as CD-ROM(s) containing the record drawings in AutoCAD Release 2019 format and PDF format for all sanitary sewer system installations associated with the project.

1.29 Construction

A. Responsibility of Contractor/Developer:

1. Contractor shall furnish all materials, implements, machinery, equipment, tools, supplies, transportation, labor, and supervision required to construct the facilities in accordance with these Technical Specifications and Developer's approved drawings. It shall be the responsibility of the Developer and Contractor to proceed with the work in the manner and within such limitations as may be prescribed by the Engineer.

B. Coordination:

1. The Developer shall be required to coordinate construction activities with the Authority, providing a minimum two-week notice prior to commencement of any construction activities.

C. Clean-Up:

1. The Contractor shall at all times keep the construction site free from accumulation of waste material or rubbish.

D. Schedule:

1. At least two (2) weeks before the start of construction, the Contractor shall meet with the Authority's representative at a pre-construction meeting and submit a projected work progress schedule.

2. Contents: The schedule shall show the work in a graphic format suitable for displaying scheduled construction logic and actual progress. Schedule shall comprise a horizontal bar chart with separate bar for each item.

E. Protection of Work and Property:

1. All existing utilities and facilities shall remain in operation at all times unless a specific plan for temporary utility service interruption has been approved by the Authority.

2. Developer shall protect and maintain existing structures, equipment, and new construction in an undisturbed condition during the construction period unless otherwise specified.

3. Developer shall provide adequate protection for the public, the Authority, and the Engineer during the construction period. Provide protective devices and equipment for protection of people and property. Protective measures shall comply with the Occupational Safety and Health Administration (OSHA) and other codes having jurisdiction.

4. The Developer shall provide adequate protection against injury or loss arising in connection with construction activities for all his work and the property of the Authority. He shall adequately protect adjacent property as provided by law and these Technical Specifications. The Developer shall provide facilities for protection required by public authority or local conditions and passageways, guard fences, lights, etc.

SECTION 2 – TRENCH PREPARATION AND EXCAVATION

2.1 General Requirements

A. Perform sheeting and shoring as required by Federal, State, and local laws and regulations and as otherwise required to protect workers, the public, and adjacent structure, utilities, and other aboveground and belowground facilities.

B. Excavation of every description and of whatever substances encountered shall be performed in accordance with all applicable Federal, State, and local requirements.

C. Stripping, Storing, and Restoring Surface Items: The Extender shall remove all 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 Extender 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.

D. Restoration: The Extender 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 or better than that before the work began, furnishing all labor and materials incidental thereto.

E. 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. However, in no case shall the trench, from 6 inches below the bottom of pipe to 12 inches above the crown of the pipe, be wider than the pipe nominal diameter plus 12 inches on each side of the pipe. Where sheeting and shoring are used, the maximum allowable width of trench shall be measured between the closest interior faces of the sheeting and shoring as placed.

F. Length of Trench:

1. No trench shall be opened more than 100 feet in advance of the pipelines laid.

2. The Extender shall limit all trench openings to a distance commensurate with all rules of safety.

3. If the work is stopped either totally or partially, the Extender shall refill the trench and temporarily repave over the same and the trench shall not be opened until he is ready to proceed with the construction of the pipeline.

4. The length of open trench shall not exceed what the Extender can complete within that working day.

5. All trench openings shall be covered for travel or filled to grade (and properly compacted) at the end of each day.

G. Pumping and Draining: The Extender shall remove by pumping, draining, or otherwise any water which may accumulate in the trenches and other excavations and shall build all dams and do all other work necessary to keep the trenches or other excavation as free from water as possible. Pumped water shall be discharged to a sediment removal facility approved by the Engineer and County Conservation District.

H. Accommodations of Drainage: The Extender 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, sewers, drains or ditches, it shall be the duty of the Extender to plank or bridge over the gutters so that the flow of water is not impeded.

I. Maintenance of Traffic:

1. Work shall be conducted so as to cause a minimum of inconvenience to pedestrian and vehicular traffic and to private and public properties along the line of work. It shall be the duty of the Extender, at all times, to maintain crossings, walks, sidewalks, and streets open to traffic and in a satisfactory condition, and to keep all fire hydrants, valves, fire alarm boxes, and letter boxes accessible for use. Whenever it is necessary to maintain pedestrian traffic over open trenches, a timber bridge at least three feet in width and equipped with side railings shall be provided. When the excavated material will encroach upon sidewalks or private property, planking shall be placed in order to keep the sidewalk or private property clear of excavated material.

2. Maintenance and protection of traffic on Township Streets and State Highways shall be in strict accordance with PennDOT 408 Specifications, Section 900; Pennsylvania Title 67, Chapter 212, Publications 212 and 213. The Extender shall modify the sign locations daily in order to protect that section of Street to be disturbed during that same day.

3. Vehicular traffic shall not be blocked for more than one (1) hour in any one direction.

J. Caution in Excavation: The Extender shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined, and shall be held responsible for the repair of such structures when broken or otherwise damaged due to carelessness on his part.

K. Protection of Utilities, Property and Structures: The existence and location of underground utilities as indicated on any plans of the Township are 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 Extender to deny responsibility for their protection and/or repair during construction.

1. The Extender shall notify all utility companies in advance of construction to include requesting the utilities to be located in accordance with Pennsylvania One Call Act 287 of 1974 as amended by Act 50 of 2017 (1-800-242-1776) and cooperate with agents of these companies during the progress of the work.

Procedures for emergency action and repairs to utilities shall be established with the utility company prior to commencement of the work. During the course of his work, if the Extender damages any of the aforementioned utilities, he shall immediately follow the procedure of emergency action and repair as established at his own expense.

2. Whenever the Extender, during the progress of the excavation, uncovers service pipes or lines, which because of injury or age are in poor condition, he shall immediately notify the proper utility owner 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 documented by the Extender.

3. The Extender shall sustain in their places, and protect from direct or indirect injury, all pipes, conduits, tracks, walls, buildings, and other structures or property in the vicinity of his work, whether above or below the ground, or that may appear in the trench.

L. Excavation in Fill: In areas where there is less than three (3) feet of existing cover over proposed pipes, the Extender shall place a compacted fill to a minimum depth of three (3) feet or 75% of the final fill depth (whichever is greater) above the proposed finished pipe depth and excavate down through the fill to install the piping.

All fill under the proposed piping shall be considered load bearing and shall be placed on a properly prepared subgrade in uniformly compacted thin lifts not to exceed eight (8) inches before compaction. The Extender shall employ the services of a qualified Geotechnical Engineer, registered in the Commonwealth of Pennsylvania, to perform the field determinations of density in accordance with ASTM D1556.

M. Sinkholes: When a sinkhole is discovered either during or after excavation the Authority must be notified immediately. Remediation of the sinkhole will proceed under the supervision of a geotechnical Professional Engineer, registered in the Commonwealth of Pennsylvania.

2.2 Stream Crossings

A. Construct stream crossing in accordance with an approved Stream Crossing Plan and an approved Sedimentation and Erosion Control Plan. Obtain all Federal, State, and local permits.

B. Make all necessary provisions for coffer damming, dewatering, and removal of excess excavated material.

C. Maintain the flow in the stream at all times.

D. Construct stream crossings as shown in the Standard Details. Encase pipe to limits shown on the Standard Detail with PennDOT 408 Class A concrete. The vertical distance between top of concrete and the lowest point in the streambed shall be no less than 36 inches.

E. 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 to provide a firm bond between the encasement and the rock. Where concrete encasement to the dimensions shown in the Standard Details is entirely in rock, the vertical distance between top of encasement and the lowest point in the stream bed may be 12 inches, but no less.

2.3 Boring, Jacking, and Tunneling

A. General: Installation of pipe lines shall be by open-cut methods unless boring, jacking, and/or tunneling is approved or required by the Engineer, PennDOT, railroad company, or other entity having jurisdiction over a particular location where a pipe line is being installed. Prior to the start of such construction, complete plans and specifications shall be submitted to and approved by the appropriate entity.

B. Casing Pipe Materials:

1. *Steel Casing Pipe*: ASTM A53 or other suitable steel meeting the approval of the appropriate entity.

   a) 35,000-psi minimum yield strength.

   b) Full circumference welded joints.

   c) Asphalt coated.

   d) Minimum wall thickness: 0.375-inch.

   e) Steel casing pipe shall be at least 6 inches in diameter larger than the outside diameter of the carrier pipe bell, or as required by the owner of the right-of-way, the entity issuing the permit, or the Authority.

   f) Smooth wall steel pipes with a nominal diameter of over 54 inches will not be permitted for use as casing pipe.

2. *Casing Spacer*:

   a) The Extender shall furnish and install casing spacers meeting the following specifications:

      1) Split ring band with minimum of two runners on each half of the band.

      2) Band material: 14-gage hot rolled and pickled carbon steel with epoxy coating.

      3) Band liner: 0.090-inch thick PVC.

      4) Riser material: 10-gage carbon steel with epoxy coating.

5) Runner material: UHMW polyethylene.

6) Studs, nuts, and washers: Type 304 stainless steel.

7) Acceptable manufacturer: Advanced Products and Systems, LLC (APS) Model SI, Material Specification C1.

3. *Casing End Seals*: Synthetic rubber with Type 304 stainless steel bands; APS Model AC or AW.

4. The type of casing spacer shown in the Standard Details will also be approved for use on gravity sewers.

SECTION 3 – PIPE BEDDING, TRENCH BACKFILL, AND GENERAL PIPE INSTALLATION REQUIREMENTS

3.1 Bedding

A. All gravity sewer, force main, low-pressure sewer, and house service lateral piping shall be provided with bedding. The trench shall be excavated to a depth of six (6) inches below the outside diameter of the pipe barrel, or deeper if so specified or required due to stability of subsurface material. The resultant subgrade shall be undisturbed, or compacted as approved by the Engineer. The bedding shall then be prepared by placing thoroughly compacted 2B (AASHTO No. 57) coarse aggregate (3/4", clean and rounded) in 4-inch (uncompacted thickness) lifts to the bottom of the pipe. Bedding material shall be deposited in the trench for the full width below and on each side of the pipe and shall be brought up along each side of the pipe, to the pipe centerline, uniformly to avoid displacing the pipe. Bedding material shall be compacted by tamping or approved mechanical methods. Bedding shall provide uniform and continuous bearing and support for the pipe at every point between pipe section ends. Pea gravel and river run shall not be acceptable bedding materials.

B. Special Bedding:

1. *Concrete Encasement*: If concrete encasement is required, the trench shall be excavated to a depth of six (6) inches below the outside of the barrel of pipes 24 inches in diameter or less and nine (9) inches below the outside of the barrel of pipes larger than 24-inches in diameter. Two (2) #5 steel reinforcing rods shall be required on the top and bottom of the concrete encasement.

2. *Unstable Subgrade*: Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, any type of refuse, vegetable, or other organic material, or large pieces or fragments of inorganic material, the Extender shall excavate and remove such unsuitable material to an approved width and depth. The unstable subgrade excavation shall be backfilled with AASHTO No. 57 aggregate compacted in maximum 4-inch thick layers.

3. *Sinkholes*: Where a sinkhole is found during construction, the Engineer shall be notified immediately. Remediation of the sinkhole shall be under the guidance of a geotechnical Professional Engineer, registered in the Commonwealth of Pennsylvania.

3.2 Backfilling

A. 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.

B. Initial Backfill Over Pipe: From the centerline of the pipe and fittings to a depth of one (1) foot above the top of the pipe, the trench shall be backfilled by hand or by approved mechanical methods with AASHTO No. 57 clean aggregate. The Extender shall use special care in placing this portion of the backfill so as to avoid damaging or

moving the pipe. The backfill shall be compacted in 4-inch layers (uncompacted thickness, unless State Highway) and compacted by tamping or other approved mechanical methods.

C. Final Backfill:

1. *Aggregate Backfill to Restoration Depth (Existing Roads)*: From one (1) foot 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 PennDOT 2A or 2RC aggregate material, subject to limitations specified, and compacted in four (4) inch loose lifts with mechanical tamper or 8" loose lifts if vibratory equipment is used to 100% of the determined dry weight density. Any consolidation method utilizing water such as jetting or puddling shall not be permitted. Consolidation shall proceed from the center of the trench to the sides to prevent arching.

2. *Backfill Material to Restoration Depth (Lawn, Meadows, and Cultivated Fields)*: From one (1) foot 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 excavated material approved by the Engineer and containing no stones larger than four (4) inches in maximum dimension. A maximum of 20% of the backfill volume may be stones if the stones are evenly distributed within the material. Excavated material shall be free of organic material, refuse, and frozen materials subject to limitations specified and shall be compacted in 4-inch loose lifts with mechanical tamper or 8-inch loose lifts if vibratory equipment is used. Any consolidation method utilizing water, such as jetting or puddling shall not be permitted. Consolidation shall proceed from the center of the trench to the sides to prevent arching.

3. *Backfill to Restoration Depth (New Roads):* For new Township roads, Contractor has the option of choosing either backfill type specified in 3.2.C.1 or 3.2.C.2 above.

4. *Compaction*:

   a) *Within State Highway Right-of-Way*: All trench backfill operations 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 that Department. The Extender shall have no claim to the Authority even though such requirements may entail more labor or services than the methods herein described. Use mechanical tampers or trench rollers to compact final backfill materials in trench refill operations to produce a density of backfill at the bottom of each layer of not less than 100 percent of maximum lab density as determined by ASTM D698 or as determined by PennDOT requirements. The Extender shall employ the services of a Professional Geotechnical Engineer, registered in the Commonwealth of Pennsylvania, to perform field determinations of density in accordance with ASTM D1556 or in accordance with PennDOT requirements.

b) *Existing and New Roads Other Than State Highway Right-of-Way:* Use mechanical tampers or trench rollers to compact backfill materials in trench refill operations to produce a density of backfill at the bottom of each layer of not less than 95 percent of maximum lab density as determined by ASTM D698. The Extender shall employ the services of a Professional Geotechnical Engineer, registered in the Commonwealth of Pennsylvania, to perform field determinations of density in accordance with ASTM D1556.

c) *Lawns, Meadows, and Cultivated Fields:* Use mechanical tampers or trench rollers to compact backfill materials in trench refill operations to produce a density of backfill at the bottom of each layer of not less than 90 percent of maximum lab density as determined by ASTM D698.

3.3 General Pipe Installation Requirements

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

B. Sewers on Steep Slopes: Sewers on 15 percent slope or greater shall be anchored securely with concrete anchors or equal, spaced as follows:

1. Not over 36 feet center to center on grades 15 percent and up to 35 percent.

2. Not over 25 feet center to center on grades 35 percent and up to 50 percent.

3. Not over 16 feet center to center on grades 50 percent and over.

C. Handling of Materials into Trench: Proper implements, tools and facilities satisfactory to the Authority shall be provided and used by the Extender for the safe and convenient prosecution of the work. All pipe, fittings, joining 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.

D. Pipe Clearance in Rocks: Ledge rock, boulders and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipe, bells, and fittings for pipes 24 inches in diameter or less, and 9 inches for pipes larger than 24 inches in diameter. 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, protection or point of such rock, boulder or stone.

E. Concrete Encasement:

1. *Preparation*: Prior to the formation of the cradle or encasement, temporary supports consisting of timber wedges and solid concrete bricks or cap blocks shall

be used to support the pipe in place. Temporary supports shall have minimum dimensions and shall support the pipe at not more than two locations, one at the bottom of the barrel of the pipe adjacent to the shoulder of the socket and the other near the spigot end. Two (2) #5 steel reinforcing rods shall be required on the top and bottom of the concrete encasement.

2. *Placing*: After joining of the pipe has been completed, concrete shall be uniformly poured beneath and on both sides of the pipe. 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.

3. 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 for at least 24 hours. Concrete shall be protected from the direct rays of the sun and kept moist, by a method acceptable to the Authority, 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 Authority shall have strict control of the rate of backfilling.

F. Hammer Test: Ductile iron pipe and iron fittings shall be inspected for defects and while suspended above grade, be rung with a light hammer to detect cracks.

G. Cleaning Pipe and Fittings: All lumps, blisters and excess coating shall be removed from the bell and spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wire brushed and wiped clean and dry and free from oil and grease before the pipe is laid.

H. Laying Pipe: Every precaution shall be taken to prevent foreign material from entering the pipe while the pipe is being placed in the trench. If the pipe-laying crew cannot put the pipe into the trench and in place without allowing earth into it, the Authority may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made into the adjacent pipe. During laying operations, no debris, tools, clothing or other material shall be placed in the pipe. After placing a length of pipe in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved aggregate material tamped under it except at the joints. Pipe and fittings that do not allow a sufficient and uniform space for joints shall be removed and replaced with pipe and fittings of proper dimensions to ensure such uniform space.

1. Precautions shall be taken to prevent dirt from entering the joint space.

2. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Authority. This provision

shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

I. Cutting Pipe: The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner, without damage to the pipe, so as to leave a smooth end at right angles to the axis of the pipe.

J. Permissible Deflection of Joints: If deflection is required, make after joint is assembled. The amount of deflection shall not exceed the maximum limits as specified in the AWWA C600 and C900.

K. Unsuitable Conditions for Laying Pipe: No pipe shall be laid in water or when, in the opinion of the Engineer, trench conditions are unsuitable.

L. Pipe Joining:

1. *Mechanical Joints*: The spigot end of the pipe shall be centrally located in the bell so that the rubber gasket is evenly seated.

a) All loose rust or foreign matter shall be removed from the inside surfaces of the bell and outside surface of the spigot prior to assembly. Bolts shall be tightened uniformly with a ratchet wrench so as to affect the joint seal. The normal ranges of bolt torque to be applied are:

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

b) If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after thorough cleaning.

2. *Push-On Type Joints*: Make joints as recommended by the manufacturer so as to affect the joint seal.

3.4 Guarantees

A. New Roads: Dedication of new roads within a development shall not be within two years of the installation of the sewer within the roadway. The Extender shall guarantee his work for two (2) years from the date of substantial completion of the sewer for all areas backfilled with suitable excavated material. The date of substantial completion shall be established by the Engineer.

B. Lawns, Meadows and Cultivated Fields: The Extender shall guarantee his work for one (1) year form the date of substantial completion of the sewer. The date of substantial completion shall be established by the Engineer.

SECTION 4 – SEPARATION OF SEWERS AND OTHER UTILITIES

4.1 Horizontal Separation

A. Potable Water Lines:

1. Do not install any sewer line closer than 10 feet horizontally to any potable water line.

2. Where site conditions prohibit the 10-foot separation, with the approval of the Authority, a sewer may be laid closer than 10 feet to a water main if:

   a) It is laid in a separate trench; or if

   b) It is laid in the same trench, with the water main located at one side of a bench of undisturbed earth; and if

   c) In either case the elevation of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.

B. Other Utilities:

1. Other underground utilities, including but not limited to storm sewers, gas mains, and electric, shall not be located within six (6) feet of the centerline of the sanitary sewer.

2. Where site conditions prohibit the 6-foot separation, alternative sanitary sewer routing must be approved by the Engineer.

4.2 Vertical Separation

A. Potable Water Lines:

1. Where a sewer line must cross under a potable water line, install the sewer line so that the top of the sewer line is at least 18 inches below the bottom of the potable water line. Maintain the 18-inch vertical separation for at least 10 feet on either side of the potable water line as measured perpendicularly from the potable water line. Provide structural support for the potable water line so that the pipe does not settle or deflect during or after completion of construction.

2. Where the sewer line cannot be located to meet the requirements specified in Section 4.2.A.1 above, proceed as follows:

   a) Relocate the potable water line to provide the 18-inch separation from top of sewer line to bottom of water line, for a minimum distance of 10 feet on either side of the sewer line as measured perpendicularly from the sewer line.

   b) Center one full length (minimum 18 feet) of potable water pipe over the sewer line so that the water line joints will be as far from the sewer line as possible.

c) Construct the relocated water line of AWWA C151 Special Class 52 ductile iron pipe with push-on joints or mechanical joints.

d) Provide adequate structural support for the potable water line so that the pipe does not settle or deflect during or after completion of construction.

e) Construct the sewer line for a minimum distance of 10 feet on either side of the potable water line, as measured perpendicularly from the water line, of AWWA C151 Special Class 52 ductile iron pipe with mechanical joints.

f) Prior to backfilling of the pipes, pressure test both the potable water line and the sewer line to ensure that any joint within 12 feet of the crossing point, as measured perpendicularly from one pipe to the other pipe, will not leak.

B. Other Utilities:

1. Other underground utilities, including but not limited to storm sewers, gas mains and electric, shall not be located within 12 inches (measured from edge of sewer pipe to edge of utility line) of the sanitary sewer.

2. Where site conditions prohibit the 12-inch separation, alternative sanitary sewer routing must be approved by the Engineer; or, utility lines may be rerouted if feasible.

4.3 Exceptions to Separation Requirements

Where a sewer line must cross over a potable water line or the separation requirements as specified above in Sections 4.1 and 4.2 cannot be met, contact the Authority to determine materials, details, and extent of concrete encasement for pipes.

4.4 Depth of Cover

Provide minimum cover of 4 feet from top of pipe to finished grade, unless otherwise approved by the Authority.

SECTION 5 – GRAVITY SEWERS

5.1 Materials

A. General: All materials shall be new, manufactured within one (1) year prior to date of installation.

B. Pipe Joints: For pipe joints, use rubber gaskets suitable for conveying domestic sewage.

C. Ductile Iron Pipe: Ductile iron cement lined pipe shall be in full accord with ANSI A21.50 and ANSI A21.51, Latest Edition, for the material class or pressure designated and AWWA C150, Latest Edition, for wall thickness.

1. Minimum diameter shall be 8 inches.

2. Minimum thickness shall be Special Class 52.

3. Pipe and fittings shall be factory coated, inside and out, with bituminous material; minimum 1 mil dry thickness. Bituminous material and finished coat conforming to seal coat requirements in ANSI A21.4.

4. Iron fittings shall be ductile iron or gray iron and shall be in full accord with the standard specification set forth in ANSI 21.10. Fittings larger than 48 inches shall be in full accordance with AWWA C100 Class B.

5. Joints shall be of the push-on type or mechanical joint type in full accord with ANSI A21.10 for all pipes except at changes in alignment or other conditions requiring restraints.

6. Ductile iron pipe shall be used for all manhole-to-manhole sewer runs where any portion of the sewer run is to be installed in fill soils.

D. Polyvinyl Chloride Sewer Pipe: PVC pipe and fittings up to and including 15" diameter shall be manufactured in accordance with ASTM D3034 "Specifications for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings" having a minimum wall thickness equal to SDR-35 (Standard Diameter Ratio) as noted in Table 1 of the ASTM Specification. PVC pipe and fittings between 18" and 21" in diameter shall be manufactured in accordance with ASTM F679 "Specifications for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings" having a minimum wall thickness equal to T-1 as noted in Table 1 of the ASTM Specification. PVC pipe and fittings between 24" and 36" in diameter shall be manufactured in accordance with ASTM F794 "Poly (Vinyl Chloride) (PVC), Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter" and ASTM F949 "Polyvinyl Chloride (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings", and shall be Ultra-Corr PVC Gravity Sewer Pipe as manufactured by J. M. Eagle Company, or equal.

1. Minimum diameter shall be 8 inches.

2. Fittings shall conform to same ASTM standard as for pipe.

3. Joints shall be push-on with elastomeric gasket, ASTM D3212; and, ASTM F477 for gasket specifications.

E. Connection into Existing Manholes: Link-Seal as manufactured by PSI Products, Kor-N-Seal Pipe-to-Manhole Connector, or equal.

F. Flexible Pipe Coupling: Clamped design with virgin PVC coupling and two (2) Type 305 stainless steel bands, "Strongback" Type as manufactured by Fernco, Inc. or equal.

G. Manhole Materials:

1. *General*: All pre-cast manhole components shall meet the requirements of ASTM C478 unless otherwise specified below.

a) *Acceptable Manufacturers*:

1) Terre Hill Concrete Products.

2) Monarch.

3) Or Equal.

2. *Precast manhole bases*: Precast manhole bases shall have flexible watertight joints at the point of entry of any sewer pipe into the manhole. The rubber compression gasket materials shall conform to ASTM C443 or ASTM 923. The gaskets shall be cast into the manhole base to become an integral part of the concrete. The gaskets shall be X-CEL as manufactured by A-LOK Products, Inc., Dura-Seal III as manufactured by Blackthorn, LLC., Tylox Dual Seal II as manufactured by Hamilton Kent, Inc., or equal.

3. *Precast concrete manhole components*: Concrete shall have a compressive strength of not less than 4,000 psi at 28 days (tests shall be in accordance with ASTM C39) with Type II cement. Manholes shall be reinforced both vertically and horizontally.

4. *Cast-in-place manhole components*: Concrete shall have a compressive strength of not less than 4,000 psi at 28 days (tests shall be in accordance with ASTM C39). Aggregates shall be of quality, gradation and proportions as approved by the Authority after submission of test results on the design mix. Each cubic yard of concrete shall contain no less than six (6) bags of Portland cement. Slump of concrete shall not exceed 4 inches. Ready-mixed concrete shall conform to ASTM C94. Portland cement shall conform to ASTM C150, Type II. Manholes shall be reinforced both vertically and horizontally.

5. *Manhole Steps*: Composed of a 1/2-inch Grade 60 ASTM A615 deformed steel reinforcing rod completely encapsulated in copolymer polypropylene compound

conforming to ASTM D4101; M.A. Industries, Inc., or equal. The distance between rungs shall be 12 inches. The rungs shall have end lugs to prevent side slippage, and shall have a minimum clear rung width of 12 inches. The step surface shall be non-slip. The steps shall be protected from dissimilar materials in accordance with ASTM C478, Latest Revision.

a) Manhole steps shall be positioned in the manhole in such a manner so as to permit easy entrance and exit from the manhole and so as not to conflict with any pipes, valves, or benches.

b) Manhole steps shall be grouted in place using a non-shrink, non-metallic grout.

c) The use of polypropylene inserts to secure the manhole steps shall not be permitted, nor shall the use of epoxy to secure the steps.

H. Non-Shrink, Non-Metallic Grout: Ready-mix product such as MasterWeld or Masterflow 713 Grout by Master Builders Solutions, F-100 by Sauereisen Cement Company, Five Star by Five Star Products, Inc., or equal.

I. Preformed Plastic Sealing Compound: Fed. Spec. SS-S-210A, AASHTO M-198B ASTM C990, 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 complete.

1. *Acceptable Manufacturers*: Henry Company BUTYL-NEK, or approved equal.

J. 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. Coat precast components at the factory.

3. *Exterior Surface Coatings*:

a) Kop-Coat, Inc., Bitumastic No. 300-M, 20-mil minimum thickness.

b) Tnemec, Tneme-Tar 46H 413, 20-mil minimum thickness.

c) Or Equal.

4. An interior plastic liner shall be provided on all force main discharge manholes, the next three (3) manholes downstream of the force main discharge manhole, and in other manholes as directed by the Engineer. Interior plastic liner shall provide a continuous, impermeable lining to shield precast concrete against deterioration caused by corrosive atmosphere. Interior plastic liner shall be AGRU Sure Grip Liner as manufactured by AGRU America, Inc and GU-BaseLiner as

manufactured by GU International. Channels, bench, and all penetrations through liner shall receive factory-applied corrosion-resistant coating.

5. Where a new force main enters an existing manhole, the interior walls, bench, and channel of this manhole and the next three manholes downstream shall be coated. The coating is applied in order to provide a continuous, impermeable lining to shield existing concrete against deterioration caused by a corrosive atmosphere. The coating of existing manholes shall be a two-step process. First, patch and repair manhole walls as necessary and provide a proper substrate for application of epoxy coating using Parson MH Liner as manufactured by Parson Environmental, F-121 Substrate ReSurfacer as manufactured by Sauereisen, or equal. Second, apply an epoxy corrosion barrier coating to the entire interior surface of the manhole using Parsonpoxy SEL-80 as manufactured by Parson Environmental, No. 210 SewerGard as manufactured by Sauereisen, or equal.

K. Manhole Frame and Cover: Gray iron castings with built-in O-ring seal conforming to ASTM A48, minimum Class No. 30, designed for AASHTO Highway Loading HS-25. Provide castings of uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion or other defects. Frame and cover design and dimensions shall be as shown in the Standard Details. Standard frame and cover shall be Cat. No. 1045 and 1040AGS, respectively, as manufactured by East Jordan Iron Works, Inc. Within 100-year floodplains and any other areas designated by the Engineer, watertight frame and covers shall be required. Watertight frames and covers shall be Cat. No. 1045 ZPT and 1040APT, respectively, as manufactured by East Jordan Iron Works, Inc. Where directed by the Engineer in non-street areas the top of rim elevation shall be set 18" above finished grade, unless directed otherwise.

1. *Finish*: Bearing surfaces shall be machined to prevent rocking and rattling under traffic.

2. *Frame Hold-down Bolts*: Drilled in threaded rod and nut or expansion anchors shown in Standard Details, four per frame.

L. Watertight Manhole Insert:

1. *General*: Manhole inserts shall be required in all manholes fit with a standard (as opposed to watertight) frame and cover. The manhole insert shall be manufactured from corrosion proof material suitable for atmospheres associated with wastewater collection systems.

2. *Material*: The insert shall be made from High Density Polyethylene Copolymer material that meets ASTM D1248 Class A, Category 5, Type III. (The insert shall have a minimum impact brittleness temperature of 105ºF or less.) The thickness shall be a uniform 1/8 inch or greater. The insert shall be manufactured to the dimensions as shown on the drawings to allow easy installation within the manhole frame. The insert shall be fit with a nylon-lifting strap for removal.

3. *Venting*: The insert shall have a system of relieving pressure from the manhole or relieving a vacuum in the manhole. The venting system shall contain NO moving

parts, which could be affected by grit accumulations, nor have any parts subject to corrosion. The venting system shall not allow water to completely fill the insert, which during freezing weather could freeze and lift the manhole cover.

4. *Manufacturer*: The insert shall be manufactured by Parson Environmental Products, Inc., or equal.

5. *Odor Control*: In areas where odor control is a concern, a special insert shall be utilized in lieu of a watertight insert when directed by the Engineer. The special insert shall be Odoreater Manhole Insert as manufactured by Parson Environmental Products, Inc. The associated carbon canister shall be replaced at maximum 6-month intervals or at intervals recommended by the manufacturer for the specific application, whichever is more stringent.

M. Precast Grade Rings: Leveling and adjusting units of 3 inches or 4 inches thick 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.

N. Underground Warning Tape:

1. Printed polyethylene tape, 3 inch minimum width, magnetic for PVC pipe, green for sanitary sewers, 1-inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types. Tape shall be placed above all sewers (refer to the Standard Details).

O. Deep Manholes: All manholes greater than or equal to 20' in depth, measured from the top of rim elevation to the invert out elevation, shall be provided with a landing (FRP grating) at the midpoint elevation. The Engineer, prior to installation, shall approve the landing and associated mounting hardware. At the approval of the Engineer, a precast safety platform may be substituted for the FRP grating landing.

P. Stubs: Where directed by the Engineer, manhole shall be fit with a plugged pipe stub (diameter and invert elevation to be determined by the Engineer) to accommodate future connections.

Q. Chemical Resistant Lined Manholes:

1. Chemical resistant lined manholes shall be required wherever manhole damage due to hydrogen sulfide may be reasonably expected, including, but not limited to, manholes including force main or low pressure sewer discharges and three (3) manholes downstream from said manholes.

2. Manholes shall be lined with an integrally cast high-density polyethylene (HDPE) liner. The liner shall be anchored into the concrete by a minimum average of 39 studs per square foot.

3. Integrally cast liner shall possess the following characteristics:
   a) Minimum pullout resistance of 110 lbs per anchor stud.

b) Shear resistance of 4,500 lbs per stud

c) Back pressure resistance: 29 psi

d) Material: 600 percent elasticity

4. The seams between liners for individual manhole sections shall be sealed through welding of an HDPE strip over the seam between liners, providing sufficient overlap to properly seal the seam.

5. The lining system shall include a rigid liner for the manway/access portion of the manhole, extending up to the underside of the cover frame. The manway liner shall be sealed with an acid resistant caulk at the frame. The manway liner shall be welded to the rigid cast in-place HDPE liner in the barrel section of the manhole.

6. The manhole base, bench and channel shall be monolithically lined with a cast-in place liner shaped to fit the channels to minimize obstructions to sewage flow. The pipe sleeves shall be a continuous part of the monolithic base liner. *(See Section 5.1.J.4 for liner models and manufacturers.)*

7. Unlined manholes installed where manhole damage due to hydrogen sulfide may be reasonably expected may be, at the Authority's option, lined with alternate liner systems that are not cast-in-place. Written authorization must be obtained from the Authority prior to installation of these systems. The Authority reserves the right to require removal and replacement of unlined manholes with manholes that utilize cast-in-place liner systems.

R. Metering Manholes: Metering manholes shall be required whenever influent gravity sewers greater than ten (10) inches are installed and where any size gravity sewer crosses the Township's boundary.

5.2 Installation

A. General: Grade of pipe and distance between manholes must meet all requirements in the most recent edition of the Commonwealth of Pennsylvania "Domestic Wastewater Facilities Manual" unless noted otherwise in these Technical Specifications. All pipe shall be laid to a uniform line and grade between manholes, bell 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 shall be centered in, shoved tight and secured against the bell of the previously laid pipe. The interior of each pipe section shall be cleaned of all excess joint and foreign material before the next pipe is laid. The pipe shall be laid in the aggregate materials as specified. Pipe laying shall commence at the lowest point and proceed upgrade. At the close of each day's work, and at such other times when pipe is not being laid, the open end of the pipe shall be protected with a close fitting stopper. Installation and joint assembly of plastic pipe shall in accordance with ASTM D 2321 for PVC pipe and AWWA C600 for ductile iron pipe.

B. Construction Control: The Contractor shall provide at least three grade boards in advance of pipe laying at all times at intervals not exceeding fifty (50) feet and stretch a line parallel with the grade line. From this line, the trench and every pipe laid shall be tested as to grade and alignment. Base lines and controlling elevations established for the construction of the work shall be preserved and kept uncovered so that they can be examined at any time.

1. The use of laser equipment shall be permitted. Grade boards as specified will not be required if a laser is used.

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.

C. Manholes: Manholes shall be placed at each change of grade, size and alignment of the pipe, and at all intersections. Terminal cleanouts will not be acceptable.

D. Construction Requirements:

1. Sanitary sewers may be placed in fill as long as the guidelines set forth in Section 2.1L are followed. Sanitary sewers shall be installed in earth trenches and shall be restored as shown in the Standard Details.

2. Sanitary sewers shall not be installed within six (6) feet of electric and gas lines.

3. Contractor shall install, cap, bury, and mark drainage pipe in trenches where springs are encountered.

5.3 Testing

A. Alignment: After the sewers have been laid and backfilled, a light shall be flashed between manholes or manhole locations to determine whether the alignment of the sewer is true and whether any pipe has been displaced, broken or otherwise damaged subsequent to laying. This test will again be conducted before final acceptance of the sewer. Each section (manhole to manhole) of sewer shall show a good light circle throughout its length and any and all defects shall be corrected by the Extender, to the satisfaction of the Authority, before the work shall proceed and before acceptance shall be made.

1. Mandrel testing will be required in addition to the lamp testing unless waived by the Authority. Refer to Paragraph 5.3.E of this Section for the applicable requirements.

B. General Requirements for Leakage Testing:

1. Perform leakage tests no sooner than five days after backfilling.

2. At the Extender's option, preliminary leakage tests (for Extender's information only) may be performed before backfilling provided that:

a) There is no conflict with other Specification Sections that require that no more than a specified length of trench is open at any time.

b) All pipe (sewer mains and service laterals) is sufficiently restrained to prevent movement during the testing process.

c) Tests for pipeline acceptance are also made after backfilling.

3. At the Developer's option, leakage testing for acceptance of the pipeline may be performed with the pipe backfilled, but with the joints exposed, provided that:

a) Pipe joints are properly backfilled in accordance with the installation Specifications and that the various types of materials used in bedding and backfilling are not contaminated with foreign or incompatible materials.

C. Air Test for Leakage:

1. *Air Testing*: The Contractor shall test each section of sewer between manholes and all laterals to the limit of this contract using low-pressure air. Testing shall not be performed, until all backfilling has been completed. The Contractor may, at his option, test the section of sewer for his own purposes, prior to completion of backfilling; however, the requirements of this subsection shall not be deemed to be completed until the lines have been tested after the backfilling has been completed and trench settlement has been minimized. The costs of any testing incurred prior to authorization from the Engineer after backfilling has been completed shall be borne by the Contractor.

2. A minimum of two minutes shall be provided to allow equilibrium of the air temperature with pipe wall before test readings shall commence. The rate of air loss shall be determined by measuring the time interval required for the average internal pressure to decrease by 1.0 psig.

3. The initial test pressure to be developed in the sewer and laterals shall be determined as follows:

a) For depths six (6) feet or less, the internal pressure shall not be less than 6.0 psig.

b) For depths greater than six (6) feet, the internal pressure in psig shall be calculated as the sum of 3.5 plus the maximum height in feet divided by 2.3 between the invert of the sewer and the existing ground surface in the section of sewer to be tested. (For example, if the maximum height were determined to be 9.2 feet, the added pressure would be 4.0 psig. The initial test pressure in the sewer would then be 7.5 psig. The allowable drop would be to 6.5 psig within the time indicated elsewhere in this subsection.)

c) In no case shall the test pressure in the sewers or laterals be greater than the maximum internal differential joint pressure recommended by the

manufacturer of the pipe or 9.0 psig, whichever is less. The minimum test pressure shall be 6.0 psig.

4. The pipe shall be considered acceptable if the air loss rate does not exceed 0.0030 cubic feet per minute per square foot of internal pipe surface when tested at the initial pressure previously defined in this subsection. The time for the air pressure to decrease 1.0 psig shall not be less than the time indicated in the following table:

Pipe Diameter	Minutes	Seconds
6"	2	55
8"	3	57
10"	4	43
12"	5	5
15"	7	5
18"	8	30
21"	9	50
24"	11	20
27"	12	45
30"	14	10
36"	17	00
42"	19	50
48"	22	40

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

6. The Contractor shall submit to the Engineer for approval the detailed test procedure and list of test equipment he proposes to use prior to testing.

D. Infiltration:

1. After the air testing described in the preceding Section 5.3.C has been completed by the Extender and prior to the use of the sewer, regardless of any indications of the test results made by the Authority, the Authority reserves the right to perform field investigations, prior to final written acceptance of each sewer section by the Authority and/or during the warranty period, to establish the leakage of groundwater into the sewer and laterals. The cost of these investigations shall be borne by the Extender.

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 Authority, and at no cost to the Authority, 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.

E. Deflection Testing of PVC Pipe:

1. Perform deflection test a minimum of 30 days after completion of backfilling on the pipe section to be tested.

2. Use a mandrel with a diameter equal to 95 percent of the actual inside diameter of the pipe. Do not use mechanical pulling devices to move the mandrel through the pipe.

3. Adjustable mandrels will not be acceptable for use in deflection testing.

4. Pipe section will be accepted if deflection does not exceed 5 percent of the actual inside pipe diameter at any point in the section under test.

F. Vacuum Testing of Manhole:

1. Vacuum testing of all manholes is required. Prior to testing manholes, thoroughly clean such and seal openings, both to complete satisfaction of the Authority. Seal openings using properly sized plugs. Perform testing with frames and covers installed. The joint between the manhole and the manhole frame shall be included in the test.

   a) Perform vacuum testing in accordance with the testing equipment and manufacturer's written instructions.

   b) Draw a vacuum of 10 inches of mercury and close the valves.

   c) Consider manhole acceptable when vacuum does not drop below 9 inches of mercury for the following manhole sizes and times:

      1) 4-foot diameter - 60 seconds.

      2) 5-foot diameter - 75 seconds.

      3) 6 foot diameter - 90 seconds.

2. If any manhole fails to pass the vacuum test, the Extender shall determine at his own expense the source or sources of leakage. The Extender shall repair or replace all defective materials and/or workmanship and shall conduct such additional retests as required to demonstrate that the manhole meets the requirements, at his own expense and at no cost to the Authority. All materials and methods used to repair the manholes shall meet with the approval of the Authority.

G. Closed Circuit Television Inspection

1. Closed circuit television inspection of all sewer piping is required. Television inspection shall be performed no sooner than thirty days after backfilling.

2. The Contractor shall provide a complete closed circuit television system consisting of but not limited to the following items:

   a) Van-type viewing room, mounted therein being camera controls, heating and air conditioning facilities, communication facilities, and monitoring facilities that provide clean and visible pictures of the work being performed.

   b) Television and video and grouting equipment capable of accurately measuring distances inside the sewer.

   c) An independent power source.

   d) A color, radial view camera with the ability to view into laterals and to view the complete pipe circumference. The camera shall include a lighting system to allow illumination of lateral sewer connections.

   e) For the inspection of sewer mains and laterals with bends and size restrictions, a mini, flexible camera shall be used. The camera shall be able to view the complete pipe circumference and shall include a lighting system that illuminates the entire pipe circumference and lateral connections.

   f) Prior to view tape televising, the pipe shall be televised to determine that the line is sufficiently clean. The contractor is responsible for providing an unobstructed view of no less than 75% of the pipe interior.

   g) Recording: All recordings are to be in digital format.

      1) Image Capture: Capture color still shots of video recordings for all defects encountered. Digitized picture images shall be stored and be exportable as JPEG formats.

      2) Video Capture: Full-time live video and audio files shall be captured for each pipe segment and lateral inspected. The files shall be stored in industry standard MPEG format viewable from a DVD on an external personal computer that utilizes Microsoft Media Player, Version 12.0, to view the recording. The MPEG video shall be ISO-MPEG Level 1 (MPEG-1) coding with a resolution of 352 pixels (x) by 240 pixels (y), and an encoded frame rate of 29.97 frames per second. System shall perform an automatic disk image/file naming structure to allow saved video/data sections to be “burned” to DVD-R format. It shall have the capability of “burning” a minimum of 120 minutes of recording to the DVD-R media. The video recording shall be free of electrical interference, and shall produce a clear and stable image. The audio recording shall be sufficiently free of background and electrical noise as

to produce an oral report that is clear and discernible. The digital recordings and inspection data shall be cross-referenced to allow instant access to any point of interest within the digital recording.

h) During videotaping, the contractor shall supply the following audio information:

1) Day, month, year and time.

2) Location of manholes using nearest street intersection and Authority manhole numbering.

3) Descriptions for the condition of all manholes, laterals, leaking joints, breaks and other problem areas.

i) During videotaping, the contractor shall provide the following screen display information, which shall be located on the screen so as to provide an unobstructed view:

1) Month, day, year.

2) Job number.

3) Manhole Number _____to Number _____.

4) Linear footage.

5) Weather conditions at time of videotaping.

H. Acceptance: Observation of successful testing of manholes or sewers by the Authority does not constitute acceptance of the system or any portion thereof. Only upon final inspection by the Engineer and upon written acceptance for same will the system or portion thereof be considered acceptable. Upon such acceptance, the warranty period will commence. If, during this final inspection, any irregularities are observed, the condition must be corrected at the Extender's expense prior to acceptance.

I. Final cleaning of gravity sewers and manholes: Prior to acceptance all gravity sewers and manholes shall be flushed and rocks, sediment, and other detritus shall be removed from the system.

SECTION 6 – GRAVITY LATERAL SEWERS AND SERVICE LINES

6.1 Materials

A. Ductile Iron Pipe: Ductile iron cement lined pipe shall be in full accord with ANSI A21.50 and ANSI A21.51, Latest Edition, for the material class or pressure designated and AWWA C150, Latest Edition, for wall thickness.

1. Minimum diameter shall be 4 inches.

2. Minimum thickness shall be Special Class 52.

3. Pipe and fittings shall be factory coated, inside and out, with bituminous material; minimum 1 mil dry thickness. Bituminous material and finished coat conforming to seal coat requirements in ANSI A21.4.

4. Iron fittings shall be ductile iron or gray iron and shall be in full accord with the standard specification set forth in ANSI 21.10.

5. Joints shall be of the push-on type or mechanical joint type in full accord with ANSI A21.10 for all pipes except at changes in alignment or other conditions requiring restraints.

6. Ductile iron pipe shall be used for all sewer laterals where any portion of the lateral is to be installed in fill soils.

B. Polyvinyl Chloride Pipe (PVC): As specified for Sewer Pipe and Fittings; 4-inch minimum diameter. SDR-35 pipe is required between the main and the right-of-way. Schedule 40 solvent joint or SDR-35 can be used between the right-of-way and the building, including trap assembly. Colored primer must be used for all solvent joint applications.

C. Pipe Plugs: Designed for permanent installation and removable. Obtain plugs for various types of pipe used from the respective pipe manufacturer.

D. Wye Connections: Wye connections are to be used for lateral connections on new sewer lines.

E. Service Saddles: Service saddles are to be used for lateral connections to existing sewer lines.

1. Saddle assembly consists of:

a) Saddle and bell.

b) Adapter as required to provide for push-on installation of service lateral.

c) Service lateral sealing gasket which fits in groove in either bell or adapter.

d) Tap gasket for sealing saddle/bell to collector pipe.

e) Strap and fasteners for securing saddle/bell to collector pipe.

2. Pressure rating of assembled push-on connection: Minimum 7 psi.

3. *Materials and Components*:

a) *Saddle/bell*: Cast iron; ASTM A48, minimum Class 35 coated inside and out with heavy coat of black asphaltum type.

b) *Service lateral push-on joint sealing gasket*: Elastomeric gasket, ASTM D3212; and ASTM F477 for gasket specifications.

c) *Adapter*: PVC; ASTM D3034, SDR 35; epoxy bonded in cast iron bell.

d) *Tap gasket*: Synthetic rubber meeting requirements of ASTM C361 for oil-resistant gaskets.

e) *Strap*: Type 304 stainless steel; minimum thickness 24 gage; minimum width 2.5 inches.

f) *Strap bolts*: Type 304 stainless steel T-bolts, washers and hex nuts; minimum diameter 3/8 inch.

4. Use service saddles instead of in-line fittings only when approved by the Authority at locations where use of in-line fittings is unfeasible or inappropriate. Service saddles may not be used for any lateral over 6 inches in diameter.

5. Use "Y" pattern connections except:

a) For vertical riser laterals, where "T" pattern service connections may be used.

b) Where "T" pattern service connections are approved by the Authority.

6. *Manufacturer*: Romac Saddle, Inserta Tee or equal.

6.2 Installation

A. Fittings (risers, bends, wyes, and plugs) and service pipe shall be furnished and installed in strict accordance with these Technical Specifications and any and all practices and precautions required above for the gravity Sanitary Sewers are equally applicable to the Lateral Sewers and Service Lines. The Extender shall place a 2” x 4” wooden marker at the end of each Lateral Sewer unless connecting directly to an existing Service Line. The marker shall be one piece and may not be constructed from two or more smaller pieces. The marker shall extend from the Lateral Sewer invert to 24 inches above grade. A PVC-compatible mechanical joint (MJ) cap or plug shall be installed at the end of the lateral.

B. If rock is encountered during the installation of a Lateral Sewer, the Extender shall construct the Lateral Sewer to provide a minimum "rock-free" distance of one foot beyond the end of the Lateral Sewer. No Lateral Sewer shall be "butted" against rock.

C. All Lateral Sewers and Service Lines shall be installed with a minimum grade of 1/4"/foot. A straight alignment shall be maintained where possible. A minimum cover of four feet (4') shall be maintained to prevent crushing and freezing of the pipe, unless the Authority approves a lesser minimum cover.

D. No trench shall be backfilled until the Lateral Sewer or Service Line has been visually inspected and approved by the Engineer and/or Authority Code Enforcement Officer (refer to the Standard Details for pipe bedding and backfill).

E. Trap:

1. A main or intercepting trap shall be placed between the Service Connection and the Building. The trap shall be a PVC trap with Vent Pipe. The Vent Pipe shall be on the Building side of the trap. Unless otherwise authorized by the Authority, the top of the Vent Pipe shall be a minimum of 6 inches (6") above the ground and shall have a cowl type vent to prevent surface water from entering the Sewer.

2. No horizontal 90-degree bends shall be permitted in the trap assembly. When directional changes are necessary, two (2) 45-degree bends with minimum one foot between shall be used.

3. A cleanout shall be installed as shown on Standard Detail No. 18.

F. The Authority reserves the right to test each Service Line prior to approval by the Authority Code Enforcement Officer. The test shall be witnessed by an agent of the Authority and the Service Line shall not be deemed acceptable until said Service Line has satisfactorily passed the test hereinafter described. All costs of testing and any subsequent test(s), including equipment, material, water or labor required shall be the responsibility of the Owner.

1. The Service Line shall be tested by plugging the line at the Service Connection (point of connection with the Lateral Sewer) and by plugging the line at its point of connection with the Building. All risers, vents, plugs and cleanouts shall be adequately blocked, plugged or supported to withstand the pressure associated with the test. The test shall be made by either air or water. In either case, the test shall be designed to provide a residual pressure of 5.0 psi throughout the length of the Service Line.

2. The test shall be made by attaching a water pump or air compressor testing apparatus to any suitable opening and after closing and supporting all other inlets and outlets to the Service Line, forcing air or water into the Service Line until there is a uniform gauge pressure of 5.0 psi. The Service Line shall be deemed acceptable if this pressure is maintained for 15 minutes without the introduction of additional water or air.

3. Care shall be taken that the pressures generated by the test do not exceed the pipe manufacturer's recommendations.

G. Lateral Sewers shall be tested in accordance with the procedures specified in Section 5 for gravity Sanitary Sewers. However, in the case of a new Lateral Sewer tying into an existing gravity sewer main, the Lateral Sewer shall be tested concurrently with the Service Line in accordance with Subsection F above.

H. The following requirements shall be applicable for that portion of a Service Line installed within the paved portion of Street rights-of-way and it shall be the responsibility of the Owner of the Improved Property served to require his plumber or contractor to adhere to these requirements.

1. The trench shall be thoroughly compacted using mechanical tamping equipment.

2. The trench area shall be graded to conform to existing grade.

3. No surplus excavated materials or debris shall be piled or stored in this area.

4. All Street surfaces that are disturbed or damaged by the Owner or his plumber or contractor shall be properly repaired at the Owner's cost.

5. Subsequent settlement of the Street resulting from improper construction practices shall be promptly repaired at the Owner's cost.

6. In no case, shall the sewer lateral be installed at a higher elevation than any potable water service within 18-inches.

7. In no case, shall a sewer lateral be installed within a 24-inch radius of any other utility, except for potable water lines, in which case a minimum separation of ten (10) feet is required.

8. If the Owner or his plumber or contractor fails to comply with any of the requirements of this Subsection H, then after reasonable notice to the Owner, the Authority may proceed on its own to make any necessary corrections or repairs so that the aforesaid requirements are fulfilled. If the Authority does so repair, then the owner of the Improved Property shall be liable to the Authority for the entire cost of such repairs and said cost will be included in the Owner's next quarterly billing for sewer services.

9. Only one (1) drop lateral connection may be employed in any single lateral.

6.3 Special Conditions and Requirements

A. Unless otherwise authorized by the Engineer or Authority Code Enforcement Officer, cleanouts shall be provided in each Service Line at one hundred (100) foot intervals.

B. Cleanouts shall be constructed using Wye or Tee-Wye fittings in the run of the pipe with a 45-degree bend (1/8 bend) and riser to the ground surface. The riser shall be provided with a standard four-inch (4") screw type ferrule.

C. Where the Service Line and the Lateral Sewer are both of the same size pipe, Service Connections shall be made by properly joining the spigot end of the Service Line with the bell end of the Lateral Sewer. This connection shall be approved by the Authority.

D. If the Service Line and Lateral Sewer are of unlike materials or sizes, the Service Connection shall be made with a fitting of PVC elastomeric sleeve or a flexible coupling or reducing coupling with stainless steel straps suitable for the type and size of pipe to be connected (Fernco Coupling or approved equal). Sealing with grout or mastic will in no circumstances be permitted.

E. All Service Connections to Sewers shall be made at the terminus of the Lateral Sewer unless the Engineer specifically authorizes otherwise.

F. When no Lateral Sewer was previously constructed, the connection to the Sewer main and the construction of the Lateral Sewer from the Sewer main to the edge of the right-of-way or sewer easement line shall be made by the owner at the cost of the owner, under the inspection of the Engineer and/or Authority Code Enforcement Officer.

G. Basement floor drains and/or sump pumps shall not be connected in any manner to the Sewer System. The Authority will not be responsible for any damage that may result from basements being flooded via floor drains due to the stoppage of sewers.

H. All cleanouts and traps shall be located as shown in the Standard Details.

I. According to field conditions, vertical risers shall be utilized when directed by the Authority. Vertical riser lateral connections shall be in accordance with the Standard Details.

SECTION 7 – FORCE MAINS

7.1 Materials

A. Ductile Iron Pipe: Use ductile iron pipe conforming to ANSI A21.51 or AWWA C151, Latest Edition, for the material class or pressure designated and ANSI A21.50 AWWA C150, Latest Edition, for wall thickness. Minimum wall thickness shall be Class 52 except where flanged pipe is required. Use Special Class 53 pipe where flanged connections are required.

1. *Cement Mortar Linings*: Conform to ANSI A21.4 or AWWA C104, Latest Edition, except the thickness of linings should not be less than 1/8-inch.

2. *Corrosion-Resistant Linings*: Ductile iron pipe and fittings shall be lined (interior) with a corrosion-resistant ceramic-epoxy lining. The lining material shall be an amine-cured Novolac epoxy containing at least 20% by volume of ceramic quartz pigment. Interior lining shall be U.S. Pipe PROTECTO 401, or approved equal.

3. *Fittings*: Ductile or gray iron in accordance with the requirements set forth in ANSI A21.10 or AWWA C110, Latest Edition. All fittings shall be minimum Class 250 with corrosion-resistant lining and joints as required for pipe restraint. Iron fittings to be enclosed in pits, vaults, or manholes shall be of the short-body flanged type in order to minimize the size of the pits, vaults, and manholes.

4. *Joints*: Push-on type or mechanical joint type in accordance with ANSI A21.11 or AWWA C111, for all pipe except at changes in alignment, valves, tees, caps, and plugs not restrained with thrust blocking.

    a) Joints requiring pipe restraint and not restrained with thrust blocking shall be HP LOK or TR Flex as manufactured by U. S. Pipe; Flex Ring as manufactured by American Pipe; TR Flex or locked mechanical joint as manufactured by McWane Ductile; or approved equal.

    b) In addition to restrained joints, adequate tie rods shall be provided to develop full joint restraint and must extend to the adjacent fitting or joint as approved by the Engineer.

    c) Mechanical joint retainer glands shall not be used. Only ductile or SDR-8 Mega-lug style joint glands or approved equal shall be installed.

    d) Prior to construction, joint restraint system details shall be submitted for Authority's review and approval.

B. Polyvinyl Chloride (PVC) Pipe and Fittings:

1. 4 Inches and Greater Diameter: PVC pipe conforming to AWWA C900 for working pressure of 200 psi.

2. Fittings: As specified for Cement Lined Ductile Iron Pipe.

3. Less than 4 Inches Diameter: PVC pipe conforming to ASTM D2241, SDR-21 except 1.5-inch pipe shall be SDR-26.

    a) Fittings: Compatible PVC fittings as recommended by pipe manufacturers, and of same Class as the pipe.

    b) Acceptable Manufacturer:
        1) CertainTeed; Fluid-Tite with Integral Bell.

        2) Or Equal.

4. Joints: Push-on type conforming to ASTM D3139.

    a) Solvent weld joints permitted only for special situations as approved by Engineer (e.g., bored service line highway crossings).

    b) PVC pipe joints shall be restrained at changes in alignment, valves, tees, caps, and plugs with thrust blocking.

    c) Joint Restraint: Suitable for use with PVC pipe. Restraint device shall be Series 2000PV, as manufactured by EBAA Iron Sales, Inc., or approved equal.

    d) Split retainer flanges shall not be used in place of thrust blocks.

C. Air Valves: The Authority reserves the right to require air valves, of any one of the following types, at any location in the force main.

1. *Sewage Air Release Valve*: Designed to automatically release air, gas or vapor under pressure during system operation. Valve design shall feature long body and float stem components so that the operating mechanism is kept free from contact with sewage during operation. Valve construction shall be as follows:

    a) *Maximum Working Pressure Rating*: 150 psi.

    b) *Valve Body and Cover*: Cast iron, ASTM A48, Class 35.

    c) *Vent Orifice*: 5/16 for 75 psi and 3/16 for 150 psi.

    d) *Discharge Orifice Seat, Mechanism and Valve Stem*: Stainless steel.

    e) *Orifice Button*: Stainless steel and Buna-N, nitrile rubber ASTM SB800.

    f) *Mechanism Lever Pins and Float*: High strength stainless steel, ASTM A240.

    g) *Backflushing and Cleaning Accessories*: Factory assembled to the valve and consisting of a shut-off valve at bottom inlet, a blow-off valve near the bottom

of the valve body, quick disconnect couplings and shut-off valve at top of valve, and a 5-foot section of rubber hose with quick disconnect coupling.

h) *Acceptable Manufacturers*:

1) DeZurik.

2) GA Industries.

3) Val-Matic Valve and Manufacturing Corporation.

4) Or Equal.

2. *Sewage Air and Vacuum Valve*: Designed to automatically exhaust large quantities of air during the filling of a system and to allow air to re-enter the system during draining or when a vacuum occurs. Valve design shall feature long body and float stem components so that the operating mechanism is kept free from contact with sewage during operation. Valve construction shall be as follows:

a) *Valve Body and Cover*: Cast iron, ASTM A48, Class 35.

b) *Inlet Size*: 2 inches.

c) *Discharge Orifice*: 2 inches.

d) *Float Stem and Guide*: Bronze, ASTM B584.

e) *Floats*: Stainless steel, ASTM A240.

f) *Orifice Seat*: Buna-N, nitrile rubber, ASTM SB800.

g) *Backflushing and Cleaning Accessories*: Factory assembled to the valve and consisting of an inlet shut-off valve, a 1-inch blow-off valve near the bottom of the valve body, quick disconnect couplings and a 1/2-shut-off valve at the top of valve, and a 5-foot section of rubber hose with quick disconnect coupling.

h) *Acceptable Manufacturers*:

1) DeZurik.

2) GA Industries.

3) Val-Matic Valve and Manufacturing Corporation.

4) Or Equal.

3. *Sewage Combination Air Release Valves*: Consisting of an air release valve and an air and vacuum valve factory piped into a compact assembly. The combination

assembly shall automatically release air, gas or vapor under system operating pressure and shall also allow air to re-enter the system during draining or when a vacuum occurs. Combination valve designs shall feature long bodies and float stem components so that the operating mechanisms are kept free from contact with sewage during operation. Valve construction shall be as follows:

a) *Air Release Valve Maximum Working Pressure*: 75 psi.

b) *Valve Bodies and Covers*: Cast iron, ASTM A48, Class 35.

c) *Inlet Size*: 2 inches.

d) *Air-Release Outlet Size*: 1/2-inch, NPT.

e) *Vacuum Discharge/Outlet Size*: 2 inches.

f) *Air Release Valve Vent Orifice*: 5/16-inch.

g) *Air Release Valve Discharge Orifice Seat, Mechanism and Valve Stem*: Stainless steel.

h) *Air Release Valve Orifice Button*: Stainless steel and Buna-N, nitrile rubber, ASTM SB800.

i) *Air Release Valve Mechanism Lever Pins and Float*: High strength stainless steel, ASTM A240.

j) *Air and Vacuum Valve Float Stem and Guide*: Bronze, ASTM B584.

k) *Air and Vacuum Valve Floats*: Stainless Steel, ASTM A240.

l) *Air and Vacuum Valve Orifice Seat*: Buna-N, Nitrile Rubber, ASTM SB800.

m) *Backflushing and Cleaning Accessories*: Factory assembled to the combination valves and consisting of two inlet shut-off valves, two blow-off valves, two clear water inlet valves, and a 5-foot section of rubber hose and quick disconnect couplings.

n) *Acceptable Manufacturers*:

    1) DeZurik.

    2) GA Industries.

    3) Val-Matic Valve and Manufacturing Corporation.

    4) Or Equal.

D. Underground Warning Tape:

1. Printed polyethylene tape, 3 inches minimum width, magnetic for PVC pipe, green for force mains, one-inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types. Tape must be placed above all force mains (reference Standard Details).

E. Cleanouts:

1. Cleanouts shall be constructed as shown in the Standard Details. Valves shall be installed in each cleanout manhole.

F. Valves and Appurtenances:

1. *Valves*: Valves shall be installed on force main at locations shown in the Standard Details and as required by the Engineer.

2. *Plug Valves*: Valves installed in valve/cleanout pits shall be actuated with a quarter turn type hand lever. Buried valves shall be actuated with an underground actuator through a cast iron valve box. Plug valves shall be non-lubricated eccentric plug valves as manufactured by DeZurik, Keystone, or Milliken.

   a) Valves shall open left (counter-clockwise).

   b) Buried valves shall have 2-inch square cast iron operating nuts. Each valve shall also be supplied with a roadway type valve box.

   c) Buried valves shall be supplied with mechanical joint end connections.

   d) Valves located in vaults, pits, or manholes shall have flanged ends.

3. Gate Valves (3”-12” in diameter):

   a) Non-rising stem type when installed underground and rising stem type otherwise.

   b) Valve stem seal of such design that allows replacement of O-rings with valve under pressure in the fully open position.

   c) Iron body, bronze mounted with resilient-seated wedge conforming to AWWA C 509.

   d) Resilient seat of styrene butadiene SBR or urethane rubber bonded to cast iron wedge.

   e) Stem seals of O-ring type.

   f) Buried valves equipped with 2-inch square operating nut and open counter-clockwise. Handwheel operator in vaults.

g) Exterior to be asphalt varnish or epoxy coated; interior ferrous metal parts to be epoxy coated, AWWA C550.

h) Acceptable Manufacturers: American Flow Control, or approved equal.

4. *Valve Boxes*: Standard 7-inch cast iron extension roadway type valve boxes shall be installed over buried valves. Screw threads shall be cast integrally with box wall. Welded screw threads are not acceptable.

G. Metering Vaults: Metering vaults shall be required whenever influent force mains greater than ten (10) inches are installed and where any size force main crosses the Township's boundary.

7.2 Installation

A. Pipe Installation:

1. *General*: All pipe shall be laid and maintained to the required lines and grades with fittings and valves at the required locations, spigots centered in bells, and all valves plumb. Pipe laying shall commence at the lowest point and proceed upgrade.

2. *Depth*: All force mains shall be buried at a minimum depth of 4 feet, measured from finished grade to the top of pipe.

3. *Construction Control*: During the installation of a force main, the pipe shall be laid at a constantly increasing grade to each high point, air valve, or point of discharge. The Extender shall provide sufficient construction control to ensure that there are no sags in the force main which could tend to accumulate air other than at the high points. Failure to comply with this requirement shall necessitate that the Extender take remedial steps to correct this situation. All associated costs shall be borne by the Extender.

4. *Cleaning Pipe and Fittings*: All lumps, blisters and excess coal tar coating shall be removed from the bell and spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wire-brushed and wiped clean and dry and free from oil and grease before the pipe is laid.

5. *Laying Pipe*: Every precaution shall be taken to prevent foreign material from entering the pipe while the pipe is being placed in the trench. If the pipe-laying crew cannot put the pipe into the trench and in place without allowing earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and let there until the connection is to be made into the adjacent pipe. During laying operations, no debris, tools, clothing or other material shall be placed in the pipe. After placing a length of pipe in the trench, the spigot end shall be centered in the bell or coupling and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the joints. Pipe and fittings, which do not allow a sufficient and uniform

space for joints, shall be removed and replaced with pipe and fittings of proper dimensions to ensure such uniform space.

6. *Jointing Ductile Iron Pipe*:

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

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

   If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after thorough cleaning.

   b) Push-On Type Joints: Make joints as recommended by the manufacturer so as to affect the joint seal.

7. *Joining PVC Pipe*: Make joints as recommended by the manufacturer so as to affect the joint seal.

B. Anchorage:

1. *Concrete Thrust Blocks*: Provide concrete thrust blocks for all fittings, and at all locations where horizontal and/or vertical deflections are made in the joints of the piping only by authorization of the Authority.

2. *Reaction Backing*: Reaction backing shall be PennDOT Class C concrete. Backing shall be placed between solid ground and the fitting to be anchored. The backing shall, unless otherwise indicated or directed, be so placed that the pipe and fitting joints will be accessible for repair.

3. *Metal Harness*: Metal harness of tie rods of adequate strength to prevent movement shall be used. Steel rods or clamps shall be type 304 stainless steel.

4. *Anchorage for Bends*: All bends deflecting 11.25 degrees or more on force mains 6 inches in diameter or greater shall be provided with a thrust restraint system to prevent movement.

   a) Either a restrained joint pipe or thrust block system (only by authorization of the Authority) will be permitted.

   b) Only a thrust block system will be used for PVC pipe.

c) Suitable metal rods shall be used only as directed by the Engineer.

d) Mechanical joint retainer glands shall not be used to obtain a restrained joint. Only ductile or SDR-8 Mega-Lug style joint glands or approved equal shall be installed.

C. Cleanout Installation: Cleanout manholes shall be installed every 2,000' and/or at low points, unless otherwise directed by the Engineer.

D. Setting Fittings and Valves:

1. *General*: Valves and fittings shall be set and jointed to pipe in the manner specified previously for cleaning, laying, and jointing pipe.

2. Provide a concrete manhole for every cleanout, air release, air and vacuum, and combination air release and air and vacuum valve. Manholes shall meet the required specified above for gravity Sanitary Sewers. The manholes shall be constructed to permit valve repairs and afford protection to the valve and pipe from impact where they pass through the manhole walls. All valves and fittings shall be supported by saddles. The saddles shall be continuous under all valves and fittings within the valve manholes.

7.3 Tests

A. Hydrostatic Tests:

1. *Pressure Test*: After the pipe has been laid and backfilled as specified, all newly laid pipe or any valved section thereof, shall be subjected to a hydrostatic pressure of 150 psi or 50% in excess of the normal working pressure, whichever is greater. Where any section of a main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least thirty days have elapsed after the concrete reaction backing was installed.

a) *Duration of Test*: Two hours.

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

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

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

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

   a) *Leakage Definition*: Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valve section thereof, to maintain pressure within 5 psi of the specified leakage test pressure after the pipe has been filled with water and the air expelled.

   b) *Permitted Leakage for Ductile Iron Pipe*: No pipe installed will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

   in which "L" equals the allowable leakage in gallons per hour; "S" is the length of pipeline tested in feet; "D" is the nominal diameter of the pipe, in inches, and "P" is the average test pressure during the leakage test, in pounds per square inch gauge. (The allowable leakage according to the formula is equivalent to 11.65 U. S. Gal. per 24 hours per mile of pipe per inch nominal diameter, for pipe in 18-foot lengths evaluated on a pressure basis of 150 psi). When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gallon per hour per inch of nominal valve size shall be allowed. There shall be no additional leakage allowed for service connections.

   c) Permitted Leakage for PVC Pipe: No pipe installed will be accepted until the leakage is less than the number of gallons per hour as determined by the following formula:

$$L = \frac{ND\sqrt{P}}{7{,}400}$$

   in which "L" equals the allowable leakage in gallons per hour; "N" is number of joints in the length of pipeline tested; "D" is the nominal diameter of the pipe, in inches; and "P" is the average test pressure during the leakage test, in pounds per square inch gauge.

   d) The Engineer will record both the makeup water and pressure at one-half hour intervals during the test period.

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

3. *Common Requirements*:

a) *Authority Presence*: The Authority or Authority Engineer shall monitor the pressure and leakage tests. The Extender shall notify the Authority of the test day at least 48 hours (two working days) in advance.

b) If testing fails to meet the test requirements, the Extender shall pay for all additional engineering personnel testing time.

c) *Weather*: No testing will be authorized unless air temperature is 35°F or higher.

d) *Field Joints*: All field joints of fittings and valves shall be exposed and examined during pressure and leakage test.

e) *Acceptance*: Observation of successful testing of force mains by the Authority 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 Authority Engineer may recommend final acceptance to the Authority. Only upon final inspection by the Authority and upon written acceptance for same will the system or portion thereof be considered acceptable. Upon such acceptance, the warranty period shall commence. If, during this final inspection, any irregularities are observed, the condition must be corrected at the Extender's expense prior to acceptance.

SECTION 8 – LOW-PRESSURE SEWER SYSTEMS

8.1 General: Low-pressure sewers shall not be installed without specific, written permission of the Authority.

8.2 Materials

A. Ductile Iron Pipe: Use ductile iron pipe conforming to ANSI A21.51 or AWWA C151, Latest Edition, for the material class or pressure designated and ANSI A21.50 or AWWA C150, Latest Edition, for wall thickness. Minimum wall thickness shall be Class 50 for 6-inch diameter and Class 51 for 3-inch and 4-inch diameter pipe except as may be required for flanged pipe or restrained joints. Use Special Class 53 pipe where flanged connections are required.

1. *Cement Mortar Linings*: Conform to ANSI A21.4 or AWWA C104, Latest Edition, except the thickness of linings should not be less than 1/8-inch.

2. *Corrosion-Resistant Linings*: Ductile iron pipe and fittings shall be lined (interior) with a corrosion-resistant ceramic-epoxy lining. The lining material shall be an amine-cured Novolac epoxy containing at least 20% by volume of ceramic quartz pigment. Interior lining shall be U.S. Pipe PROTECTO 401, or approved equal.

3. *Fittings*: Ductile or gray iron in accordance with the requirements set forth in ANSI A21.10 or AWWA C110, Latest Edition. All fittings shall be minimum Class 250 with cement lining and joints as required for pipe restraint. Iron fittings to be enclosed in pits, vaults, or manholes shall be of the short-body flanged type in order to minimize the size of the pits, vaults, and manholes.

4. *Joints*: Push-on type or mechanical joint type in accordance with ANSI A21.11 or AWWA C111, for all pipe except at changes in alignment, valves, tees, caps, and plugs not restrained with thrust blocking.

    a) Joints requiring pipe restraint and not restrained with thrust blocking shall be HP LOK or TR Flex as manufactured by U. S. Pipe; Flex Ring as manufactured by American Pipe; TR Flex or locked mechanical joint as manufactured by McWane Ductile; or approved equal.

    b) In addition to restrained joints, adequate tie rods shall be provided to develop full joint restraint and must extend to the adjacent fitting or joint as approved by the Authority.

    c) Mechanical joint retainer glands shall not be used. Only ductile or SDR-8 Mega-lug style joint glands or approved equal shall be installed.

    d) Prior to construction, joint restraint system details shall be submitted for Authority's review and approval.

B. Polyvinyl Chloride Pipe and Fittings (PVC):

1. *4-Inches and Greater Diameter*: PVC pipe conforming to AWWA C900 for working pressure of 200 psi.

   a) Fittings: As specified for ductile iron pipe.

2. *Less than 4-Inches Diameter*: PVC pipe conforming to ASTM D2241, SDR-21 except 1.5-inch pipe shall be SDR-26.

   a) Fittings: Compatible PVC fittings as recommended by pipe manufacturers, and of same class as the pipe.

3. *Joints*: Push-on type conforming to ASTM D3139.

   a) Solvent weld joints permitted only for special situations as approved by Engineer (e.g., bored service line highway crossings).

   b) PVC pipe joints shall be restrained at changes in alignment, valves, tees, caps, and plugs with thrust blocking.

   c) Split retainer flanges shall not be used in place of thrust blocks.

   d) Proposed joint restraint system shall be submitted for Engineer's review and approval.

C. Polyethylene Pipe and Fittings (PE):

1. *2-Inches through 6-Inches Diameter*: PE pipe conforming to ASTM D1248 and D3350, SDR-9, Type III, Grade P34, Category 5, and Plastic Pipe Institute Material Designation PE-3408.

   a) Joints: Thermal butt-fusion in accordance with ASTM D2657 and manufacturer's recommendations.

2. *Under 2-Inches Diameter*: PE pipe conforming to ASTM D1248 and D3350, SDR-11, Type III, Grade P34, Category 5, and Plastic Pipe Institute Material Designation PE-3408.

   a) Joints: Socket fusion type in accordance with ASTM D2657 and manufacturer's recommendations.

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

4. *Fittings*:

a) Under 4-Inches Diameter: SDR-11 molded polyethylene fittings of same class as the pipe.

b) 4-Inches through 6-Inches Diameter: As specified for cement-lined ductile-iron pipe.

D. Air Valves: The Authority reserves the right to require air valves, of any one of the following types, at any location in the force main.

1. *Sewage Air Release Valve*: Designed to automatically release air, gas or vapor under pressure during system operation. Valve design shall feature long body and float stem components so that the operating mechanism is kept free from contact with sewage during operation. Valve construction shall be as follows:

a) *Maximum Working Pressure Rating*: 75 psi or 150 psi.

b) *Valve Body and Cover*: Cast iron, ASTM A48, Class 35.

c) *Vent Orifice*: 5/16-inch for 75 psi and 3/16-inch for 150 psi.

d) *Discharge Orifice Seat, Mechanism and Valve Stem*: Stainless steel.

e) *Orifice Button*: Stainless steel and Buna-N, nitrile rubber ASTM SB800.

f) *Mechanism Lever Pins and Float*: High-strength stainless steel, ASTM A240.

g) *Backflushing and Cleaning Accessories*: Factory assembled to the valve and consisting of a shut-off valve at bottom inlet, a blow-off valve near the bottom of the valve body, quick disconnect couplings and shut-off valve at top of valve, and a 5-foot section of rubber hose with quick disconnect coupling.

h) *Acceptable Manufacturers*:

1) Val-Matic Valve and Manufacturing Corporation; Model No. 48 BWA.

2) Or Equal.

2. *Sewage Air and Vacuum Valve*: Designed to automatically exhaust large quantities of air during the filling of a system and to allow air to re-enter the system during draining or when a vacuum occurs. Valve design shall feature long body and float stem components so that the operating mechanism is kept free from contact with sewage during operation. Valve construction shall be as follows:

a) *Valve Body and Cover*: Cast iron, ASTM A48, Class 35.

b) *Inlet Size*: 2 inches.

c) *Discharge Orifice*: 2 inches.

d) *Float Stem and Guide*: Bronze, ASTM B584.

e) *Floats*: Stainless steel, ASTM A240.

f) *Orifice Seat*: Buna-N, nitrile rubber, ASTM SB800.

g) *Backflushing and Cleaning Accessories*: Factory assembled to the valve and consisting of an inlet shut-off valve, a 1-inch blow-off valve near the bottom of the valve body, quick disconnect couplings and a 1/2-shut-off valve at the top of valve, and a 5-foot section of rubber hose with quick disconnect coupling.

h) *Acceptable Manufacturers*:

1) Val-Matic Valve and Manufacturing Corporation; Model No. 300 Series.

2) Or Equal.

3. *Sewage Combination Air Release Valves*: Consisting of an air release valve and an air and vacuum valve factory piped into a compact assembly. The combination assembly shall automatically release air, gas or vapor under system operating pressure and shall also allow air to re-enter the system during draining or when a vacuum occurs. Combination valve designs shall feature long bodies and float stem components so that the operating mechanisms are kept free from contact with sewage during operation. Valve construction shall be as follows:

a) *Air Release Valve Maximum Working Pressure Rating*: 75 psi.

b) *Valve Bodies and Covers*: Cast iron, ASTM A48, Class 35.

c) *Inlet Size*: 2 inches.

d) *Air Release Outlet Size*: 1/2-inch, NPT.

e) *Vacuum Discharge/Outlet Size*: 2 inches.

f) *Air Release Valve Vent Orifice*: 5/16-inch.

g) *Air Release Valve Discharge Orifice Seat, Mechanism and Valve Stem*: Stainless steel.

h) *Air Release Valve Orifice Button*: Stainless steel and Buna-N, nitrile rubber, ASTM SB800.

i) *Air Release Valve Mechanism Lever Pins and Float*: High-strength stainless steel, ASTM A240.

j) *Air and Vacuum Valve Float Stem and Guide*: Bronze, ASTM B584.

k) *Air and Vacuum Valve Floats*: Stainless steel, ASTM A240.

l) *Air and Vacuum Valve Orifice Seat*: Buna-N, nitrile rubber, ASTM SB800.

m) *Backflushing and Cleaning Accessories*: Factory assembled to the combination valves and consisting of two inlet shut-off valves, two blow-off valves, two clear water inlet valves, and a 5-foot section of rubber hose and quick disconnect couplings.

n) *Acceptable Manufacturers*:

1) Val-Matic Valve and Manufacturing Corporation; Model No. 48 or 49/300 Series.
2) Or Equal.

E. Underground Warning Tape:

1. Printed polyethylene tape, 3 inches minimum width, magnetic for PVC pipe, green for force mains, one-inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types. Tape must be placed above all force mains (reference Standard Details).

F. Cleanouts:

1. Cleanouts shall be constructed as shown in the Standard Details. Valves shall be installed in each cleanout manhole.

G. Valves and Appurtenances:

1. *Valves*: Valves shall be installed on force main at locations shown in the Standard Details and as required by the Authority.

2. *Ball or Plug Valves*: Valves installed in valve/cleanout pits shall be actuated with a quarter turn type hand lever. Buried valves shall be actuated with an underground actuator through a cast iron valve box. Ball valves on individual properties shall be oriented with the seat in place for pressure. Valves 3-inch and larger shall be flanged end DeZurik Eccentric or equal. Valves 2-inch and 2½-inch shall be flanged end DeZurik Eccentric or equal. One and one half inch valves shall be screwed end DeZurik Eccentric or equal.

a) Valves shall open left (counter-clockwise).

b) Buried valves shall have 2-inch square cast iron operating nuts. Each valve shall also be supplied with a roadway type valve box.

c) Buried valves shall be supplied with mechanical joint end connections.

d) Valves located in vaults, pits, or manholes shall have flanged ends.

3. *Valve Boxes*: Standard 7-inch cast iron extension roadway type valve boxes shall be installed over buried valves and service line cleanouts in accordance with AWWA C500. Screw threads shall be cast integrally with box wall. Welded screw threads are not acceptable.

8.3 Installation

A. Pipe Installation:

1. *General*: All pipe shall be laid and maintained to the required lines and grades with fittings and valves at the required locations, spigots centered in bells, and all valves plumb. Pipe laying shall commence at the lowest point and proceed upgrade.

2. *Depth*: All low pressure force mains shall be buried at a minimum depth of 4 feet, measured from finished grade to the top of pipe.

3. *Construction Control*: During the installation of a force main, the pipe shall be laid at a constantly increasing grade to each high point, air valve, or point of discharge. The Extender shall provide sufficient construction control to ensure that there are no sags in the force main which could tend to accumulate air other than at the high points. Failure to comply with this requirement shall necessitate that the Extender take remedial steps to correct this situation. All associated costs shall be borne by the Extender.

4. *Cleaning Pipe and Fittings*: All lumps, blisters and excess coal tar coating shall be removed from the bell and spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wire-brushed and wiped clean and dry and free from oil and grease before the pipe is laid.

5. *Laying Pipe*: Every precaution shall be taken to prevent foreign material from entering the pipe while the pipe is being placed in the trench. If the pipe-laying crew cannot put the pipe into the trench and in place without allowing earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and let there until the connection is to be made into the adjacent pipe. During laying operations, no debris, tools, clothing or other material shall be placed in the pipe. After placing a length of pipe in the trench, the spigot end shall be centered in the bell or coupling and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the joints. Pipe and fittings, which do not allow a sufficient and uniform space for joints, shall be removed and replaced with pipe and fittings of proper dimensions to ensure such uniform space.

6. *Jointing Ductile Iron Pipe*:

   a) Mechanical Joints: The spigot end of the pipe shall be centrally located in the bell so that the rubber gasket is evenly seated. All loose rust or foreign matter shall be removed from the inside surfaces of the bell and outside surface of the

spigot prior to assembly. Bolts shall be tightened uniformly with a ratchet wrench so as to affect the joint seal. The normal range of bolt torques to be applied are:

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

If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after thorough cleaning.

b) Push-On Type Joints: Make joints as recommended by the manufacturer so as to affect the joint seal.

7. *Jointing PVC Pipe*: Make joints as recommended by the manufacturer so as to affect the joint seal.

8. *Jointing PE Pipe*: Make joints by thermal butt-fusion or socket fusion as recommended by manufacturer so as to affect the joint seal.

B. Service Connections:

1. *General*: Service connections to PE, PVC and ductile iron pipe over 3-inch diameter shall be made by tapping through saddles or another method approved by the Engineer. The saddles shall be wide and provide full 360 support against the pipe. U-bolt style saddles shall not be used.

2. *Saddles*: Provide saddles for different pipe materials as follows:

a) 4-inch and greater ductile iron – Style FAST as manufactured by Ford Meter Box Company, Inc., or equal.

b) 4-inch and 6-inch C-900 PVC - S90 brass saddles as manufactured by Ford Meter Box Company, Inc., or equal.

c) 3-inch PVC (pressure pipe) - Style 238 as manufactured by Smith-Blair or equal.

3. Service connections shall be made by installing tee fittings of compatible material and the same class as the low-pressure sewer main.

C. Setting Fittings And Valves:

1. *General*: Valves and fittings shall be set and jointed to pipe in the manner specified previously for cleaning, laying and jointing pipe.

2. Provide a precast concrete manhole for every cleanout, air release and vacuum valve meeting the requirements for manholes as previously specified. The

manholes shall be constructed to permit valve repairs and afford protection to the valve and pipe from impact where they pass through the manhole walls. All valves and fittings shall be supported by saddles as indicated on the Drawings. The saddles shall be continuous under all valves and fittings within the valve manholes.

D. Anchorage:

1. *Concrete Thrust Blocks*: Provide concrete thrust blocks for all fittings, and at all locations where horizontal and/or vertical deflections are made in the joints of the piping only by authorization of the Authority.

2. *Reaction Backing*: Reaction backing shall be PennDOT Class C concrete. Backing shall be placed between solid ground and the fitting to be anchored. The backing shall, unless otherwise indicated or directed, be so placed that the pipe and fitting joints will be accessible for repair.

3. *Metal Harness*: Metal harness of tie rods of adequate strength to prevent movement shall be used. Steel rods or clamps shall be Type 304 stainless steel.

4. *Anchorage for Bends*: All bends deflecting 11.25 degrees or more on force mains 6 inches in diameter or greater shall be provided with a thrust restraint system to prevent movement.

   a) Either a restrained joint pipe or thrust block system (only by authorization of the Authority) will be permitted.

   b) Only a thrust block system will be used for PVC pipe.

   c) Suitable metal rods shall be used only as directed by the Engineer.

   d) Mechanical joint retainer glands shall not be used to obtain a restrained joint. Only ductile or SDR-8 Mega-Lug style joint glands or approved equal shall be installed.

E. Cleanout Installation: Cleanout manholes shall be provided at each dead end and at 500-foot intervals (maximum) on long stretches of force main. Terminal cleanout manholes shall be used on all dead ends and at other locations as required by the Authority.

8.4 Tests

A. Hydrostatic Tests:

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

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

a) *Duration of Test*: Two hours.

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

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

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

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

a) *Leakage Definition*: Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valve section thereof, to maintain pressure within 5 psi of the specified leakage test pressure after the pipe has been filled with water and the air expelled.

b) *Permitted Leakage for Ductile Iron Pipe*: No pipe installed will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

in which "L" equals the allowable leakage in gallons per hour; "S" is the length of pipeline tested in feet; "D" is the nominal diameter of the pipe, in inches, and "P" is the average test pressure during the leakage test, in pounds per square inch gauge. (The allowable leakage according to the formula is equivalent to 11.65 U. S. Gal. per 24 hours per mile of pipe per inch nominal diameter, for pipe in 18-foot lengths evaluated on a pressure basis of 150 psi). When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gallon per hour per inch of nominal valve size shall be

allowed. There shall be no additional leakage allowed for service connections.

c) *Permitted Leakage for PVC Pipe*: No pipe installed will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{ND\sqrt{P}}{7{,}400}$$

in which "L" equals the allowable leakage in gallons per hour; "N" is number of joints in the length of pipeline tested; "D" is the nominal diameter of the pipe, in inches; and "P" is the average test pressure during the leakage test, in pounds per square inch gauge.

d) The Authority will record both the makeup water and pressure at one-half hour intervals during the test period.

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

3. *Common Requirements*:

a) *Authority Presence*: The Authority or Authority Engineer shall monitor the pressure and leakage tests. The Extender shall notify the Authority of the test day at least 48 hours (two working days) in advance.

b) If testing fails to meet the test requirements, the Extender shall pay for all additional engineering personnel testing time.

c) *Weather*: No testing will be authorized unless air temperature is 35°F or higher.

d) *Field Joints*: All field joints of fittings and valves shall be exposed and examined during pressure and leakage test.

e) *Acceptance*: Observation of successful testing of force mains by the Authority does not constitute acceptance of the system or any portion thereof. Upon completion of any determined portion of a total system, and successful testing thereof, the Engineer may recommend final acceptance to the Authority. Only upon final inspection by the Authority and upon written acceptance for same will the system or portion thereof be considered acceptable. Upon such acceptance, the warranty period shall commence. If, during this final inspection, any irregularities are observed, the condition must be corrected at the Extender's expense prior to acceptance.

SECTION 9 – RESTORATION AND CLEAN-UP OF SURFACE

9.1 Replacement of Property

The Extender shall restore (unless otherwise stipulated) all sidewalks, curbing, gutters, shrubbery, fences, poles, sod, markings, traffic lines, 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.

9.2 Pavement Restoration

Restoration of State Highways shall be in accordance with Pennsylvania rules and regulations, PennDOT requirements, and the provisions of the highway occupancy permit. Restoration of Township Streets and other paved surfaces shall be in accordance with the requirements of the Township.

9.3 Seeding Restoration

A. Lawn Restoration Materials:

1. *Permanent Seed Mixture*: PennDOT 408, Section 804, Formula B.

    a) *Kentucky Bluegrass Mixture*; a combination of improved certified varieties with no one variety exceeding 25 percent of the total Blue Grass component: 50 percent by weight.

    b) *Creeping Red Fescue or Chewings Fescue*: 30 percent by weight.

    c) *Perennial Ryegrass Mixture*; a combination of improved certified varieties with no one variety exceeding 50 percent of the total Ryegrass component: 20 percent by weight.

2. *Temporary Seed Mixture*: PennDOT 408, Section 804, Formula E. Annual Ryegrass: 100 percent.

3. Provide seed that complies with the Pennsylvania Seed Act of 1965, Act No. 187, and regulations of the Pennsylvania Department of Agriculture, Bureau of Plant Industry.

4. *Lime*: Pulverized agricultural limestone; PennDOT 408, Section 804.

5. *Mulching Material*: Oat or wheat straw, dry, free from weeds and foreign matters detrimental to plant life. Hay or chopped cornstalks are not acceptable.

6. *Mulching Material*: Wood cellulose fiber, free of growth or germination inhibiting ingredients.

7. *Planting Fertilizer*: Dry formulation of 10-20-20 analysis; PennDOT 408, Section 804.

8. *Slow-Release Nitrogen Fertilizer*: Dry formulation of 38-0-0 ureaform.

9. *Water*: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

B. Restoration of Lawns, Pastures, Meadows, and Cultivated Fields:

1. *General*:

a) Topsoil shall be screened free from subsoil, brush, weeds, or other litter, clay lumps and stones, but may contain decaying vegetable matter.

b) Comply with laws and regulations related to sediment and erosion control.

c) Seed shall be not more than two years old. Germination tests of seeds shall be made not more than six months prior to seeding. Do not use seed that has become wet, moldy, or otherwise damaged.

d) Submit all seed mixture formulas to the Authority for approval prior to seeding.

e) The Extender shall be responsible for seeding all areas of bare soil, which result from his construction operations, and for producing a stand of grass in all seeded areas. Erosion, drought, or any other condition will not relieve the Extender of this requirement.

2. *Lawns*:

a) Prior to construction, strip and stockpile the full depth of existing topsoil, but no less than six inches, from all areas to be disturbed.

b) Scarify top of trench backfill to minimum depth of two inches before placing topsoil.

c) Use stockpiled topsoil to bring the trench area to final grade.

d) If stockpiled topsoil is not sufficient to provide at least six inches of topsoil over area to be restored, import sufficient topsoil to provide such coverage.

e) Use topsoil in relatively dry state. Place during dry weather.

f) Fine grade topsoil eliminating rough or low areas.

g) Remove stone, roots, grass, weeds, debris, and foreign material from topsoil while spreading.

h) Manually spread topsoil around trees, plants, building, and paving to prevent damage.

i) Lightly compact placed topsoil. Use roller weighing no more than 120 pounds per foot of roller width.

j) Remove surplus subsoil and topsoil from site.

k) Leave stockpile area and site clean and raked, ready to receive landscaping.

l) *Grading tolerance*: Finished surface of topsoil shall not deviate by more than 1/2-inch up or down from a straight edge or stringline placed across the trench and held on existing grade on both sides of the trench.

m) Apply lime at the rate of 800 pounds per 1,000 square yards.

n) Do not apply fertilizer sooner than three days after lime application.

o) Apply planting fertilizer at the rate recommended by manufacturer. Apply fertilizer after raking topsoil smooth and prior to roller compaction. Do not apply fertilizer at the same time or with the same machine as will be used to apply seed.

p) After spreading of fertilizer is complete, apply peat moss to a depth of 1/4-inch over the area to be seeded.

q) Mix lime, fertilizer, and peat moss thoroughly into the upper two inches of topsoil.

r) Lightly water to aid the dispersion of fertilizer.

s) Apply seed at a rate of 21 pounds per 1,000 square yards evenly in two intersecting directions. Rake in lightly. Do not seed area in excess of that which can be mulched on same day.

t) *Planting season*: March 15 to June 1 and August 1 to October 15. Areas in which trench backfilling operations are completed in other time periods shall be seeded with annual Ryegrass (PennDOT 408, Section 804, Formula E at the rate of 10 pounds per 1,000 square yards to provide temporary protection. Permanent seeding shall then be applied later during the specified periods.

u) Do not sow seed immediately following rain, when ground is too dry, or during windy periods.

v) Roll seeded area with roller not exceeding 120 pounds per foot of roller width.

w) Immediately following seeding and compacting, apply mulch at the rate of 1,200 pounds per 1,000 square yards for straw or 320 pounds per 1,000 square yards for wood cellulose fiber.

x) If straw is used for mulch, anchor straw with emulsified asphalt binder or other material approved by Engineer.

y) Apply water with a fine spray immediately after each area has been mulched.

z) At completion of Extender's work, apply slow-release nitrogen fertilizer to all seeded areas at the rate of 50 pounds per 1,000 square yards.

aa) Re-seed areas that show bare spots prior to expiration of the Extender's warranty period.

3. *Pasture and Meadows*:

a) Prior to construction, strip and stockpile the full depth of the existing topsoil, but no less than 12 inches, from all areas to be disturbed. Use stockpiled topsoil to bring the trench area to final grade.

b) Remove all crushed stone and construction debris from the disturbed area.

c) *Planting season*: Perform seeding no later than the start of the next planting season following completion of trench backfilling. The planting season shall be as established by the U. S. Agricultural Service for the area of construction.

d) *Seed mixture*:

1) Timothy: 18%.

2) Orchard Grass (Pennlate or Pennmeade): 46%.

3) Redtop: 18%.

4) Kentucky Bluegrass: 18%.

e) Spread the seed using an approved seeding procedure at the rate of 22 to 25 pounds per acre.

4. *Cultivated Fields*:

a) Prior to construction, strip and stockpile the full depth of existing topsoil, but no less than 12 inches, from all areas to be disturbed.

b) Upon completion of construction, remove all crushed stone and other construction debris.

c) Use stockpiled topsoil to bring the trench area to final grade.

d) Scarify to minimum depth of 10 inches all areas that have been compacted as a result of construction operations.

SECTION 10 – CLEAN-UP AND MAINTENANCE DURING CONSTRUCTION WORK

10.1 Clean-Up

During construction, surfaces of all areas including, but not limited to, streets and driveways shall be maintained on a daily basis to produce a safe, desirable, and convenient condition.

A. Streets shall be swept and flushed after trench backfilling, and recleaned as dust, mud, stones, and debris caused by the work, or related to the work, again accumulates.

B. Failure of the Extender to perform this work shall be cause for the Authority to order the work to be done by others and to charge all costs to the Extender.

C. During construction, Contractor is required to provide the necessary materials and equipment to maintain dust control.

10.2 Repair or Correction of Unsatisfactory Conditions

Any subnormal or dangerous condition caused by the work, on any surface, shall be repaired and/or corrected within two hours of observation or notification of its existence. If repairs are not made with this two-hour period, the Authority shall cause to have the work completed and the resulting cost will be charged to the Extender.

10.3 Temporary Pavement

The Township and/or PennDOT may require that the Extender construct temporary pavement until conditions are suitable for placement of permanent pavement. The Extender shall continuously maintain temporary pavement until it is replaced with permanent pavement.

SECTION 11 – PERMANENT PUMPING STATIONS

11.1 General

A. Pump stations shall be poured-in-place concrete (not pre-cast). Pre-engineered and/or pre-fabricated pumping stations will be considered by the Authority on a case-by-case basis.

B. Only wet well/dry well type pumping stations will be considered acceptable. No submersible pumping stations will be considered acceptable (except grinder pumps, see Section 12). All pumping station designs, uses, and installations must be approved by the Authority. The design of the pump station shall include materials and equipment necessary to make the pump station facilities vandalism-proof.

C. Extender shall meet all Federal, State, and local laws, regulations, and codes applicable to pump station, building, site design and construction and shall meet all requirements of the Commonwealth of Pennsylvania "Domestic Wastewater Facilities Manual", latest edition. All required permits and approvals shall be obtained and paid for by the Developer.

1. Essential Facility: Pumping station and the associated building shall be considered an essential facility and shall be designed for time increased importance factor and other special provisions dictated by the building code.

D. When a sinkhole is discovered before, during, or after construction, the Authority must be notified immediately. Remediation of the sinkhole will proceed under the supervision of a geotechnical Professional Engineer, registered with the Commonwealth of Pennsylvania at the Extender's expense.

11.2 Extender's Warranty

A. The Extender shall warrant the pumping station equipment, materials, and workmanship for a period of 12 months following the date that the pumping station is dedicated to the Authority. Any equipment or materials manufacturer warranties that extend beyond this 12-month warranty period shall be transferred from the Extender to the Authority.

11.3 Submittals

A. Three sets of complete construction drawings, structural calculations, geotechnical soils reports, specifications, and hydraulic computations for the pumping station shall be submitted to the Engineer for approval. All drawings, structural calculations, reports, specifications, and hydraulic computations shall be prepared, signed, and sealed by a Professional Engineer registered in the Commonwealth of Pennsylvania.

B. Five copies of each of the following items shall be submitted to the Engineer for approval prior to installation, except Final Operation and Maintenance Manuals, which shall be submitted prior to dedication of the pumping station to the Authority:

1. *Shop Drawings*: Submit approved manufacturer's assembly-type shop drawings indicating dimensions, weights, required clearances, and methods of assembly of components.

2. *Product Data*: Submit manufacturer's technical product data, including installation and start-up instructions, furnished specialties, and accessories.

3. *Wiring Diagrams*: Submit manufacturer's electrical requirements for pumping station, including ladder wiring diagrams for interlock and control wiring. Clearly indicate required field connections.

4. *Maintenance Data*: Submit maintenance data and parts lists for all pumping station equipment, controls, and accessories. Include lubrication schedule that shows recommended frequency and type of lubrication for each equipment item. Include trouble-shooting guide for each piece of equipment.

5. *Preliminary Operation and Maintenance Manuals*: Submit three (3) copies of O&M Manuals containing all items listed above under Paragraph 11.3.B prior to start-up of any equipment. The manuals shall be organized so that all data for given equipment item is contained in a single section of the manual. Dividers shall be provided to identify the various sections. For major equipment items, a separate manual may be provided in lieu of a separate section within a larger manual.

6. *Final Operation and Maintenance Manuals*: Submit five complete copies of the Final O&M Manuals only after successful start-up of equipment and acceptance by Engineer and Authority. Final O&M Manuals must be submitted to Authority prior to dedication of pump station. The Final O&M Manuals shall be a resubmission of the Preliminary O&M Manual with corrections made per Engineer's comments and all information updated to "As-Built" conditions. Include the following materials in the manuals for each piece of equipment supplied:

   a) Equipment name, location, and number of units.

   b) Manufacturer's name, address, and phone number.

   c) Name, address, and phone number of the nearest certified manufacturer's representative.

   d) Nameplate data for basic unit as well as components such as motor and drive.

   e) Approved Shop Drawings, corrected to as-built conditions.

   f) Manufacturer's bulletins, schematics, diagrams, and supplemental material which is necessary to provide a complete functional description of the subject

equipment and component parts including basic configuration and nomenclature; operating principles and characteristics including test data and performance curves where applicable; dimension drawings; and capacity or conditions of service.

1) If the manufacturer's bulletins cover more than one size, model, or configuration, clearly indicate the information covering the specific unit or units supplied under this Contract.

g) Detailed written procedures to be used for all modes of operation including any precautions for personal safety or for prevention of damage to the equipment. This includes initial start-up, normal operation, emergency operation, shutdown, and restarting. Describe required operating checks, calibration, and field performance measurements.

h) Guides to testing and troubleshooting. Include a chart giving symptoms, probable cause, and remedies.

i) Instructions with easily understood schematics or diagrams for disassembling and assembling the equipment for overhaul and repair.

j) A lubricating schedule showing lubrication point, frequency, and recommended lubricant, including one or more major brand alternates. Include lubrication recommendations for periods when equipment is in standby or storage.

k) Recommended preventive maintenance measures and frequency of performance. Describe each recommended maintenance measure in terms of procedure, tools, parts, materials, or test equipment necessary to perform the procedure.

l) Complete parts list with parts assembly drawing (preferably by exploded view), recommended list of spare parts to be kept "in stock", and ordering information.

m) Identification of any special tools required for proper maintenance.

n) Any additional information required to maintain equipment warranty.

o) For equipment that will function as part of a system, assemble data in a manner that describes the operation and maintenance of the entire system. Provide systems information described below, corrected to as-built conditions:

1) Process and instrumentation drawings.

2) Ladder diagrams.

3) Wiring diagrams including one-line diagrams, schematic or elementary diagrams, and terminal board identification diagrams.

4) Piping and interconnection drawings.

5) Circuit board schematics with components' models and descriptions.

11.4 Site Work

A. No construction work shall commence until all plans have been reviewed and all items addressed in the review have been resolved.

B. Prior to the start of any construction, the Extender shall prepare an Erosion and Sedimentation Control Plan for the site and shall obtain approval of this Plan from the Chester County Soil Conservation District. The Plan must be available at the site at all times during construction. The Extender shall comply with the Plan and with any supplementary instructions from regulatory agencies having jurisdiction.

C. The pumping station building shall be located on a separate lot with minimum area of 7,500 square feet. No portion of the building superstructure shall be closer than 15 feet to any property line or as required by any applicable subdivision/zoning ordinance, whichever results in the most stringent requirement.

D. The finished grade slope on any portion of the pumping station lot shall be no steeper than 10 percent and all unpaved areas outside the building (areas which will be seeded) shall be accessible by 24-inch wide mower. The lot shall be graded to prevent erosion of soils on the lot and in areas adjacent to the lot. Ditches, swales, culverts, and riprap shall be provided where necessary to prevent erosion and control storm runoff. Finished grade of all lot areas shall be a minimum of 2 feet above the 100-year flood elevation.

E. Access to the pumping station lot shall be provided by a minimum 14-foot wide paved access road. The extent of pavement around the pumping station building shall be as approved or directed by the Authority. Paving shall consist of, as a minimum, 6 inches of compacted PennDOT 2A coarse aggregate, 4 inches of Superpave 25 mm PG64-22 0.3 to 1.0 million ESALs, and 2 inches of Superpave 9.5 mm PG64-22 0.3 to 1.0 million ESALs SRL-M. All materials used in pavement construction shall meet the requirements of Commonwealth of Pennsylvania, Department of Transportation (PennDOT) Specifications, Publication 408 (PennDOT 408), latest edition, and shall be obtained from a source approved by PennDOT.

F. If the Authority deems necessary, the entire lot shall be fenced with a PVC-coated steel chain link fence constructed to a height of 6 feet. The fence shall be topped with three (3) strands of barbwire. The fence shall include a lockable chain link double swing gate with minimum clear opening of 12 feet. Locks shall match existing Upper Uwchlan Municipal Authority standards.

G. At completion of construction, all unpaved areas outside the building shall be topsoiled, limed, fertilized, seeded, and mulched in accordance with Section 9, Paragraph 9.3.A, 9.3.B.1, and 9.3.B.2. Prior to the start of seeding, specifications for liming, fertilizing, seeding, and mulching shall be submitted to and approved by the

Authority. The seeding shall be covered by the Developer's one-year warranty and the Developer shall re-seed any areas where a healthy stand of grass has failed to develop during the warranty period.

H. Where necessary, the Authority will require that landscaping be used to screen the pumping station from streets and adjacent properties or to otherwise improve the appearance of the pumping station lot. The Developer shall submit the landscaping plan to the Authority for approval. Landscaping shall be covered by the Developer's one-year warranty and the Developer shall replant trees, shrubs, and ground cover which have died or otherwise failed to develop properly.

I. Underground water and sewer lines associated with the pumping station shall be installed in accordance with the Authority's Sewer and Water System Regulations and Technical Specifications (latest revision). Electric and telephone service entrances and underground electric and telephone lines shall be installed in accordance with the appropriate Utility Company's requirements. Developer shall make arrangements for and pay for all service entrances, lines, and connections required to serve the pumping station.

11.5 Structural Excavation and Backfill

A. All excavation operations shall comply with OSHA rules and regulations. Excavations shall be sheeted and shored where required to meet OSHA rules and regulations and where required to protect property and improvements adjacent to the pumping station lot.

B. Prior to the start of excavation operations, all topsoil shall be stripped from the excavation areas. Topsoil shall be stockpiled, in accordance with Chester County's Erosion and Sedimentation and Pollution Control Plan requirements, and replaced to a minimum depth of 6 inches on all areas to be seeded. All materials other than topsoil, which were cleared from the pumping station lot before starting excavation operations, shall be disposed of legally off the pumping station site at the expense of the Extender. On-site burning of cleared materials will not be permitted.

C. Blasting during clearing and excavation operations will be allowed only if prior permit is obtained, on a case-by-case basis, from the Engineer. If allowed, 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.

D. Structural backfill may consist of excavated material approved for re-use by the Engineer. Structural backfill shall contain no stones larger than 4 inches in any dimension. If material excavated on the pumping station site is not approved for use as structural backfill by the Authority, the Extender shall import suitable backfill. Where warranted by poor soil conditions, the Engineer may require that the structural excavations be backfilled with PennDOT 2B aggregate.

E. Prior to the construction of concrete foundations within the excavation(s), the entire bottom of the excavation shall be covered with a minimum 8-inch thick compacted layer of PennDOT 2B or AASHTO No. 57 coarse aggregate.

F. The Extender shall submit a list of and specifications for the compaction equipment to be used for backfill compaction. In no case shall backfill be placed in lift thicknesses which exceed the equipment's compaction capability as specified by the equipment manufacturer for a given soil type. Maximum lift thickness, regardless of the equipment used, shall be 12 inches. Backfill shall be compacted to a minimum of 98 percent of standard Proctor density as determined by ASTM D698.

11.6 Structural Concrete

A. The entire pumping station substructure, including footings, foundation walls, frost walls, wet wells, dry wells, channels, stairwells, exterior stairs, and at-grade slabs, shall be constructed of reinforced concrete.

B. Concrete shall meet the PennDOT 408 requirements for Class AAA concrete and shall be obtained from a source approved by PennDOT. Portland cement used for all concrete shall be ASTM C150 Type II.

C. Reinforcing steel used in all reinforced concrete shall be deformed steel bars meeting the requirements of ASTM A615 Grade 60. Welded wire fabric, if approved by the Authority for use as reinforcing, shall meet the requirements of ASTM A185.

D. Reinforced concrete shall be designed in accordance with ACI 318 "Building Code Requirements for Reinforced Concrete" (latest edition), ACI 350 "Environmental Engineering Concrete Structures" (latest edition), and local building codes. The strictest requirement shall govern when differing provisions are encountered. Concrete structures shall be designed to prevent uplift and flotation (minimum Factor of Safety = 1.2) when the structure is empty and the surrounding soil is saturated to finished grade. Concrete foundation shall be designed for allowable soil bearing/bedding and to minimize differential settlement.

E. Concrete shall be placed, consolidated, and cured in accordance with the requirements of the latest editions of ACI standards 304R, 305R, 306.1, 308, and 309R.

F. Access to the main floor of the pump station shall be 6" above finished grade elevation. Access to the pump level of the dry well shall be provided by means of aluminum stairs with I-bar grating tread. Access to the influent level of the wet well (bar screen, grinder, and flow measurement channel) shall be provided by means of an exterior reinforced concrete stairwell or a stainless steel ladder assembly with safety climbing equipment. Minimum clear width of all stairs shall be 3 feet.

G. The substructure shall be designed to facilitate removal of all pumps and grinders from the wells to a position on the at-grade floor from which these equipment units can then be easily moved to a paved area outside the pumping station. (Refer to Section 11.10.E)

H. The entire interior surface of wet wells and all other concrete surfaces which will be in contact with sewage shall be coated as follows:

1. Surface Preparation: Use dry abrasive blasting equipment with a compressed air blast nozzle. Perform abrasive blast cleaning to open up surface voids and remove laitance. Do not expose aggregate. After abrasive blasting, clean surface by vacuuming.

2. First and Second Coats: Refer to Section 11.19.F.

11.7 Structural Steel

A. Structural steel shapes shall meet the requirements of ASTM A36. Structural steel tubing shall meet the requirements of ASTM A500.

B. Steel shall be welded in accordance with AWS D1.1.

C. Structural steel shall be designed, fabricated, and erected in accordance with AISC Specifications.

D. Structural steel shall be coated as follows:

1. Interior-nonsubmerged:

a) *Surface preparation*: SSPC-SP6, Commercial Blast Cleaning.

b) *First Coat*: Tnemec 66-121 Epoxoline Primer, 3.0 – 5.0 mils dry film thickness.

c) *Second Coat*: Tnemec 66-Color High Build Epoxoline, 4.0 – 6.0 mils dry film thickness.

2. Interior/Exterior – In contact with sewage or water (color required):

a) Surface Preparation: SSPC SP10 Near White Blast Cleaning.

b) First Coat: Tnemec 104-1255 Hi-Solids Epoxy, 6.0 – 8.0 mils dry film thickness.

c) Second Coat: Tnemec 104-Color Hi-Solids Epoxy, 6.0 – 8.0 mils dry film thickness.

3. For steel that is not exposed in the finished work, the second coat will not be required.

4. Where approved by the Engineer, galvanizing may be substituted for painting. Structural steel shall be galvanized in accordance with ASTM A123 to provide a minimum of 1.25 ounces per square foot of galvanized coating on all surfaces.

11.8 Control Building Design and Components

A. The Control Building shall be segregated into 3 separate rooms as follows: Control/Generator Room; Chemical Room; and Toilet Room. Ceiling height shall be a minimum of 10 feet but in no case less than required to allow for proper generator ventilation and exhaust. The building shall have sufficient floor space to provide equipment manufacturers' minimum specified repair and maintenance clearances.

1. The Control/Generator Room shall be designed to provide sufficient interior space for pumping system control panels, variable frequency drives (if applicable), sewage grinder hydraulic drive unit and control panel, emergency generator and automatic transfer switch, circular chart recorder, auto dialer, and any other necessary control equipment as well as required heating, ventilating, lighting and electrical equipment.

2. The Chemical Room shall be designed to provide sufficient interior space for the chemical feed system specified subsequently in this Section, as well as required heating, ventilating, lighting and electrical equipment.

3. The Toilet Room shall be designed to provide sufficient interior space for a toilet and lavatory as specified subsequently in this Section, as well as required heating, ventilating, lighting and electrical equipment.

B. Walls: Building walls shall be masonry wall construction, as directed by the Authority, and shall consist of the following components:

1. *Interior Wall*: Minimum 8-inch sound-absorbing concrete masonry units (CMUs); Proudfoot Soundblox Type RSC. The requirement for sound-absorbing CMUs will be waived only under the following conditions:

   a) The generator is located in a room separated from the rest of the pumping station superstructure and the generator room is constructed of sound-absorbing CMUs; and

   b) The pump motors are located within the dry well.

2. *Cavity*: The cavity located between the interior and exterior walls shall be approximately 1.5 inches wide. The cavity shall contain 1-inch thick polystyrene board insulation securely fastened to the interior CMU wall. Through-wall flashing and weepholes shall be used to convey water collecting at the bottom of the walls to the exterior of the building.

3. *Exterior Wall*: The exterior walls shall be constructed of a material as selected by the Authority as follows:

   a) Brick and block cavity wall with 8" CMU, 1½" cavity with 1" insulation, and 4" face brick. The brick color and style shall be as selected by the Authority.

b) 10” split-faced block minimum with core insulation. The block color and style shall be as selected by the Authority.

c) Stucco finished wall consisting of 8” CMU minimum with core insulation and stucco exterior finish with construction details per manufacturer and as approved by Authority. The stucco color and finish style shall be as selected by the Authority.

d) Masonry wall consisting of 8” CMU wall minimum with core insulation. The exterior color shall be as selected by the Authority. The exterior wall shall be painted as follows:

1) Surface Preparation: Surface shall be clean and dry.

2) First and Second Coat (Authority to select to suit project): 156-Enviro-Crete matte smooth texture, 4.0 – 8.0 mils; 157-Enviro-Crete matte sand texture, 6.0 – 9.0 mils; 180-W.B. Tneme-Crete flat decorative smooth texture, 4.0 – 10.0 mils; and 181-W.B. Tneme-Crete flat decorative sand texture, 4.0 – 10.0 mils.

4. *Wall Reinforcing*: Masonry wall or cavity wall reinforcing shall be galvanized truss type with box ties for tying brick wall to CMU wall if required. Reinforcing shall be horizontally continuous and shall be located in every other CMU course.

5. *Bond Beams*: A continuous bond beam shall be installed as the top course of all CMU walls. The bond beam shall be reinforced with two (2) No. 5 deformed steel bars and shall be filled with coarse sand/cement grout. Anchors for the wall cap plate shall be embedded in the bond beam. The cap plate shall be 2-inch thick (nominal) SPIB Utility Grade wood treated with CCA preservative to 0.25 pounds/cubic foot retention in accordance with AWPA standards.

6. *Grout*: As a minimum, fill CMUs adjacent to all wall openings and at all corners with Portland/cement grout and No. 5 bar doweled into foundation or concrete substructure.

7. *Lintels*: Lintels over all wall openings in CMU walls shall be steel bar reinforced precast concrete with minimum 28-day compressive strength of 3,000 psi. Minimum bearing length on each side of opening shall be 8 inches. Steel bar reinforced precast concrete lintels shall be as manufactured by York Lintel & Cast Stone, Inc., Nitterhouse Concrete Products, Inc., Pennsylvania Precast Concrete Company, Associated Products Company, or equal.

a) Lintels for cavity walls shall consist of two (2) 4” wide x 8” high precast with #5 bar top and bottom and a steel angle 5” x 3½” x 5/16” with long leg vertical to support the brick.

b) Lintels for split-faced block walls shall consist of a 6” wide x 8” high precast with two (2) #5 bars top and bottom and a steel angle 5” x 3½” x 5/16” with long leg vertical to support a 4” wide split-faced block facing.

8. Vertical wall reinforcement shall be provided in accordance with the Building Code, but shall not be less than #5 reinforcing steel bars spaced at 48" centers. Grout block cores at reinforcing as noted in 11.8.B.6 above.

9. Provide preformed vinyl base where walls meet floor in the Toilet Room.

C. Floor: Cast in place concrete with minimum 6" thickness on bed of 8" minimum thickness compacted PennDOT 2A or AASHTO No. 57 aggregate. Concrete shall have a minimum compressive strength of 4,000 psi at 28 days, and shall contain 4" x 4" welded wire fabric. Provide 1/2" preformed expansion joint all around. Floor shall be finished with concrete sealer and chemical hardener.

D. Roof Trusses:

1. Roof trusses shall be designed by a professional engineer, registered in the Commonwealth of Pennsylvania, and shall be fabricated in accordance with the more stringent published standards of the National Forest Products Association and the Truss Plate Institute's TPI-85 standard or in accordance with the International Building Code 2018 or latest edition. Trusses are to be designed for the following minimum loads:

   a) Top chord dead load: 10 psf.

   b) Top chord live load: 30 psf (both balanced, unbalanced, and drifting snow conditions).

   c) Bottom chord dead load: 6 psf.

   d) Bottom chord live load: 10 psf.

   e) Wind load: As required by local building code.

   f) Duration-of-load factor, snow: 1.15.

   g) Duration-of-load factor, wind: 1.33.

   h) Add truss dead loads to the dead loads specified above.

2. Minimum size of any truss member: 2-inch x 4-inch.

3. Provide lateral and diagonal truss bracing in accordance with TPI's "Bracing Wood Trusses: Commentary and Recommendations". Minimum brace size shall be 2-inch x 4-inch.

4. Truss connection loading requirements:

   a) Shear load of 200 pounds per connection.

   b) Uplift load of 120 pounds per connection.

5. Provide hurricane hold-down mechanical connections at each truss bearing location.

E. Roofing shall consist of the following components:

1. Minimum 23/32-inch; APA Rated Sheathing 32/16, Exposure 1.

2. Unperforated No. 15 asphalt felt underlayment; ASTM D226, Type 1.

3. Fiberglass-base asphalt shingles, minimum 240 pounds per square; ASTM D3018, Type I, and ASTM D3462. Shingles shall have UL Class A fire rating and UL wind resistance label. Color and pattern will be selected by Authority from manufacturer's standard range.

4. *Ridge Vent*: Ply Gem aluminum.

5. *Soffit*: Vented aluminum with minimum metal thickness of 0.019 inches; Ply Gem.

6. *Fascia*: 1" x 8" wrapped with aluminum.

7. *Siding*: 4" vinyl siding shall be installed on each gable end. Color shall be selected by Authority.

8. *Insulation*: 9 ½" batt.

F. Roof Drainage System: Five-inch OG aluminum gutters with minimum metal thickness of 0.032 inches and 2 x 3-inch aluminum downspouts with minimum metal thickness of 0.024 inches; as manufactured by Ply Gem. Downspout shall discharge into a precast concrete splash block.

G. Ceiling: Minimum 5/8-inch thick gypsum board; ASTM C36; USG 200 Series or equal. Ceiling shall be painted with color as selected by Authority:

H. Attic Insulation: Minimum 9.5-inch thick unfaced fiberglass batt insulation; ASTM C855, Type I.

I. Doors and Frames:

1. Provide double doors with minimum clear opening of 6 feet. Locate and size doors so that all pumping station equipment units can be moved to the outside of building directly onto a paved area. Minimum door height shall be 7 feet, except that monorail doors shall be higher to accommodate the monorail projecting through the door opening. Monorail doors shall be equipped with weathertight seals surrounding the monorail. The dry well access door may be a single door, which shall be equipped with hardware similar to that specified for double doors. Minimum clear opening for a single door shall be 3 feet wide by 6 feet 8 inches high.

2. *Doors*: Insulated hollow metal (steel) doors meeting the requirements for SDI-100 Grade III doors.

3. *Frames*: Provide welded steel frames with minimum metal thickness of 16 gage and mitered corners. After installation, fill frames with fine sand/cement grout.

4. *Hardware*: Equip each double door with the hardware as follows:

   a) Three pairs hinges; TB 2314, 4.5 x 4.5 inches, US26D finish, NRP; McKinney.

   b) One panic rim exit device with overlapping strike; 372 x 33K x SNB; Corbin Russwin.

   c) Two surface bolts attached to interior of inactive leaf; Ives.

   d) One flat stainless steel astragal attached to exterior of active leaf.

   e) Two kickplates; 0.05-inch stainless steel, 8 inches high x door width minus 2 inches; Ives.

   f) One door closer attached to active leaf; P2810 BH-4-SBL; Corbin Russwin.

   g) One aluminum threshold; 185 AV; Pemko.

   h) One set of weather-stripping; 303 AV; Pemko.

   i) Locks and keys: As directed by the Authority.

J. Painting:

1. *Interior CMU Walls*: Tnemec 54-562 Fine Masonry Filler applied at the rate of 60 to 80 SF/gal followed by two coats of Tnemec 66-Color HiBuild Epoxoline at 4 to 6 mils DFT per coat.

2. *Gypsum Board Ceiling*: Tnemec 51-792 PVA Sealer at 1 to 2 mils DFT followed by two coats of Series 113 (Satin)/114 (Gloss)-Color Tnemec Tufcoat at 4 to 6 mils DFT per coat.

3. *Interior Wood Trim*: Tnemec 10-99 Tnemec Primer at 2 to 3.5 mils DFT followed by two coats of Tnemec 23-Color Enduratone at 1.5 to 3 mils DFT per coat.

4. *Doors*: Tnemec 104-1255 Hi-Solids Epoxy at 6 to 8 mils DFT followed by one coat of Tnemec 104-Color High Solids Epoxy at 6 to 8 mils DFT.

K. Fire Extinguishers: Provide a minimum of two (2) 10-pound multi-purpose dry-chemical fire extinguishers with UL rating of 4A, 60B, C equipped with pressure gage, fully filled and ready for use. Mount on interior walls of building at locations directed by the Authority.

L. Dehumidifier: A dehumidifier shall be provided in the pump room. The dehumidifier shall be of the automatic refrigeration type, with auto-humidistat, circulation fan, compressor, coil, and a capacity of 24 pints per 24 hours at 80°F and 60 percent relative humidity. The unit shall operate on 120-volt service. The drain shall be piped into the sump.

11.9 Metal Fabrications

A. Access Hatches: Aluminum; Bilco Type J (single leaf) or Type JD (double leaf), Halliday Products Model W2S, or equal.

B. Railing:

1. Design railing in accordance with local building codes. If there are no codes directly applicable to railing, design in accordance with the BOCA Building Code (latest edition) requirements for guards and handrails.

2. Railing shall be all-welded 1.5-inch diameter (minimum) 40-gage (minimum) aluminum pipe set to a minimum depth of 6 inches in concrete and secured with non-shrink, non-metallic grout.

C. Grating: Grating shall be aluminum I-bar type designed to provide a maximum deflection of 0.25 inch under a concentrated load of 300 pounds at mid-span and under a uniform load of 150 pounds per square foot (two loads not applied simultaneously). Grating shall be banded at each end of each panel. Grating shall be supported by aluminum angles set in and anchored to the concrete slab.

D. Ladder: Design ladder to meet ANSI A14.3 “American National Standard for Fixed Ladders” (latest edition) and the local building code.

E. Interior Stairs: Design stairs to meet ANSI A1264.1 “American National Standard Safety Requirements for Workplace Floor and Wall Openings, Stairs and Railing Systems” (latest edition) and the local building code.

11.10 Equipment

A. Sewage Pumps:

1. The pump system shall include a minimum of two (2) pumps and shall be designed to handle the peak instantaneous flow, tributary to the pump station, in accordance with Commonwealth of Pennsylvania, Department of Environmental Protection “Domestic Wastewater Facilities Manual”. When peak instantaneous flow exceeds one million gallons per day (1.0 MGD), the pumping system shall include a minimum of three (3) pumps. The pump system shall also be designed to handle the peak instantaneous flow with the largest pump out of operation. Flow used for design purposes shall be peak instantaneous flow projected 20 years into the future.

2. Minimum pump efficiency shall be 70 percent. Exceptions to this requirement will be granted by the Authority only if it can be shown, using manufacturer's data, that this efficiency cannot be achieved with pumps of the required capacity and of the specific type and manufacturer required by the Authority's rules and regulations.

3. Pumps shall be one of the following, but all sewage pumps within a given pumping station shall be of the same type and by the same manufacturer:

    a) Submersible centrifugal non-clog pumps specifically designed for installation in a dry pit: Xylem Flygt, Type CT.

    b) Vertical non-clog dry-pit centrifugal pumps with extended shaft and motors installed on the main pumping station floor: Xylem Flygt AC Pump Type NSWV.

4. Submersible pumps shall be of the air filled type and shall be equipped with a cooling jacket unless the Developer submits, to the Authority, the manufacturer's certification stating that a cooling jacket is not required. Jackets shall provide cooling action by circulating the pumped liquid around the motor. The cooling jacket shall also be equipped with fittings to provide for future use of an external source of cooling liquid.

5. Vertical dry-pit pumps shall be equipped with a packing gland and lantern ring sealing system which uses an external source of clear water for lubricating and flushing the seal. The Developer shall make all provisions for conveying clear water to the pump seal, including piping, valves, pressure regulator, pressure gage, and, if an existing source of clear water is not available at the site, a water well specifically installed for the purpose of providing seal water. Requests for use of proprietary sealing systems, not requiring an external source of water, will be considered by the Authority on a case-by-case basis. Shaft and coupling guards shall be provided and shall meet OSHA requirements.

6. Maximum rotational speed for all pumps shall be 1,800 rpm.

7. All pumps shall be equipped with a seal leakage detector system.

8. *Submittals*: Developer shall submit the following items to the Authority:

    a) Certified pump curves showing head vs. flow, efficiency, NPSHR, horsepower, and shutoff head. Pump curves shall be developed from factory tests performed in accordance with Hydraulic Institute Standards. Pump curves shall be shown on the design plans.

    b) For extended shaft installations, computations to determine extended shaft diameter and the need for intermediate shaft supports.

    c) Two shaft sleeves, two sets of packing glands and two lantern rings for each pump.

d) Two complete sets of bearings for each pump.

e) One replacement impeller for each pump.

f) Any special tools required for pump maintenance and disassembly.

g) Manufacturer's standard municipal 5-year materials and workmanship warranty.

B. Sewage Pump Motors:

1. Provide squirrel-cage, premium-efficiency induction motors. All motors shall be inverter duty rated for use with a variable frequency drive.

2. *Insulation System*: Class F.

3. *Temperature Rise Rating*: Class B.

4. *Enclosure*: Provide submersible, explosion-proof enclosures for submersible pumps rated for operation in a Class I, Division 1, Group D hazardous atmosphere, temperature code T3C.

5. *Service Factor*: 1.15; the service factor shall be reserved for the Authority's protection. The motors shall not be loaded beyond their nameplate horsepower rating at any point throughout the entire operating range of the certified pump curve.

6. Design pumps for continuous duty under full load and to sustain a minimum of 15 starts per hour.

7. Equip motors with heavy-duty lifting lugs that will, in the case of submersible pumps, support the entire pump/motor assembly.

8. Equip pumps with sealed ball bearings designed for a minimum L_{10} life of 40,000 hours.

9. Locate conduit box so that it will be accessible in the final installation.

10. *Power Supply*: 240/480 volts AC, 3 phase, 60 Hz.

11. Equip each pump with a stainless steel nameplate that is visible in the final installation and which shows, as a minimum, the following information: manufacturer's name and address; type or style, model designation, serial number and catalog number; horsepower rating; speed in rpm; full-load current; voltage; frequency; number of phases; time rating; maximum ambient temperature; insulation class code number; power factor; and service factor.

12. Motor field windings shall be supplied with two normally closed over-temperature contacts that will open on high temperature.

C. Grinder:

1. A sewage grinder shall be installed in the influent channel of the pumping station. The grinder, and the channel in which it is installed, shall be sized to handle the peak instantaneous flow.

2. The grinder shall meet the following JWC Environmental channel units: 30000 Series; 40000 Series; Model CMD; or Model CDD. The grinder unit shall be driven by a JWC Environmental hydraulic drive unit equipped with the standard controller. The hydraulic drive unit shall be mounted on the main (at-grade) floor of the pumping station. The Franklin-Miller Taskmasters will be considered during the review process.

3. The grinder shall be mounted in a frame fabricated from Type 304 stainless steel and shall be designed to facilitate removal of the channel by lifting the grinder vertically out of the frame. Unless the station arrangement is such that the grinder can be lifted to the main floor by the station monorail system, a jib crane/manual winch system, provided by the grinder manufacturer, shall be installed to lift the grinder to main floor.

4. In addition to the straight-through grinder channel, a grinder bypass channel, sized to handle the peak instantaneous flow, shall be provided. A sloped aluminum bar screen shall be installed in the bypass channel and a perforated aluminum plate, designed for temporary storage of material removed from the bar screen, shall be installed in a horizontal orientation above the bar screen. The bypass channel shall be isolated from the grinder channel by removable aluminum stop plates.

D. Sump Pumps: A duplex sump pump system shall be installed in a sump within the dry well. The pumps shall be Hydromatic Model SW33 or approved equal, each with a capacity of 35 gpm at 10 feet total head. Pump starts and stops shall be controlled by a float switch system. The pumps shall discharge to the wet well, above the maximum sewage level, through 1.5-inch diameter Schedule 40 PVC pipe(s). Each pump discharge line shall be equipped with a PVC check valve and PVC true-union ball valve. Provide explosion-proof motors for submersible pumps rated for operation in Class I, Division 1, Groups C and D hazardous atmosphere, temperature code TEC.

E. Monorail System: A monorail system shall be installed in the pumping station to provide the capability to lift and move the pumps/motors from their installed position through a double door to a paved area outside the pumping station. The monorail system capacity shall be sufficient to lift/move, in the case of submersible pumps, the largest pump/motor assembly or, in the case of vertical dry-pit pumps, the heaviest unit, either motor or pump. The hoist shall be the electric-chain type with chain bucket and the trolley shall be the geared type with chain loop to move the trolley along the monorail. Maximum chain pull shall be 40 pounds. The monorail beam shall be designed to withstand the monorail at any location and have a maximum (LL) deflection of 1/4" under worst-case loading. The motor(s) shall receive power through an electrified rail system.

11.11 Mechanical

A. Pipe: Raw sewage piping shall be flanged Special Class 53 ductile iron meeting the requirements of AWWA C115 and C151 and shall have a double-thick cement mortar lining meeting the requirements of AWWA C104. Each pump suction line shall have a down-turned bell fitting within the wet well. The vertical distance between the wet well floor and the open end of the bell shall be as recommended by the pump manufacturer. The exterior of the pipe shall be painted with one coat of Tnemec 104-1255 High Solids Epoxy to a dry film thickness (DFT) of 6 to 8 mils followed by a coat of Tnemec 104-Color High Solids Epoxy to a DFT of 6 to 8 mils; color to be selected by the Authority.

B. Sleeve Couplings: Sleeve couplings, including flanged coupling adapters, shall meet the requirements of AWWA C219 and shall be manufactured by Dresser, Smith-Blair, or approved equal.

C. Pipe Seals: Where pipes pass through walls, a seal shall be effected by the use of cast iron wall pipes or double Link-Seal by GPT Industries. Under some conditions, the Authority may approve the use of single Link-Seal. All bolts shall be stainless steel.

D. Non-Lubricated Plug Valves (Eccentric Type):

1. Designed for a minimum working water pressure of 175 psi for valves through 12-inch, 150 psi for valves 14-inch through 36-inch, and 125 psi for valve sizes 42-inch through 54-inch.

2. Provide non-lubricated eccentric type plug valve with valve bodies of cast iron conforming to ASTM A126 Grade B or valve bodies of semi-steel with coated plug suitable for wastewater and nickel or stainless steel seats.

3. Provide full pressure, drip-tight shutoff, with rated pressure from either direction.

4. Provide straight through, round port configuration or rectangular style design, however, port area shall be a minimum of 80% of corresponding pipe area.

5. Valves 8-inch and larger operated by enclosed worm and gear.

6. Provide enclosed worm and gear operator for valves less than 8 inches that must be chain operated.

7. Acceptable Manufacturers:

   a) DeZurik; Series 100 Eccentric Valves.

   b) Keystone, USA Valve Division; Ballcentric.

   c) McWane Ductile.

   d) Or Equal.

E. Check Valves: Provide check valves on each pump discharge line. Check valves shall be swing check with outside lever and weight. Check valves shall be manufactured by GA Industries, or approved equal. Check valves shall, in all cases, be installed in a horizontal position. Under conditions of high head, the Authority may require the installation of oil-controlled swing check valves by DeZurik, American Flow Control, or approved equal.

F. Surge Relief Valves: Under high head conditions, the Authority may require the installation of a surge relief valve. The surge relief valve shall be GA Industries 624-D, or approved equal. The surge relief valve shall discharge to the wet well when the set-point pressure in the raw sewage pump discharge piping is exceeded.

G. Air Valve: A combination single-body sewage air valve shall be located at the high point of the discharge header. The air valve shall be DeZurik, Crispen, or approved equal and shall be equipped with backflushing accessories.

H. Pressure Gages: A pressure gage shall be installed on each pump discharge line. The gage shall read in psi to 100 percent above the pump shutoff head. Psi readings shall be in increments of 2 psi. The gage shall be liquid filled, shall have a stainless steel case and safety glass window, and shall be a minimum of 4 inches in diameter. Each gage shall be installed on a Ronningen Petter Iso-Ring with an isolation valve.

I. Pipe Supports: Concrete and/or stainless steel pipe supports shall be installed to prevent movement of the pipe system during pump startup and shutdown and to ensure that the pumps do not carry any of the piping system weight.

11.12 Plumbing

A. Piping: Potable water piping (interior) shall be Type L hard-temper copper with solder (sweat) joints. Exterior potable water piping shall be Type K annealed copper with brazed or flared joints. Drain piping shall be PVC Schedule DWV with solvent weld joints.

B. Hose Bibbs: A minimum of three 3/4-inch brass hose bibbs shall be provided in the pump station to provide for washdown. Hose bibbs shall be supplied with potable water or clear well water. Each bibb shall be labeled with the type of water being supplied.

1. All hose bibbs installed on potable water lines must be fitted with a vacuum breaker.

C. Yard Hydrant: Provide one (1) ¾" non-freeze post type yard hydrant along an exterior wall of the Control Building. Yard hydrant shall be Zurn Industries, Inc., Model Z-1385, or approved equal.

D. Backflow Preventer: A reduced pressure backflow preventer shall be provided inside the Control Building to protect the potable water system from contamination. The backflow preventer shall be as specified under the cross connection regulations.

E. Floor Drain: Manufactured by Zurn Industries, Inc.

F. Emergency Eyewash: An emergency eyewash fountain shall be mounted on an interior wall of the Chemical Room. Eyewash shall be wall-mounted design, corrosion resistant stainless steel bowl with twin aerated eyewash heads activated by stainless steel push flag handle chrome-plated 1/2-inch I.P.S. stay open ball valve. Include unit with flow switch and normally open dry contact that closes on flow to send alarm when eyewash is activated.

1. *Water Supply*: 1/2-inch I.P.S. Provide water heater and mixing valve to temper water.

2. *Waste*: Dome type strainer and 1¼-inch drain.

3. *Identification Sign*: 14 x 3-inch aluminum sign designed for wall mounting with the words "EMERGENCY EYEWASH FOUNTAIN".

4. *Acceptable Manufacturers*:

   a) Bradley Corporation; Model S1922, SB-SR.

   b) Haws Corporation; 7760-B.

   c) ENCON; 455.

   d) Or Equal.

G. Toilet Room: The Toilet Room minimum footprint shall be 5'-0" x 5'-0", and shall contain the following fixtures:

1. *Lavatory*: Enameled cast iron design as manufactured by American Standard, Kohler, Eljer, or equal. Provide combination water heater/mixing faucet designed to deliver 6.25 gal/hr at 110°F, Model/UWL as manufactured by In-Sink-Erator.

2. *Water Closet*: Water-saver, vitreous china, siphon jet action as manufactured by American Standard, Kohler, Eljer, or approved equal, with chrome plated flush valve as manufactured by Sloan, Delany, or approved equal.

3. *Drain Piping*: Route drain piping from above fixtures to the wet well. Provide flap valve on drain line at point of entry into wet well.

H. Service Sink: A Florestone service sink with cold water faucet shall be installed in the pumping station at a location approved by the Authority. The service sink shall be 17 x 22 inches in plan and 12 inches deep.

11.13 Heating and Ventilating

A. Heating: Each room of the Control Building shall be heated by means of electric unit heater(s). The heater(s) shall be sized and located to maintain the temperature within the room at no less than 50°F when the outside ambient temperature is minus 15°F. Heaters shall be Chromalox Model LUH or HCH, or equal, with wall-mount thermostats. Thermostats shall have single pole double throw switches. For corrosive environments, utilize Chromalox Model HD3D. For hazardous locations, utilize Chromalox Model CXH-A.

B. Ventilating:

1. *Wet Well*: The wet well shall be ventilated intermittently at the minimum rate of 30 air changes per hour. The wet well exhaust fan shall be a centrifugal fan fabricated from fiberglass-reinforced polyester (FRP). The fan shall be Varantis CLMP Series or equal by Hartzell. Wet well ventilating ductwork shall also be fabricated from FRP. Exhaust fan shall be activated upon opening the access hatch/door.

2. *Dry Well and Remainder of Pump Station*: A separate ventilation system shall be provided for the non-wet-well portion of the pump station. This separate system shall provide continuous ventilation at the rate of 6 air changes per hour. The continuous ventilation shall allow these areas to remain unclassified in accordance with NFPH 820.

    a) Ventilation system shall be controlled by a thermostat with a remote outside sensing bulb. When outside temperatures fall below 50°F, fan speed shall decrease by 25 to 50%.

    b) Fan shall be a two-speed unit, able to accommodate the above-referenced temperature control.

3. Oxygen level and combustible gas monitoring equipment will be required by the Authority for the wet well and dry well.

4. *Control Room/Generator Room and Chemical Room*: The Control Room/Generator Room and Chemical Room shall each be thermostatically controlled and ventilated at the minimum rate of 12 complete air changes per hour. Intake louver shall be supplied and have a Kynar finish.

5. *Chemical Room*: The Chemical Room shall be equipped with an intake louver mounted in the exterior wall. Intake louver shall be minimum of 2’ x 2’, fixed with motorized damper and insect screen, mounted 24” above finished floor. The louver shall have a Kynar finish.

6. *Toilet Room*: A brick vent intake shall be mounted in the exterior wall. Brick vent shall be 15-7/8” W x 7-3/4” H, equipped with opposite blades, damper and insect screen, mounted 7’-0” above finished floor.

7. *Control Building Roof*: Exhaust fans shall have gravity backdraft damper, hinged subbase, insect screen, safety disconnect switch, and roof curb.

8. *Vent Pipes*: Horizontal vent pipes shall be sloped back to the fixture drain pipe or to the drain pipe.

9. *Meter/Wastewater Valve Vaults*: Provide intermittent ventilation for meter/wastewater valve vaults at a rate of 30 air changes per hour. The supply fan shall be an in-line type for hazardous locations manufactured by Marc Climatic Controls, Inc., Model ISFX.

10. *Generator Room Ventilation Control*: While the generator is in operation, the generator room ventilation system shall not operate.

11.14 Emergency Generator

A. Generator shall be Cummins, MTU Onsite Energy or Caterpillar sized to provide 100% back-up power for the pump station, in the event of an electrical utility company power outage.

B. The generator shall be equipped with critical grade muffler, battery charger, batteries and cables, line circuit breaker, standard generator set control panel with common fail output contact, AC meter package, frequency meter, running time meter, engine jacket water heater, 50°C radiator, oil drain extension, and all fluids.

C. The generator set manufacturer shall provide field start-up, testing, test report, and certification.

D. Foundation: Provide separate reinforced concrete foundation for generator 4" above floor slab. Generator foundation shall be 3" longer and wider than the generator with 1/2" expansion material and joint sealant all around to isolate the generator foundation from the floor slab. Generator foundation should rest on compacted free draining fill material (if unsuitable soft soils are encountered at subgrade, further excavation and placement of fill material is required).

E. Fuel System:

1. The engine shall be capable of operating on No. 2 diesel fuel.

2. The fuel supply line, normal vent line, and emergency vent line shall be black steel (no galvanized). Supply (fill) line shall be extended through exterior wall and terminated with a 45 degree bend and threaded cap. Both vent lines shall be extended through the exterior wall to a height of 10'-0" above grade and terminated with insect-proof vent caps. The normal vent line shall be provided with a whistler for determining when the tank is full.

3. The fuel storage tank shall be a dual wall subbase tank provided as an integral part of the generator package for diesel engines. The tank shall be sized to provide a run-time of 24 hours minimum at full load.

F. Exhaust System: The exhaust system shall consist of a critical grade side-entry silencer, a flexible stainless steel exhaust connection to engine, a drip leg at the first point of rise of exhaust line, a condensate trap and manual valve, and horizontal stainless steel exhaust lines that slope toward discharge. The muffler and exhaust piping shall be insulated with 2" minimum thickness rigid hydrous calcium silicate to maintain a surface temperature not to exceed 120°F. Do not insulate flexible exhaust fitting. No asbestos shall be allowed. Exhaust line shall extend 1'-6" beyond the exterior wall through a fire-rated wall thimble, and terminate with a stainless steel hinged flapper. The weight of the exhaust system shall not be supported from the generator.

G. Combustion and Cooling Air System:

1. The intake louver shall be mounted 24" above finished floor on an exterior wall of the Control/Generator Room. Intake louver shall be fixed with motorized damper and insect screen, power close, spring open, and shall be appropriately sized for the application. Louver color shall be selected by the Authority. Coating material shall be Kynar. Coordinate style and color with other louvers.

2. The discharge louver shall be mounted 24" above finished floor on an exterior wall of the Control/Generator Room. Discharge louver shall be fixed with gravity damper, and shall be appropriately sized for the application. Ductwork and flexible duct adapter shall be installed between the discharge louver and the engine radiator. Louver color shall be selected by the Authority.

H. Automatic Transfer Switch: The automatic transfer switch (ATS) shall be supplied by the generator manufacturer as a package with 7-day load/no-load exercise clock, battery charger, standard time delays including two-second loss-of-power delay on start, emergency/normal door mounted indicator lights, one NO and one NC auxiliary contacts for each normal and emergency position, test switch, and solid state controls. House the transfer switch in a NEMA 1 enclosure of the motor control center (when motor control center is provided). Enclosure shall be NEMA 12 if it is an individual enclosure. The ATS shall be located in the Control/Generator Room of the Control Building.

I. Testing: The Extender shall provide a four-hour full load test of the generator at the site after finalizing the project. Use load banks for performing the test. Submit a test report to the Engineer.

11.15 Electrical

A. General:

1. Comply with the latest version of the National Electrical Code (NEC) in performing all electrical work. In addition, comply with electrical construction code requirements of State and local agencies and requirements of electrical Utility Company. Provide electrical equipment that is listed by Underwriters Laboratories, Inc. (UL).

2. Obtain and pay for all required electrical system permits and approvals. Upon completion of the electrical work, have it inspected by an authorized inspection agency for compliance with NEC and State and local codes. Obtain certificates of approval, acceptance, and compliance. Submit permits and certificates to the Authority.

B. Earthwork: Perform all excavation, trenching, and backfilling required for underground conduit and outdoor equipment pads. Backfill shall be in layers not exceeding 8 inches in thickness and shall be thoroughly compacted. Soil or crushed rock materials used for backfill shall not contain stones with any dimension greater than 2 inches and shall not contain organic material.

C. Reinforced and Plain Concrete: Underground duct banks shall be encased in concrete with 28-day compressive strength of 3,000 psi. Equipment pads shall be constructed of PennDOT Class A reinforced concrete. Outdoor concrete equipment pads shall be constructed on an 8-inch compacted base of AASHTO No. 57 coarse aggregate. Indoor equipment pads shall be mounted on a 4-inch high curb or pad of reinforced concrete.

D. Conduit:

1. *Interior Non-corrosive Areas*: Rigid metal conduit and fittings.

2. *Wet Well*: PVC coated rigid thick-wall metal conduit and fittings by KorKap, Perma-Cote, or Plasti-Bond.

3. *Underground*: Rigid high-impact PVC conduit and fittings. Use Schedule 40 conduit and fittings except where NEC requires Schedule 80. All underground conduit bends shall be long-radius steel. Exceptions to the rule are that rigid steel conduit shall be used if required by a Utility Company, for all VFD conductors, and all instrumentation conductors.

4. *Connections to Motorized Equipment*: Flexible liquid-tight metal conduit with PVC jacket, in lengths not exceeding 24 inches.

E. Boxes: Outlet, switch, junction, and pull boxes shall be cast steel. In hazardous and corrosive areas, hubs shall be cast integrally with the box. Boxes in the wet well shall be PVC coated. Use UL listed "wet location" boxes in outdoor and wet areas. Pressed steel boxes may be used for general interior work.

F. Wire and Cable:

1. Use copper wire. Conductors 10 AWG and smaller shall be solid or stranded and conductors larger than 10 AWG shall be stranded. Size wire and cable as follows:

a) *Power Circuits*: Minimum size of 12 AWG.

b) *Control and Alarm Circuits*: Minimum size of 14 AWG.

c) *Signal Circuits*: 2/C #18 AWG shielded, 300-volt insulation.

2. Insulation shall be rated for 600 volts and type shall be as follows:

a) *8 AWG and Smaller*: THHN/THWN above grade and XHHW below grade.

b) *6 AWG and Larger*: THHN/THWN above grade and XHHW below grade.

c) *All Submerged Wire and Cable*: Hypalon jacketed SPC.

G. Grounding: Grounding and bonding shall be provided in accordance with NEC and basic materials shall be as follows:

1. *Ground Rods*: 3/4-inch by 10 feet long Copperweld.

2. *Ground Conductors*: Code gage stranded copper or equivalent ampacity copper-clad cable.

3. *Ground Clamps*: Thermite weld.

4. *Conduit Ground Bushings*: Galvanized malleable iron with screw pressure connector and, where required, insulated throat.

H. Wiring Devices:

1. *Switches*: Specification Grade meeting requirements of UL-Listed and NEMA WD-1-2. Switches shall have screw terminals; push-in terminals are not allowed.

2. *Receptacles*: Specification Grade meeting requirements of UL-Listed and NEMA WD-1-3.

3. *Toggle-handle Snap Switches*: 20-amp, single-pole, double-throw, 3- or 4-way, with metal cover plate.

4. *Weatherproof Wiring Devices*: Enclosed in cast aluminum weatherproof box with gasketed metal weatherproof cover. Provide "in-use" weatherproof covers where required by the NEC.

5. *Standard Face Design Receptacles*: Specification Grade, 20-amp, two-pole, 3-wire, grounding duplex, with metal cover plate.

6. *Ground Fault Interrupter Receptacle*: 20-amp.

7. *Power Outlet Receptacles*: Simplex, heavy-duty design, polarized, twist-lock.

I. Disconnect Switches: UL listed safety switches meeting NEMA KS-1 and UL 98 standards, heavy-duty, horsepower rated, fusible or non-fusible (as necessary), viewing window, enclosure rated for duty, padlockable OFF; Square D or equal.

J. Fuses: UL listed Class RK, Class J, or Class L. Provide 10 percent spare fuses of each rating (minimum 3 per rating).

K. Nameplates: Provide engraved phenolic nameplates of black background with white letters on each panel, cabinet, motor starter, enclosed circuit breaker, disconnect switch, and all other electrical system components that require identification. Nameplates shall be attached by means of rivets.

L. Service Entrance: Meet requirements of electric Utility Company. Coordinate service entrance work with Utility Company and pay all costs required to provide a suitable service entrance.

M. Branch Circuit Panelboard: Provide dead-front safety type panelboard equipped with automatic thermal-magnetic circuit breakers, copper bus bars, enclosure with cover, lock, and typed directory. 240 volts – Eaton Pow-r-Line, Square D Model NQ or similar; 277/480 volts – Eaton Pow-R-Line, Square D Model NF or similar; 480 volts – Eaton Pow-R-Line, Square D Model I-Line or similar.

N. Variable Frequency Drives (VFDs): When VFDs are required, they shall be as manufactured by Square D, Eaton Cuttler-Hammer, Yaskawa, Allen-Bradley, or approved equal. VFDs shall be programmed such that the minimum flow rate in the discharge force main is sufficient to sustain a minimum velocity of 2 feet per second in the force main.

1. VFD shall convert fixed frequency, 3-phase voltage input power to a symmetrical 3-phase, pulse-width modulated (PWM) adjustable output frequency and voltage for controlling the speed of a standard NEMA Design B, 3-phase, AC induction motor.

2. Drive shall accept incoming 480 VAC, 60 Hz line power.

3. Provide manual speed adjustment to permit variation of drive speed when operating in the manual mode.

4. When operating in the automatic mode, drive speed shall be controlled by a 4-20 mA input signal.

5. VFD shall be provided with a digital display and keypad for input programming. Keypad shall be capable of controlling the VFD and setting drive parameters. Display shall, as a minimum, provide indication of output speed in percent of base speed, output frequency, motor amps, output motor volts, and output load. The display shall also function as a fault indicator.

6. *Remote Run Input*: Causes drive to start and stop when drive is in auto mode.

7. *Drive Run Dry Contact Output*: Activates whenever drive is turned on.

8. *Drive Fail Dry Contact Output*: Activates on internal drive fault.

9. *Analog Inputs*: 4-20 mA, controls motor speed in auto mode.

10. VFDs shall be programmed to run at 60 Hz. In the event of a loss of speed, reference signal when operating in the automatic mode.

11. *Drive Type and Size*: Extender shall be responsible for providing proper type and size drive for the driven load. Use 6-pulse drives for motors less than 75 hp along with line reactors, disconnect switch, fusing, and dV/dT filters if conductors are longer than 35 feet. Use 18-pulse drives with disconnect switch and fusing for motors 75 hp and larger.

12. *Enclosure*: NEMA Type 1 construction in the Motor Control Center line-up if applicable; otherwise, NEMA 12 enclosure.

O. Lighting:

1. *Control/Generator Room*: Furnish and install three surface-mounted (3) 4-foot industrial fluorescent, spec. grade, 15% uplight, porcelain enamel finish, energy efficient, rapid start, thermally protected, high power factor, 120V 0 degree ballasts as manufactured by Columbia Lighting Type KL fixture or equal with number of lamps as required to provide maintained 30-40 foot candles. Furnish and install F32/T8 lamps and electronic ballasts.

2. *Chemical Room*: Furnish and install one (1) surface-mounted 4-foot industrial fluorescent, enclosed and gasketed fiberglass industrial, energy efficient, rapid start, thermally protected, high power factor, 120V 0 degree ballast as manufactured by Columbia Lighting (Cat. No. LUN4-232-EU-SSL). Furnish and install two (2) F32/T8 lamps per ballast.

3. *Toilet Room*: Furnish and install one (1) wall-mounted 2-foot fluorescent, spec. grade, up/downlight, thermally protected, energy efficient, 120V, UL listed for damp locations, ballast as manufactured by Columbia Lighting (Cat. No. WPM2-217-EU). Furnish and install two (2) F17/T8 lamps per ballast.

4. *Valve/Meter Vault*: Furnish and install two (2) enclosed and gasketed incandescent fixtures, wall and junction box mounted (as high as possible), 120V with globe and guard as manufactured by Crouse-Hinds (Cat. No. VXHBF25GP). Furnish and install one (1) 150W/A21 lamp per fixture.

5. *Wet Well*: Furnish and install two (2) explosion proof, wall bracket mounted, incandescent fixture with globe and guard, 120V, suitable for operation in Class I, Division 1, Groups C and D hazardous atmosphere, as manufactured by Crouse-Hinds (Cat. No. EVBX-215). Furnish and install one (1) 200W/A23 lamp per fixture.

6. *Control Building Exterior*: Furnish and install one (1) exterior wall-mounted HPS, bronze polycarbonate access door/prismatic lens assembly, bronze die cast aluminum rear housing with photo cell, 120V fixture as manufactured by Hubbell

(Cat. No. PVL3-070S-18-BZ). Furnish and install one (1) C70S62/C lamp per ballast.

P. Explosion Proof Requirements: All electrical equipment and devices installed within the wet well and valve/meter vault shall be explosion proof as recommended by NFPA 820.

Q. Motor Control Center (MCC):

1. MCC shall be NEMA Class II, Type B Construction, with number of sections and devices as necessary for control of all pumping station equipment. Spare sections shall be provided as required by the Authority. The complete unit shall meet the requirements of NEMA ICS-2 and UL 845 standards.

2. *Enclosure*: NEMA 1 ventilated.

3. MCC shall be equipped with:

   a) Horizontal wireway top and bottom accessible by removal of cover plate.

   b) Bus assemblies rated for not less than 42,000 symmetrical RMS amps.

   c) Tin plated copper bus bars.

   d) Combination NEMA line starters. Circuit breakers used with combination line starters shall be adjustable instantaneous (magnetic) motor circuit protectors.

   e) Bimetallic type overload relays.

   f) NO and NC electrical interlocks.

   g) Molded case circuit breakers with thermal inverse time limit overload and instantaneous short circuit protection (for use as individual circuit breakers not associated with motor starters).

   h) Engraved nameplates for circuit identification.

   i) For each motor, provide HOA switch with out-of-auto contact, red run pilot light and green off pilot light, emergency stop push button, start push button when in manual operation, and amber pilot lights where required. All pilot devices shall be 30 mm; pilot lights shall be push-to-test transformer or LED type.

   j) Control transformer with line side and load safe fuses, transformer to have 50 VA additional capacity.

4. MCC shall be Allen Bradley, Eaton Cutler-Hammer, Square D, or approved equal.

R. Security System:

1. *Key Switch*: Weatherproof, heavy-duty, red ON LED pilot light, tumbler type switch, key removable in activated position, 5 amp 120 VAC contact, DPDT, two keys, legend plate as shown on the drawings, Securitron MKA2 Series or equal.

2. *Door Contact Switches*: Magnetic contact type, heavy-duty, Securitron or equal.

3. All necessary components shall be provided as needed, such as power supply for voltage operation. Battery back-up shall be provided for a minimum of six hours operation with battery charging during normal power. The system must be set up such that the key switch will activate or deactivate the system with notification through the ON LED when the system is activated. When the system is deactivated, the door contacts will not be active. If the system activates by illegal entry, a signal shall be sent remotely. The system may be deactivated by selecting the OFF position on the key switch. There shall be a two second time delay before the alarm is sent just to avoid false alarms. Second pole of switch may be used as needed.

S. Surge Protection Device:

1. *Main Service Entrance*: 120 kA per phase, 60 kA per mode with sinewave tracking, 480/277 volts; Surge Suppression, Inc., Model CKLA3Y2 or Total Protection Solutions Model SurgeTrack TK-ST120-3Y480. Protect through a 60 amp, three-pole circuit breaker or non-fused disconnect switch.

11.16 Telephone Systems

A. Service Entrance: Meet requirements of telephone Utility Company. Coordinate service entrance work with Utility Company and pay all costs required to provide a suitable service entrance.

B. Hand Set: Provide a factory assembled touch-tone, single-line beige plastic telephone equipped for wall mounted at a modular jack. Provide a one-year warranty. Hand set shall be either Verizon, ITT, or AT&T.

C. Auto dialer:

1. Provide self-contained, automatic, microprocessor-controlled real-voice telephone dialer connected to a standard dial-up telephone line by means of a standard modular jack. Mount auto dialer 48” above finished floor in the Control/Generator Room.

2. Auto dialer shall be housed in a heavy-gage JIC and UL listed steel cabinet.

3. The unit shall operate from a standard 120-volt AC circuit and shall be provided with batteries for 24-standby operation. An external surge suppression system shall be provided for both power supply and telephone line.

4. The auto dialer shall include a separate power failure monitor and provisions for the following independent alarm conditions plus a minimum of two spares: wet well high level, wet well high-high level, wet well low level, pump failure (for each pump), damper failure (Control/Generator Room intake), generator failure, generator low fuel, generator fuel tank leak, VFD failure (for each pump if applicable), seal fail and overtemperature fail (for each pump), high water in dry well, security breach, BIOX tank alarm, and sewage grinder failure.

5. The auto dialer shall be RACO Verbatim.

11.17 Instrumentation and Controls

A. Flow Measurement System: The flow measurement system shall consist of an in-line magnetic flow meter (mag meter), a remote wall-mount transmitter, and a circular chart recorder. The mag meter shall be located in the valve/meter vault. To optimize meter accuracy, the meter and vault shall be strategically located to provide a minimum of ten straight pipe diameters upstream of the meter and five straight pipe diameters downstream of the meter. "Straight pipe" refers to the absence of valves, bends and fittings. Meter and transmitter shall be FM Class I, Division 1, Groups C and D approved.

1. The mag meter shall be provided with flat flanges for installation and ground rings when required. The mag meter shall be ABB, unless otherwise approved by the Authority. The pumping system shall be designed and the mag meter sized such that the minimum velocity through the meter during any pump operating scenario shall be 2 fps. The minimum meter accuracy shall be +/- 0.5% of rate of flow between velocities of 2 and 33 fps. Furnish one (1) flanged spool piece equal in laying length to the mag meter.

2. The transmitter shall provide a 4-20 mA output, proportional to flow. Provide necessary cable between flow meter element and transmitter, and between transmitter and recording chart.

3. The circular chart recorder shall be 10" diameter Eurotherm Model No. 392, or approved equal. Chart recorder shall be single-pen with totalizer, on-site configuration, 40-character display, EEPROM memory, and retransmission. Provide one-year supply of charts and pens.

B. Pump Control Methodology: The following methodology is specific to duplex pumping systems. Similar methodology for triplex pumping systems shall be submitted to the Authority for review and approval.

1. When the selector switch is in the OFF position, the pump shall not operate.

2. When the selector switch is in the HAND position, the pump shall operate regardless of the level in the wet well.

3. When both selector switches are in the AUTO position, the pumps shall be controlled automatically by the primary level control system, the redundant float switch system, and the alternator as follows:

    a) The control circuit is placed in "permissive start" mode when the liquid level rises to the lowest level activation point, which is a float-switch function. The float switch is a redundant pump shutoff and low wet well level alarm system that is located just below the primary level control system point that normally activates the pump shutoff and low wet well level alarm functions.

4. As the liquid level continues to rise, the control circuit is energized when the primary level control system low-level point is reached.

5. As the liquid level continues to rise and the next primary level control system activation point is reached, the lead pump starts. In this step, the pumps will alternate on successive cycles. If pump #1 starts first on one cycle, pump #2 will start first on the next cycle.

6. As the liquid level in the wet well is pumped down, the lead pump will continue to operate until the liquid level drops just below the primary level control system pump off point and the lead pump is then shut down.

C. Sewage Pump Control System: The following requirements are for a duplex constant-speed pump system. Control system descriptions for systems requiring more than two pumps and/or pumps with VFDs shall be submitted to the Authority for approval.

1. The Pump Control System shall be provided with an alternator with provisions for automatic pump alternation and manual selection of lead and lag pumps in non-automatic alternation.

2. The Pump Control System shall be protected by a lightning and surge arrestor system.

3. Each pump shall be provided with the following:

    a) NEMA-rated combination motor starter with MCP type circuit breaker.

    b) Non-resettable run-time meter with 99999.9 readout.

    c) HAND/OFF/AUTO (H-O-A) selector switch.

    d) Pump Run and Pump Off indicating lights.

    e) Three-phase power monitor with adjustable settings to stop pump in the event of line undervoltage, phase loss, phase reversal, and motor undercurrent. Motor undercurrent shall initiate a pump malfunction alarm.

D. Pump Controller System:

1. The following requirements pertain to pumping systems with VFDs. Pump control panel shall be furnished by the pump supplier and shall include, but not necessarily be limited to, the following:

   a) *Enclosure*: NEMA 12 with three-point or quarter-turn latches and padlocking capabilities.

   b) *Primary Pump Controller*: Flygt/Multitrode pump controller with VFD option and Monitor Pro panel-mounted interface terminal, and U.S. Filter pressure transducer (Model No. A-1000).

   c) *Back-up Pump Controller*: Flygt/Multitrode pump controller with five (5) float switches. Flat switches shall be chemical resistant polypropylene encapsulated casing, mercury switch with integral 12/2 Type SJO neoprene cord.

   d) Monitor Pro and back-up pump level controller keypad shall be mounted on the door of the control panel.

   e) Back-up pump controller shall be activated automatically in the event of any primary pump controller failure and shall provide a controller failure alarm.

   f) Interconnection wiring between the pump control panel and the VFDs shall be in accordance with the manufacturer's wiring diagrams and instructions.

   g) *Power Requirements*: 120V, 1 phase.

2. The following requirements pertain to pumping systems without VFDs. Pump control panel shall be furnished by the pump supplier and shall include, but not necessarily be limited to, the following:

   a) *Enclosure*: NEMA 12.

   b) Lockable panel main disconnect switch operable from outside the enclosure.

   c) Motor circuit protector for each motor.

   d) NEMA rated motor starter for each motor.

   e) Through-door overload reset button for each pump.

   f) Elapsed time run meter for each pump motor.

   g) Phase loss/under voltage protection with automatic reset for each motor.

   h) Control power transformer with NEMA fusing. Control power: 120 VAC.

i) *Primary Pump Controller*: Flygt/Multitrode pump controller with U.S. Filter pressure transducer (Model No. A-1000).

j) *Back-up Pump Controller*: Flygt/Multitrode pump controller with five (5) float switches. Flat switches shall be chemical resistant polypropylene encapsulated casing, mercury switch with integral 12/2 Type SJO neoprene cord.

k) Pump level controller keypads shall be mounted on the door of the control panel.

l) Back-up pump controller shall be activated automatically in the event of any primary pump controller failure and shall provide a controller failure alarm.

m) *Power Requirements*: 480V, 3-phase.

n) Hand-Off-Auto selector switch for each motor. In the auto mode, the pump motor shall be controlled by the primary or back-up pump controller.

E. Miscellaneous Control System Devices:

1. *Limit Switches*: Lever-arm type, DPDT, 10-amp contacts, 120-volt AC, with NEMA 4X or NEMA 7 (as applicable) enclosure and standard pre-travel spring return; Square D Class 9007, Type C.

2. *Float Switches*: Non-mercury switches sealed in a polypropylene shell with cable molded in end and cable weights to keep float switches in position.

3. *H-O-A Switches and Pushbuttons*: Oil tight.

4. *Indicator Lights*: Push-to-test, transformer type. Indicator lights shall be color coded according to function.

5. *Control Relays and Timers*: Relays shall be general-purpose type with contact rating of not less than 10 amps at 120 VAC. Each relay shall be equipped with dust cover and quick-disconnect terminals. All relays and timers shall be mounted in sockets.

F. Primary Level Control System: The primary wet well level control system shall produce a 4-20 mA analog signal which is directly proportional to depth of liquid in the wet well. The system shall have provisions for a minimum of 4 liquid level set or activation points. The primary level control system shall be by Time Mark or approved equal.

G. Annunciator:

1. The annunciator shall be an integral part of the level sensing and pump control system. Each alarm shall be provided with a contact to activate the auto dialer.

2. The following alarms and conditions shall be displayed on the level control/sensing device:

   a) High Wet Well Level; activated by either primary level control system or redundant float switch.

   b) Low Wet Well Level; activated by either primary level control system or redundant float switch.

   c) High Water in Dry Well; activated by float switch in sump.

   d) Louver Failure; activated from louver control enclosure.

   e) Generator Malfunction; activated from generator control panel,

   f) Pump Malfunction; activated by current sensors shall shut down the pump and provide alarm contacts to the auto dialer.

   g) VFD Malfunction; activated by any failure within the VFD and shall shut down the pump, and provide alarm contacts to the auto dialer.

   h) Motor Seal Fail; activated by seal fail system and provide alarm contacts to the auto dialer.

   i) Motor Overtemperature; activated by thermal devices in the motor, shutdown of pump, and provide alarm contact to the auto dialer.

   j) Grinder Malfunction; activated by contact in grinder control panel and provide alarm contact to the auto dialer.

   k) Generator Low Fuel; activated by contact in generator control panel and provide alarm contact to the auto dialer.

   l) Generator Fuel Tank Leak; activated by contact in generator control panel and provide alarm contact to the auto dialer.

   m) BIOX Tank Alarm; activated by contact in BIOX control panel and provide alarm contact to the auto dialer.

11.18 Valve/Meter Vault

A. General: Two (2) precast reinforced concrete valve/meter vaults shall be installed downstream of the wet well. One installed at the pump station to measure effluent and one installed upstream of the wet well to measure influent.

B. Ventilation: Provide mechanical ventilation as previously specified. Also, provide a 4" 304SS gooseneck exhaust vent with mesh bird screen located a minimum of 24" above the top of the valve/meter vault.

C. Access Hatch: Provide one (1) access hatch as previously specified. Size and location of access hatch shall be approved by the Authority. Equip hatch with hatch drain. Hatch limit switch (which triggers supply fan operation and lights) shall be 120 VAC, DPST explosion proof, Square 'D' class 9007 or approved equal. Limit switch shall be mounted on the hatch frame in such a manner that the contacts are open when the hatch is closed, and the contacts close when the hatch is opened.

D. Paint: Paint exterior of vault with one coat of Tnemec 46H-413 Hi-Build Tnemec-Tar, 16-20 mils DFT.

E. Manhole Steps: Copolymer polypropylene manhole steps at 12" spacing.

F. Safety Post: Bilco Model LU-4 Ladder Up Safety Post.

G. Lighting: Fixtures as previously specified. Lights shall come on when access hatch is opened. Class I, Division 1, Groups C and D.

H. Sump Pump: One 12" x 12" x 12" sump and sump pump. Sump pump shall be floor mounted submersible type with float, simplex with double mechanical seals and cast iron construction, rated for 20 gpm minimum, 115 VAC, 60 Hz, 1-phase. Sump pump motor shall be ½ HP, UL Listed, Class 1 Division 1 Groups C and D explosion proof. Sump pump shall be manufactured by Weil Pump Company, Inc., or approved equal. Discharge shall be 2" diameter PVC. Sump pump shall discharge into wet well or French drain located near the valve/meter vault.

I. Bypass Connection: Install a tee with a blind flange (facing vertically upward) on the force main to serve as a bypass connection point.

11.19 Wet Well

A. General: Wet well shall be precast reinforced concrete. Wet well shall be sized and level settings shall be selected to conform with detention time requirements identified in the Commonwealth of Pennsylvania "Domestic Wastewater Facilities Manual" (latest edition), and to limit the number of starts per pump per hour to no more than fifteen, unless recommended otherwise by the pump manufacturer.

B. Fillet: Provide grouted fillet along interior seam of vertical walls with bottom of wet well.

C. Ventilation: Provide mechanical ventilation as previously specified. Also, provide a 4" 304SS gooseneck exhaust vent with mesh bird screen located a minimum of 24" above the top of wet well.

D. Lighting: Fixtures as previously specified. Lights shall come on when access hatch is opened.

E. Access Hatch: Provide access hatch (or hatches) as previously specified. Sizes and locations of access hatches shall be approved by the Authority. Hatch limit switch (which triggers supply fan and operation and lights) shall be 120 VAC, DPST

explosion proof, Square 'D' class 9007 or approved equal. Limit switch shall be mounted on the hatch frame in such a manner that the contacts are open when the hatch is closed, and the contacts close when the hatch is opened.

F. Paint: Paint wet well interior with two coats of Tnemec 104-1255 High Solids Epoxy, 6-10 mils DFT per coat, for a total dry film thickness of 12-20 mils. Paint exterior of wet well with one coat of Tnemec 46H-413 Hi-Build Tnemec-Tar, 16-20 mils DFT.

G. Slide Rails: Pump and sewage grinder slide rails and supports shall be 304 stainless steel.

H. Davit Crane: Provide one (1) stainless steel portable hoist (davit crane) with stainless steel floor mounted socket(s) strategically located on the top of the wet well to access each pump and sewage grinder, and not hinder movement of the access hatch doors. Davit crane shall be Series DA or DB as manufactured by Halliday Products, or approved equal, and shall be rated to handle the entire weight of each pump or sewage grinder, whichever is heavier, with a minimum 10% safety factor. The portable hoist manufacturer shall furnish one ¼" stainless steel cable for each pump and sewage grinder. Each cable shall be 30' minimum length and shall include a safety hook. Portable hoist shall be normally stored in the Control Building.

I. Ladder and Platforms: The wet well shall be provided with a 16" wide full-depth 304 stainless steel ladder (and Bilco Model LU-4 Ladder Up Safety Post) with rungs at 12" spacing, and intermediate platforms at vertical intervals not to exceed 12 feet. Platforms shall comply with the following requirements:

1. Wet well grating platform, structural framing and connections shall be fiberglass reinforced plastic (FRP) and shall be designed by the manufacturer. The design shall be in accordance with governing codes and standards as applicable.

2. Manufacturer's design shall comply with OSHA Specifications 1910 24 for a moving concentrated load of 1000 pounds minimum with a factor of safety of three applied.

3. Supplier shall design, fabricate and install FRP platforms following the FRP design manual for the following loads:

   a) *Dead Load*: Self-weight of material.

   b) *Live Load*: Not less than 100 pounds per square foot for pultruded grating and 200 pounds per square foot for molded grating.

4. Grating deflection at the center of a simple span shall not exceed 0.25 inch. Deflection in any direction shall not be more than 1/180 of span for structural members.

5. Connectors shall be designed to transfer the above loads. Connection bolts and hardware shall be stainless steel. Hold-down clamps shall be Type 316L stainless steel with a minimum of 4 each per panel.

6. Platform color shall be visibility safety yellow (OSHA safety yellow).

7. Seal all cuts and abrasions of FRP with a compatible resin coating to prevent intrusion of moisture.

8. Top surface of all panels shall have a nonskid grit affixed to the surface by a baked epoxy resin followed by a topcoat of baked epoxy resin.

9. Structural shapes shall be made from a premium grade vinyl ester resin with fire retardant additives to meet Class 1 flame rating of ASTM E84 and meet the self-extinguishing of ASTM D635. All structural shapes shall contain a UV inhibitor.

10. Structural FRP member composition shall consist of a glass fiber reinforced vinyl ester resin matrix, approximately 50% resin to glass reaction. A synthetic surface veil shall be the outermost layer covering the exterior surfaces. Continuous glass strand rovings shall be used internally for longitudinal strength. Continuous strand glass mats shall be used internally for traverse strength.

11. Removable sections necessary for equipment access and removal shall be secured with stainless steel cords.

11.20 Chemical Feed and Storage System

A. General: Furnish and install one (1) complete chemical feed and storage system in the Chemical Room of the Control Building. Chemical shall be utilized for odor control purposes. Chemical shall be dripped into the wet well. All products described below shall be provided by Evoqua Water Technologies, and shall conform to the manufacturer's standard requirements.

B. Chemical: Bioxide®.

C. Storage Tank: Furnish and install one (1) chemical storage tank. Tank shall be 550 gallon, 4' diameter, 6.5' high, manufactured of High Density Cross Linked Polyethylene (HDXLPE). Tank shall be equipped with a 2" fill line with ball valve extending through the exterior vertical wall of the Control Building, a ½" sight tube extending through the exterior vertical wall of the Control Building, and a 3" vent.

D. Control Panel: Control panel shall be manufacturer's standard as recommended by the manufacturer for the specific application. Control panel enclosure shall be NEMA 3R

E. Chemical Feed Pump: Furnish and install two (2) chemical feed pumps (one primary, one standby). Pumps shall be bellows type, Model No. 15907-001, flow range from 5 – 50 mL/min., 40 psi maximum discharge pressure, 115V, 60 Hz, 0.034 HP, 1-phase.

F. Chemical Feed Tubing: Furnish and install two (2) ½" chemical feed tubes between the chemical feed system and the wet well via a 3" PVC conduit.

11.21 Sewage Grinder

A. General: Furnish and install one (1) sewage grinder in the wet well with remote hydraulic drive unit located in the Control/Generator Room of the Control Building. Sewage grinder shall be mounted along the interior wall of the wet well where the influent line enters the wet well. Sewage grinder shall be Muffin Monster series as manufactured by JWC Environmental.

B. Grinder Unit: The equipment manufacturer shall furnish Type 304 stainless steel wall mount frame, slide rail system, lifting bail and trash basket for the grinder unit in the wet well. The trash basket shall be utilized if and when the grinder unit is removed from the wet well.

C. Hydraulic Motor: Hydraulic motor shall be a 5 HP Hydraulic Power Pak, 480V, 3-phase, 60 Hz. Motor shall be mounted on a 3" skid furnished by the equipment manufacturer. Equipment manufacturer shall furnish hydraulic fluid initial fill.

D. Control Panel: Sewage grinder hydraulic motor and control panel shall be frame mounted as a single unit. Controller model number shall be PC2240, and controller enclosure shall be NEMA 4X FRP.

E. Hydraulic Lines: Equipment manufacturer shall select (type, diameter and length) and furnish all required hydraulic lines and appurtenances, including quick disconnect fittings. The length of hydraulic lines shall be sufficient to permit equipment removal. Hydraulic lines shall be connected from the hydraulic motor in the Control/Generator Room of the Control Building to the grinder unit in the wet well via a 4" PVC conduit. Where the conduit enters the Control Building and wet well, the conduit shall be fit with conduit seals meeting the requirements of the National Electrical Code, latest edition, to prevent sewer gases from entering the Control Building. At the approximate midpoint of the conduit run, a 4" tee shall be installed with a 4" vertical riser extending 6" above finished grade with a mushroom cap.

11.22 Testing

A. Extender shall demonstrate to the satisfaction of the Engineer the mechanical performance of each item of equipment when operated in accordance with the design intent indicated by the Technical Specifications and design drawings.

B. A minimum of two (2) volumetric wet well drawdown tests shall be performed on each pump to verify the design capacity of each pump. The Engineer reserves the right to require additional tests.

11.23 Metering/Sampling Facility (If Applicable)

A. Flow meter shall be an ultrasonic type flow measuring device for measuring flow in an open channel. The element shall be provided high in the metering facility to stay above any surcharging. The transmitter shall be mounted within the building. Provide

the necessary wires, cables, intrinsic barrier, surge protection, conduit, and explosion-proof seals to connect between element, transmitter, and recording chart.

1. Transmitter: IP65 enclosure rating, 5 Form C, 5 amp, 230 volt output contacts; 4-20 mA, RS-485 and RS-232 output; digital display; integral keypad; 120 VAC, Pulsar Model Flowcert Lite or equal.

2. Flow Element: Hazardous Class I Division 1, Groups C and D area; submergence shield; integral temperature compensation; high acoustic power output; Pulsar Model DB or equal. Exact unit shall be sized for the application.

B. The circular chart recorder shall be 10" diameter Eurotherm Model No. 392, or approved equal. Chart recorder shall be single-pen with totalizer, on-site configuration, 40-character display, EEPROM memory, and retransmission. Provide one-year supply of charts and pens.

SECTION 12 – GRINDER PUMPING SYSTEMS

12.1 General

A. In order to utilize a grinder pumping system, the Extender must demonstrate that installation of a single pumping station is technically not feasible, and economically cost prohibitive. A gravity collection system conveying sewage to an Authority maintained pumping station is preferred. The use of grinder pumping systems shall be minimized.

B. No more than five (5) individual single-family dwellings may be served by individual grinder pumps within a single development.

C. Use of grinder pump systems will be approved by the Authority on a case-by-case basis. In order to obtain approval of a grinder pumping system, the Owner or Extender shall submit the following information to the Authority:

1. Capacity and horsepower for the proposed pump.

2. Size and construction of the wet well.

3. Details of the electrical power, control, and alarm systems.

4. Size and material of proposed pump discharge line and associated valves.

5. Details of the connection to the Sewer System.

6. Proposed location of all system components.

7. Design computations.

8. Copies of permits and approval notifications from agencies other than the Authority.

D. Plans and specifications for all proposed grinder pump systems must be reviewed and approved by the Engineer before installation.

E. Following approval by the Engineer, the Owner or Extender will be responsible for all costs associated with construction of the system, for all permit and approval costs, and for all costs which may result from damage to the Sewer System, or to other utilities and facilities, during construction of the system. The Owner or Extender shall be responsible for continuously maintaining the system after installation.

12.2 Equipment

A. Grinder pump system for each single-family or single use shall be as follows:

1. Grinder pump system shall be the simplex (single-unit) type, and shall be installed as shown in the Standard Details.

2. Grinder pump shall be minimum 3 HP, and shall be manufactured by Barnes, Flygt, or approved equal.

3. For developments, the Extender shall provide the Authority with one spare grinder pump for every five (5) grinder pumps installed.

4. No grinder pump shall be installed indoors. All grinder pumps shall be installed outdoors as shown in the Standard Details.

5. Gate and check valves shall be installed in the wet well of each grinder pump system.

SECTION 13 – OIL AND GREASE INTERCEPTORS

13.1 General

A. When Sanitary Sewage and/or Industrial Waste which is being discharged to the Authority Sewer System contain excessive (greater than 80 mg/l) oil and/or grease as determined by the Authority, oil and/or grease interceptors shall be installed.

B. Installation plans and specifications for proposed oil and grease interceptor systems shall be submitted to the Authority prior to the start of installation. Installation shall not be started until approval of the system has been obtained from the Authority.

C. The minimum volume of oil and grease interceptors shall be 1,000 usable gallons.

SECTION 14 – SAMPLING AND FLOW MEASUREMENT

14.1 General

A. When required by the Authority, the Owner of any property serviced by the Sewer System shall install at his expense a suitable control manhole together with such meters and other appurtenances in the Building Sewer and/or Service Line to facilitate observation, sampling, and measurement of the waste generated on the Owner's property. All materials, use, and installation must be approved by the Authority prior to the installation of such system.

B. Refer to the Standard Details for Metering/Sampling Facility requirements.

APPENDICES

APPENDIX 1

Sewer Testing Forms

LIST OF SEWER TESTING FORMS

Form Name	Form No.
Force Main Pressure Test Report	1
Gravity Sewer Test Report	2
Manhole Vacuum Test Report	3
Lateral Locations	4
Volumetric Wet Well Drawdown Test	5
House Service Line Installation Report	6

Upper Uwchlan Township Municipal Authority

Date: _____
Development: _____
Drawing No.: _____
Contractor: _____

FORCE MAIN
PRESSURE TEST REPORT

Computed By: _____
Checked By: _____
Sheet No. _____

Test Pressure: _____ Test Start: _____ Test Finish: _____

ALLOWABLE WATER LOSS

L = Leakage in Gallons (GPH) _____
S = Length of Pipe Tested In Feet _____
D = Diameter of Pipe in Inches _____
P = Test Pressure in PSI _____
NOTE: 7.48 Gallons/FT^3

Location: _____

TEST DATA			
Time	Pressure	Loss or Depth	
			Start
			1/2 Hr. Reading
			Repressure
			1 Hr. Reading
			1 1/2 Hr. Reading
			Repressure
			2 Hr. Reading
			Repressure

Total Leakage for 2 Hour Period _____
Allowable Leakage for 2 Hour Period _____
Line Passes or Fails Test _____

CALCULATIONS

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

SEAL OF UPPER UWCHLAN MUNICIPAL AUTHORITY

Upper Uwchlan Township Municipal Authority

Gravity Sewer Test Report

Development: ______________________ Drawing No.: ______________________ Sheet No.: ______________

Contractor: ______________________ Inspected By: ______________________ Date: ______________

Street	Between		Length Tested	Lamp Tested	Mandrel Test	Time		Pressure Test			Result
	MH No.	MH No.				Start	Complete	PSIG Start	PSIG End	PSIG Loss	

Upper Uwchlan Township Municipal Authority

Manhole Vacuum Test Report

Development: _____ Drawing No.: _____ Sheet No. _____

Contractor: _____ Inspected By: _____ Date: _____

Comment	Manhole	Time		Vacuum (inches of Hg)			Result	
		Start	Stop	Start	Stop	Loss	Pass	Fail

UPPER UWCHLAN TOWNSHIP MUNICIPAL AUTHORITY

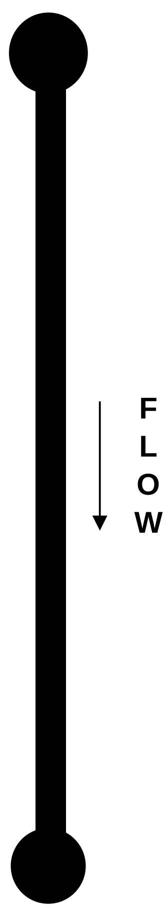
Lateral Locations

Development: ______________________________

Contractor: ______________________________

Material: ____________ Distance: ____________ Slope: ____________

Street Name: ____________________ In a Right-of-Way: ____________

Lot	Length	Depth	Station	**Manhole No. ___**	Station	Depth	Length	Lot
				 **Manhole No. ___**				

Date Tested: ____________ Drawing No.: ____________

Inspector: ____________ Prepared By: ____________

VOLUMETRIC DRAWDOWN TEST

Name of Client: UUTMA Project No.: _____

Name of Pump Station: _____ Date: _____

Type of Station:

W. W./D. W. _____ Submersible _____ Suction Lift _____

Wet Well Dimensions (FT.):

Length: _____ Width: _____ Diameter: _____

Volume/Vertical Foot: _____ Cubic Feet

Volume/Vertical Foot: _____ Gallons

Pump Number _____

Test No. 1	Test No. 2	Test No. 3
Wet Well Level	**Wet Well Level**	**Wet Well Level**
Start _____	Start _____	Start _____
End _____	End _____	End _____
Volume _____	Volume _____	Volume _____
Time _____	Time _____	Time _____
Flow Rate (GPM) _____	**Flow Rate (GPM)** _____	**Flow Rate (GPM)** _____
Rated Pump Capacity (GPM) _____	**Rated Pump Capacity (GPM)** _____	**Rated Pump Capacity (GPM)** _____

UPPER UWCHLAN TOWNSHIP MUNICIPAL AUTHORITY

HOUSE SERVICE LINE INSTALLATION

DATE: _____ CONTRACTOR: _____

DEVELOPMENT: _____ DRAWING NO.: _____

LOT #: _____ STREET NAME: _____

TYPE AND SIZE OF LINE: _____

SLEEVE THROUGH WALL: ☐ YES ☐ NO

CONNECTOR USED: _____

SLOPE OF LINE (at least ¼" per foot) ☐ YES ☐ NO

CLEANOUT OVER 50': ☐ YES ☐ NO

6" STONE UNDER PIPE: ☐ YES ☐ NO

12" STONE OVER PIPE: ☐ YES ☐ NO

CLEANOUT AND VENT IN PLACE: ☐ YES ☐ NO

FEET FROM HOUSE FOR CLEANOUT & VENT: _____

JOB FOREMAN/PLUMBER: _____

DEPTH OF SERVICE LINE AT HOUSE: _____

LENGTH OF SERVICE LINE: _____ DEPTH OF TEST TEE: _____

AIR TEST: _____ START TIME: _____ STOP TIME: _____ RESULT: _____

RPR SIGNATURE: _____

APPENDIX 2

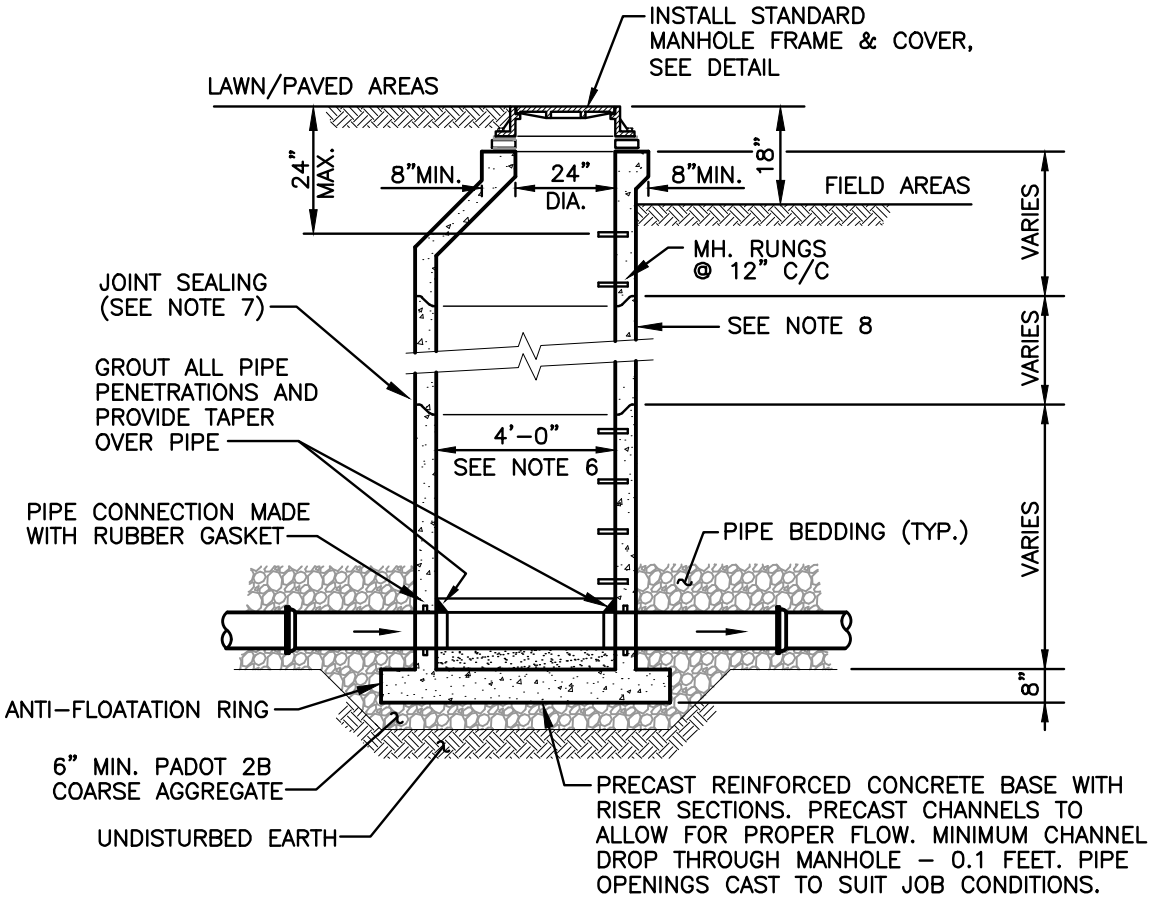
Standard Details

LIST OF STANDARD DETAILS

Detail	Detail No.
Trench Restoration Parking Areas & Driveways	28
Trench Restoration Lawn/Field Areas	29
Metering/Sampling Facility Site Plan	30
Metering/Sampling Facility Sectional Plan	31
Metering/Sampling Facility Sections	32

NOTES:

1. ADJUST TO GRADE WITH CONCRETE GRADE RINGS (MAXIMUM VERTICAL ADJUSTMENT 6") SEE FRAME & COVER DETAILS
2. MECHANICALLY VIBRATED PRECAST CONCRETE SHALL CONFORM TO A.S.T.M. SPEC. C-478.
3. IF INCOMING INVERT EXCEEDS OUTGOING INVERT BY GREATER THAN OR EQUAL TO 6", SEE INSIDE SPLASH/INSIDE DROP MANHOLE DETAILS.
4. FOR MANHOLES WHERE TOP OF RIM TO INVERT DISTANCE IS LESS THAN 5'-0", USE FLAT TOP MANHOLE IN LIEU OF CONE TOP.
5. FILL ALL LIFTING HOLES WITH NON-SHRINK, NON-METALLIC GROUT.
6. LARGER DIAMETER MANHOLE REQUIRED ON INSIDE DROP AND INSIDE SPLASH CONNECTION GREATER THAN 12", SEE MANHOLE DETAILS FOR INSIDE SPLASH/INSIDE DROP
7. PROVIDE 2 RINGS OF PREFORMED BUTYL RUBBER SEALING COMPOUND (INSIDE & OUTSIDE) AT ALL MANHOLE JOINTS.
8. COAT EXTERIOR WITH BITUMASTIC, 20-MIL DFT (TYP.).



SECTION

REVISION	DATE
4	4/21
3	1/13
2	6/05
1	11/04

Upper Uwchlan Township Municipal Authority

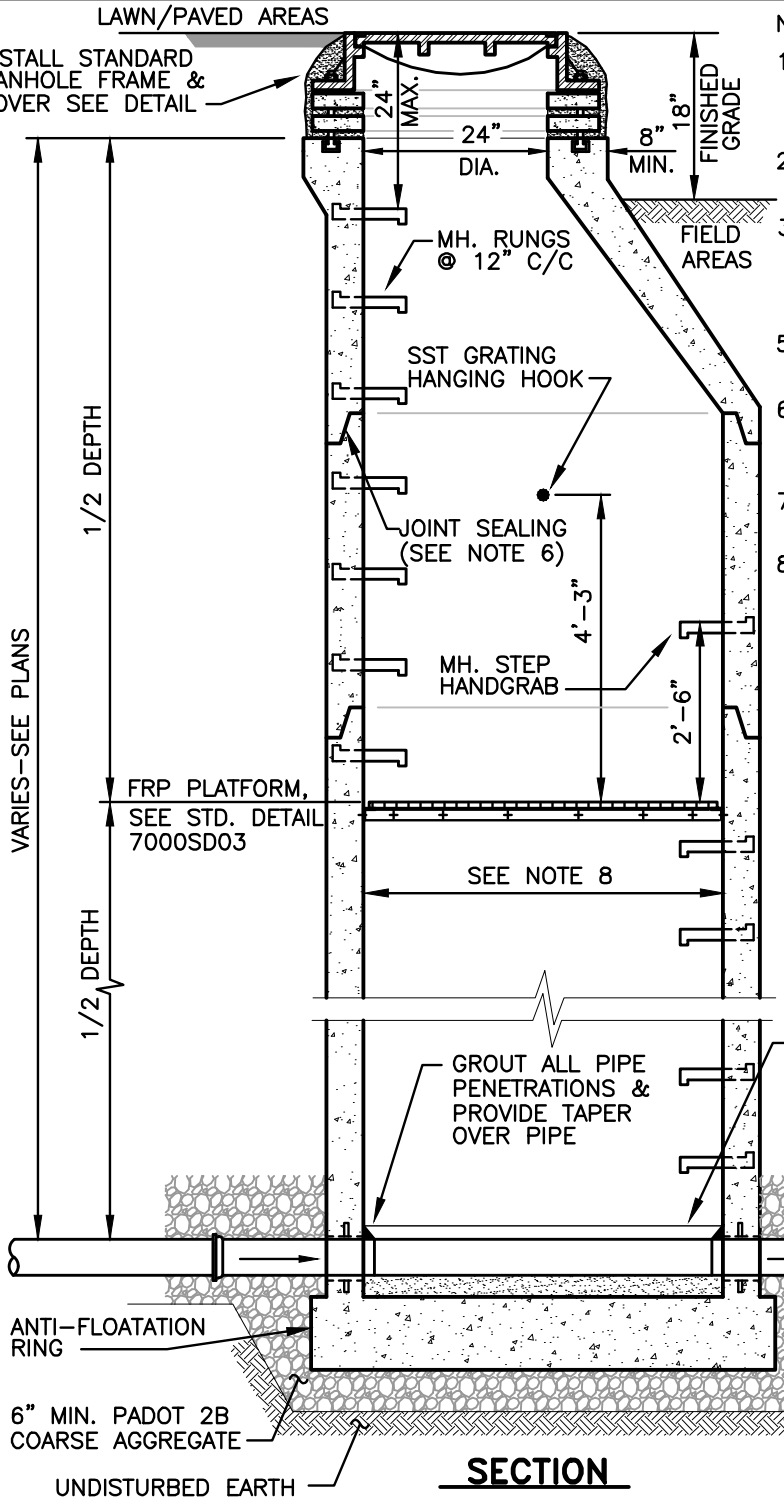
STANDARD DETAIL - SEWER SYSTEM

PRECAST MANHOLE 8" THROUGH 24" SEWERS

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

DETAIL: 7000SD01



SECTION

NOTES:

1. ADJUST TO GRADE WITH CONCRETE GRADE RINGS (MAXIMUM VERTICAL ADJUSTMENT 6") SEE FRAME & COVER DETAILS
2. MECHANICALLY VIBRATED PRECAST CONCRETE SHALL CONFORM TO A.S.T.M. SPEC. C-478.
3. IF INCOMING INVERT EXCEEDS OUTGOING INVERT BY GREATER THAN OR EQUAL TO 6". SEE INSIDE SPLASH/INSIDE DROP MANHOLE DETAILS.
5. FILL ALL LIFTING HOLES WITH NON-SHRINK, NON-METALLIC GROUT.
6. PROVIDE 2 RINGS OF PREFORMED BUTYL RUBBER SEALING COMPOUND (INSIDE & OUTSIDE) AT ALL MANHOLE JOINTS.
7. COAT EXTERIOR WITH BITUMASTIC, 20-MIL DFT (TYP.).
8. MANHOLES THAT ARE 20' DEEP AND DEEPER SHALL BE 5'-0" INSIDE DIAMETER & BE EQUIPPED WITH A FRP GRATING PLATFORM.

REVISION	DATE
4	4/21
3	1/13
2	6/05
1	11/04

Upper Uwchlan Township Municipal Authority

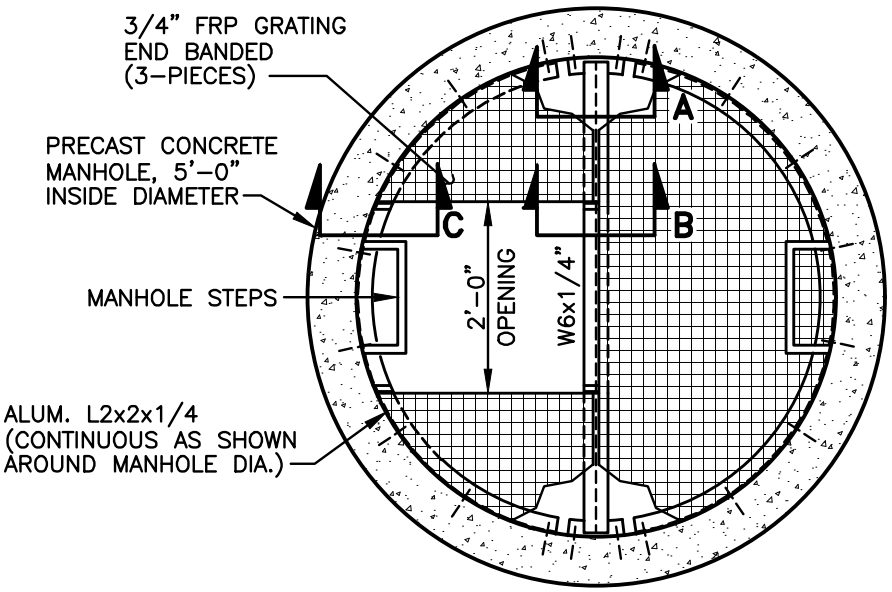
STANDARD DETAIL - SEWER SYSTEM

20' PRECAST MANHOLE

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

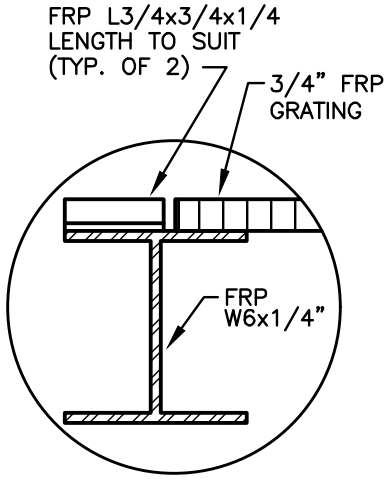
DATE: APRIL 2021

DETAIL: 7000SD02

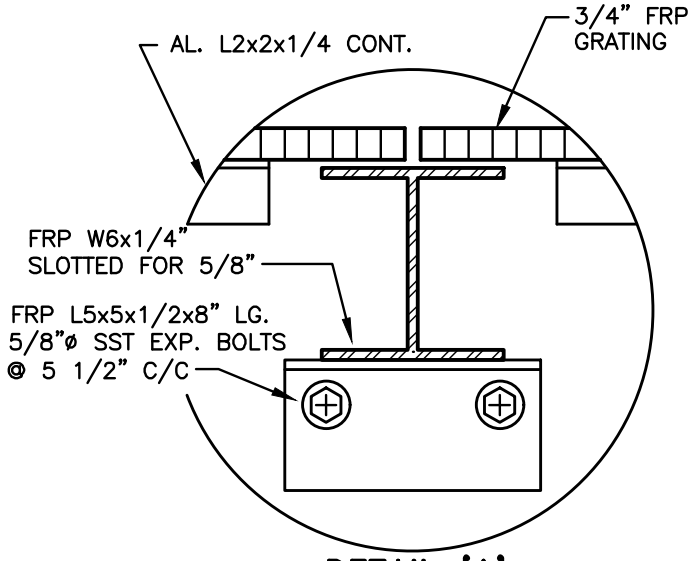


GRATING PLATFORM PLAN
NO SCALE

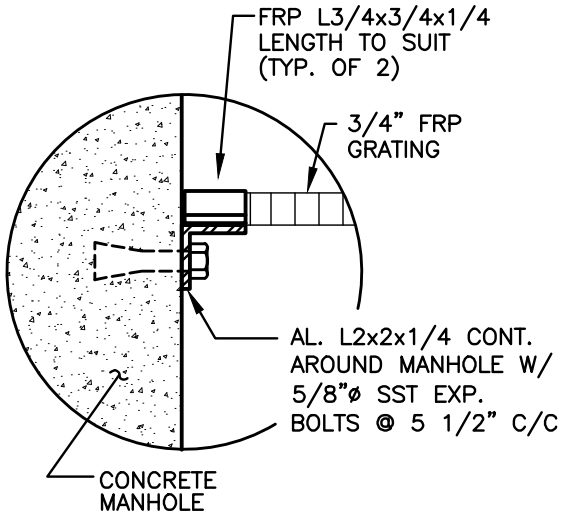
NOTES:
1. FRP MANUFACTURER IS RESPONSIBLE FOR DESIGN OF PLATFORM & ALL SUPPORTS & ANCHORS.
2. ANY ALUMINUM IN CONTACT WITH CONCRETE SHALL BE COATED WITH BITUMASTIC.



DETAIL 'B'



DETAIL 'A'



DETAIL 'C'

REVISION	DATE
4	4/21
3	1/13
2	6/05
1	11/04

Upper Uwchlan Township Municipal Authority

STANDARD DETAIL - SEWER SYSTEM

MANHOLE PLATFORM

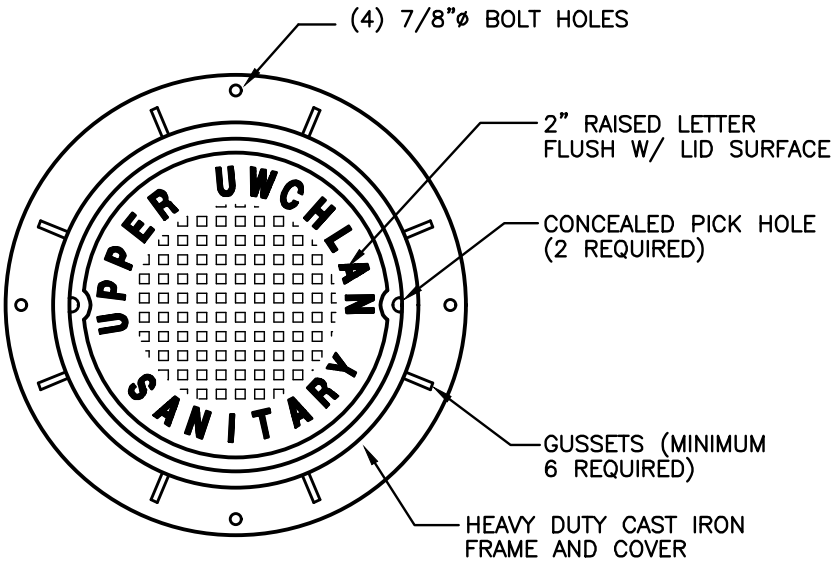
ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

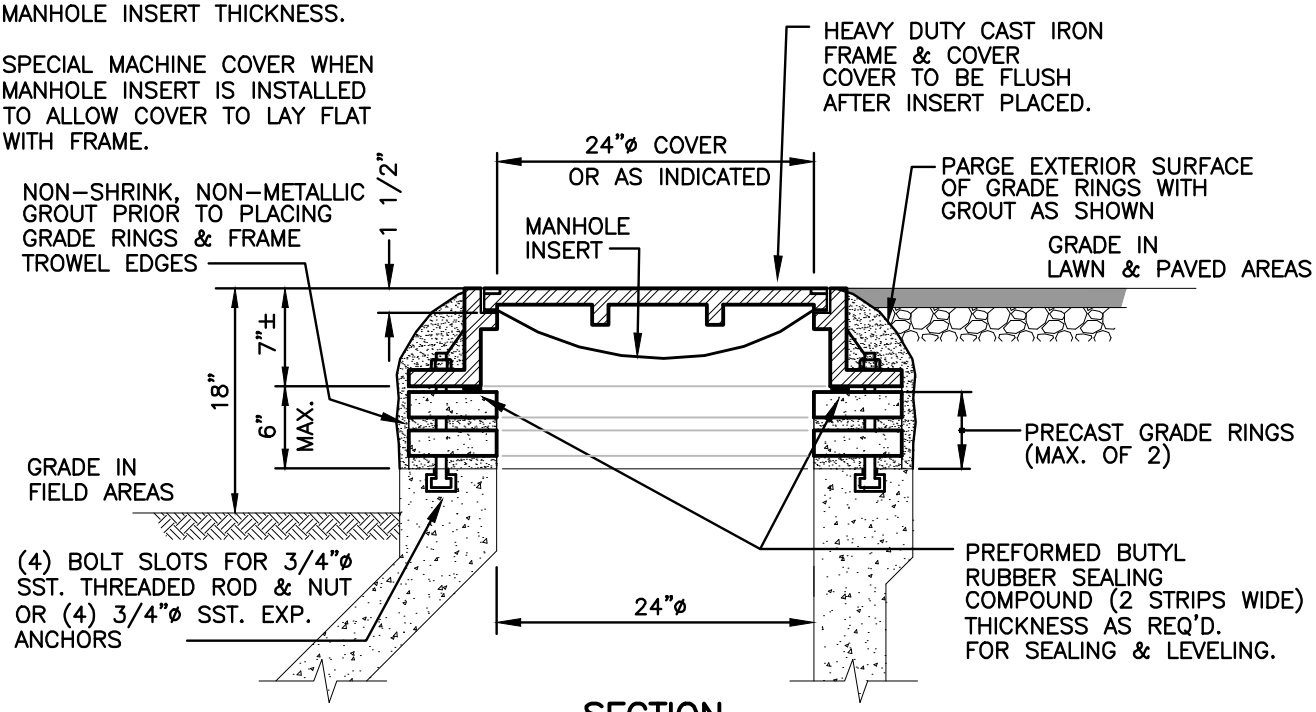
DETAIL: 7000SD03

NOTES:

1. MANHOLE FRAME & COVER SHALL BE CAT. NO. 1045 FRAME & 1040AGS COVER, BY EAST JORDAN IRON WORKS, DESIGNED FOR AASHTO HS–25 LOADING.
2. MANHOLE INSERT IS NOT REQ'D. WHEN INSTALLING A WATERTIGHT FRAME & COVER.
3. ANCHOR BOLT HOLES SHALL BE DRILLED WITH A PERCUSSION OR ROTARY HAMMER DRILL UTILIZING A CARBIDE DRILL BIT. CORE DRILLING, OR ROTATIONAL ONLY DRILLING, OF ANY KIND, IS NOT ALLOWED.
4. FRAME ANCHORS SHALL BE TIGHTENED PRIOR TO CURING OF NON–SHRINK, NON–METALLIC GROUT.
5. COVER RECESS SHALL BE DESIGNED TO ACCOMMODATE MANHOLE INSERT THICKNESS.
6. SPECIAL MACHINE COVER WHEN MANHOLE INSERT IS INSTALLED TO ALLOW COVER TO LAY FLAT WITH FRAME.



PLAN–COVER PATTERN



SECTION

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4	4/21
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1	11/04

Upper Uwchlan Township Municipal Authority

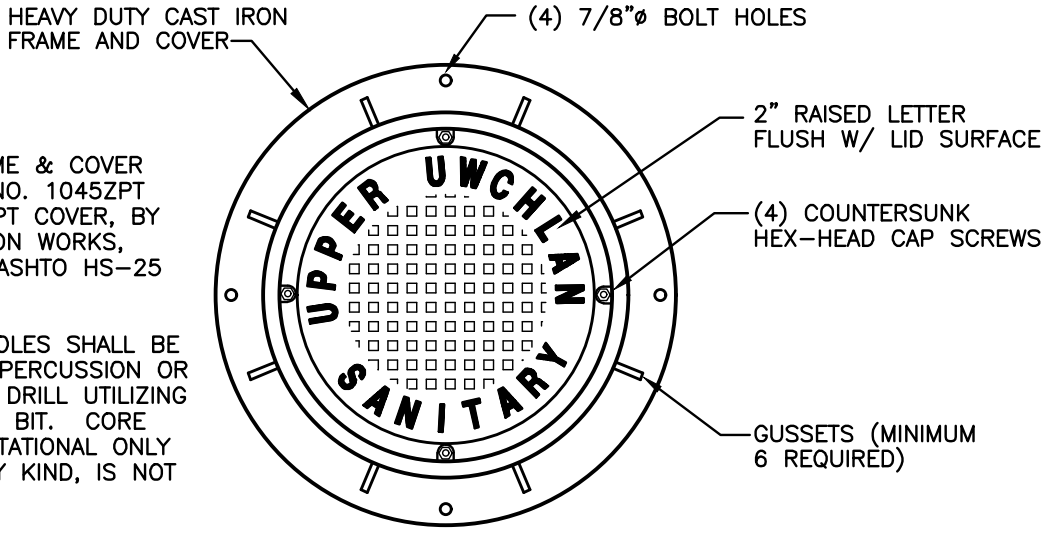
STANDARD DETAIL – SEWER SYSTEM

MANHOLE FRAME & COVER

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

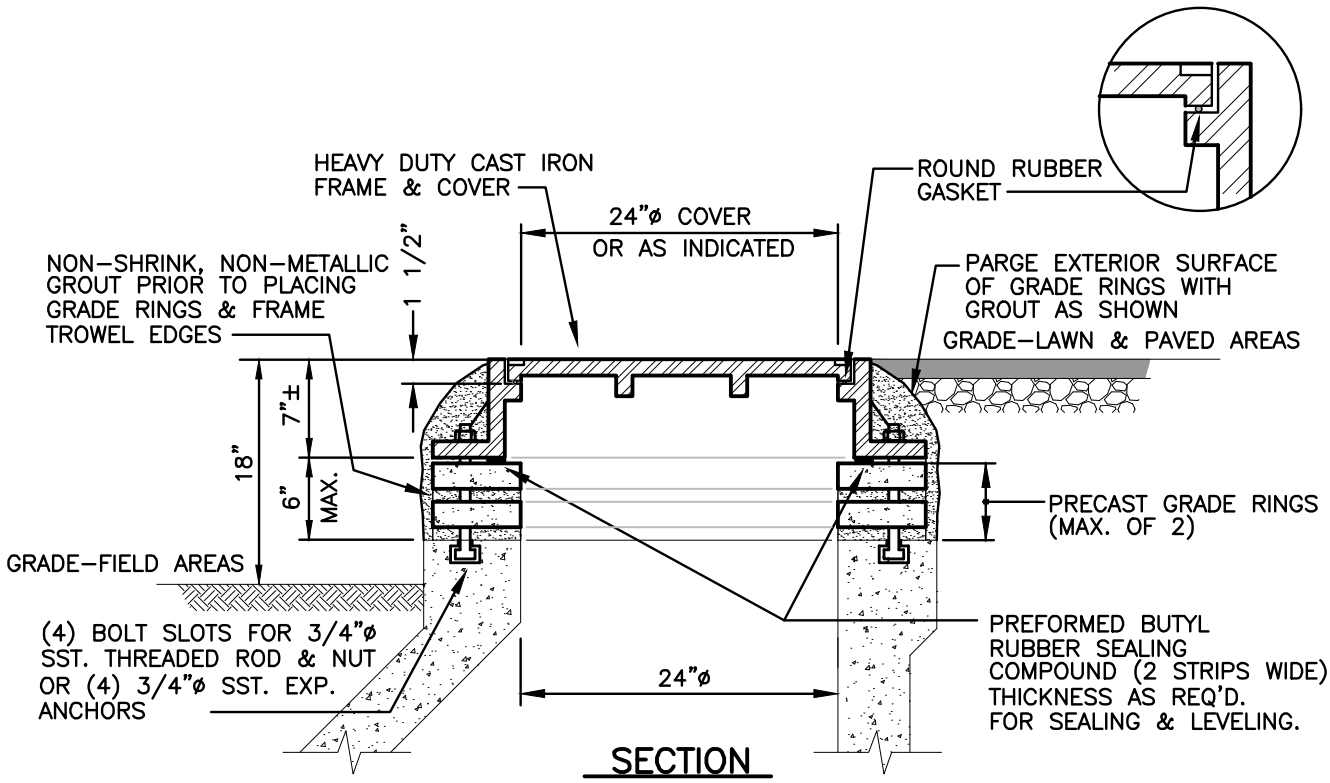
DETAIL: 7000SD04



NOTES:

1. WATERTIGHT FRAME & COVER SHALL BE CAT. NO. 1045ZPT FRAME & 1040APT COVER, BY EAST JORDAN IRON WORKS, DESIGNED FOR AASHTO HS-25 LOADING.
2. ANCHOR BOLT HOLES SHALL BE DRILLED WITH A PERCUSSION OR ROTARY HAMMER DRILL UTILIZING A CARBIDE DRILL BIT. CORE DRILLING, OR ROTATIONAL ONLY DRILLING, OF ANY KIND, IS NOT ALLOWED.
3. FRAME ANCHORS SHALL BE TIGHTENED PRIOR TO CURING OF NON-SHRINK, NON-METALLIC GROUT.

PLAN-COVER PATTERN



SECTION

REVISION	DATE
4	4/21
3	1/13
2	6/05
1	11/04

Upper Uwchlan Township Municipal Authority

STANDARD DETAIL - SEWER SYSTEM

MANHOLE FRAME & COVER (WATERTIGHT)

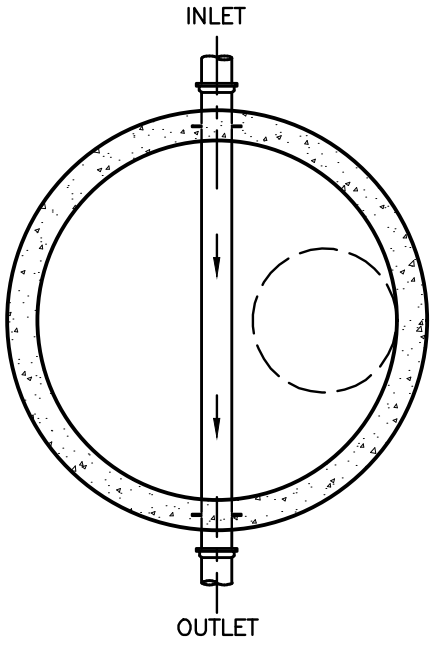
ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

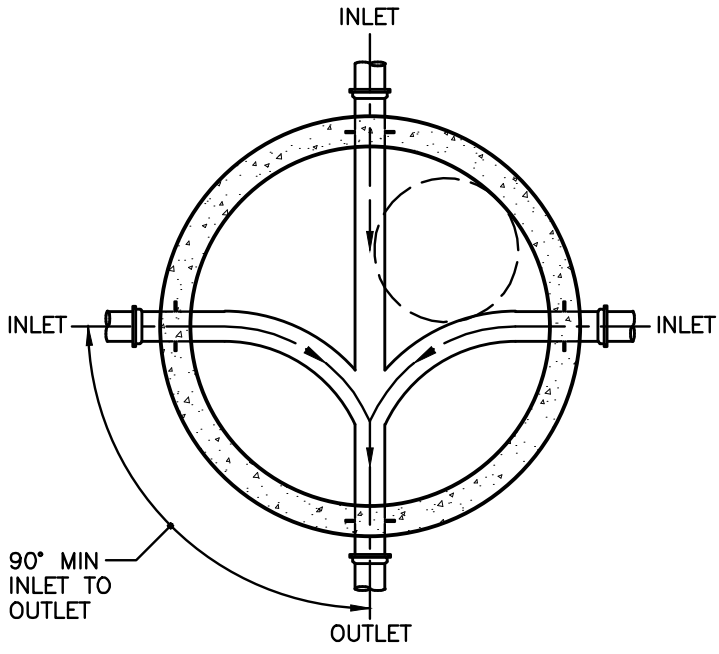
DATE: APRIL 2021

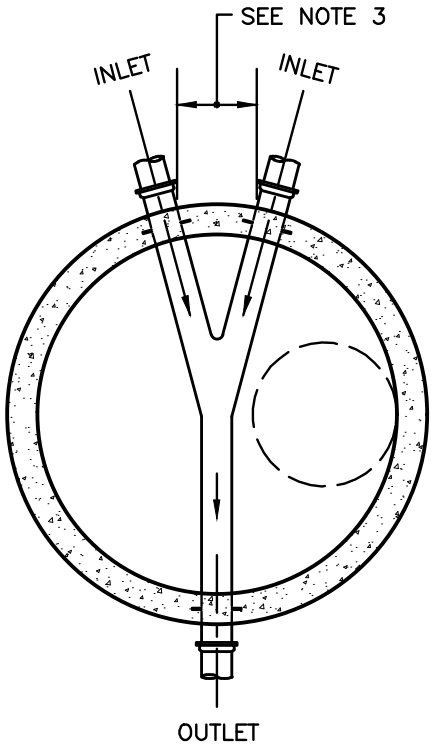
DETAIL: 7000SD05

NOTES:

1. THREE INLET PIPES AND ONE OUTLET PIPE MAX INTO MANHOLE.
2. NO LATERALS INTO MANHOLES, EXCEPT BY SPECIAL EXCEPTION FROM TOWNSHIP AUTHORITY.
3. MINIMUM 12" SEPARATION FROM EDGE OF PIPE PENETRATION TO EDGE OF PIPE PENETRATION.
4. MINIMUM CHANNEL DROP THROUGH MANHOLE:
   STRAIGHT THROUGH – 0.1 FEET
   BEND – 0.2 FEET
5. ALL CHANNELS SHALL BE PRECAST, UNLESS OTHERWISE SPECIFICALLY NOTED OR APPROVED.
6. THESE DETAILS APPLY TO PRECAST CHANNELS IN NEW MANHOLES, AND FIELD–FORMED CHANNELS IN EXISTING MANHOLES.
7. CHANNEL BENCH AT PIPE SHALL MATCH 3/4 CROWN ELEVATION OF PIPE AND RISE 1/2" PER FOOT TO THE MANHOLE WALLS.
8. CHANNELS SHALL MATCH THE CROSS–SECTIONAL DIMENSIONS OF THE PIPES ENTERING AND EXITING THE MANHOLE. SMOOTH TRANSITIONS SHALL BE PROVIDED BETWEEN CHANGES IN PIPE SIZE.







4	4/21
3	1/13
2	6/05
1	11/04
REVISION	DATE

Upper Uwchlan Township Municipal Authority

STANDARD DETAIL – SEWER SYSTEM

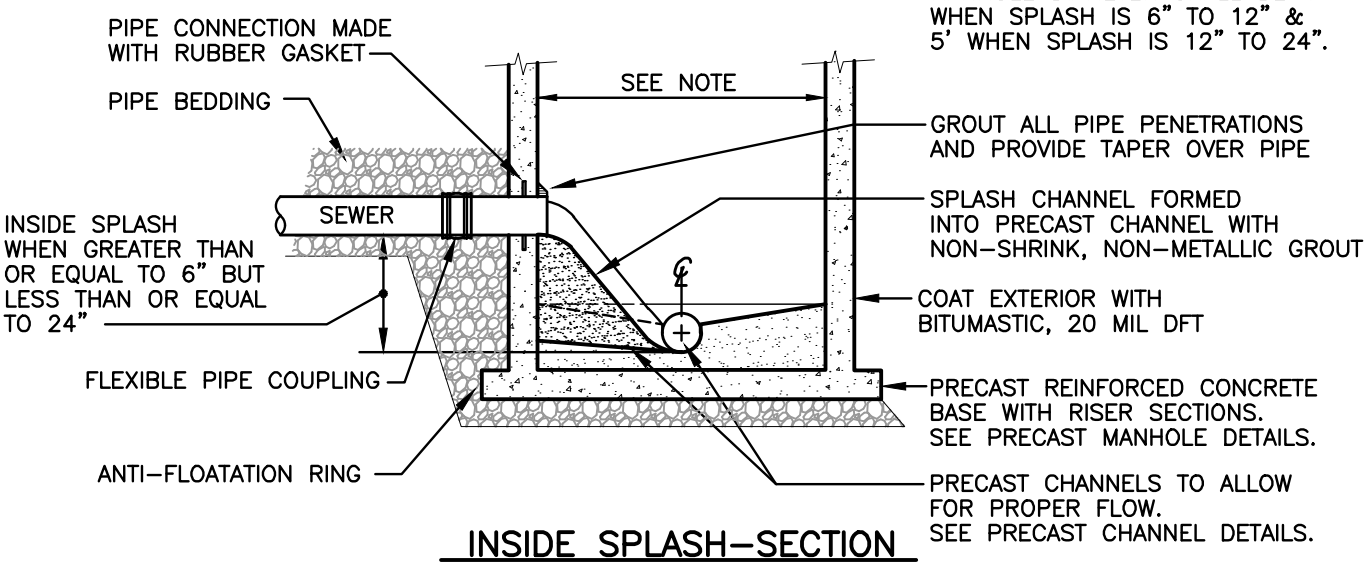
PRECAST MANHOLE CHANNELS

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

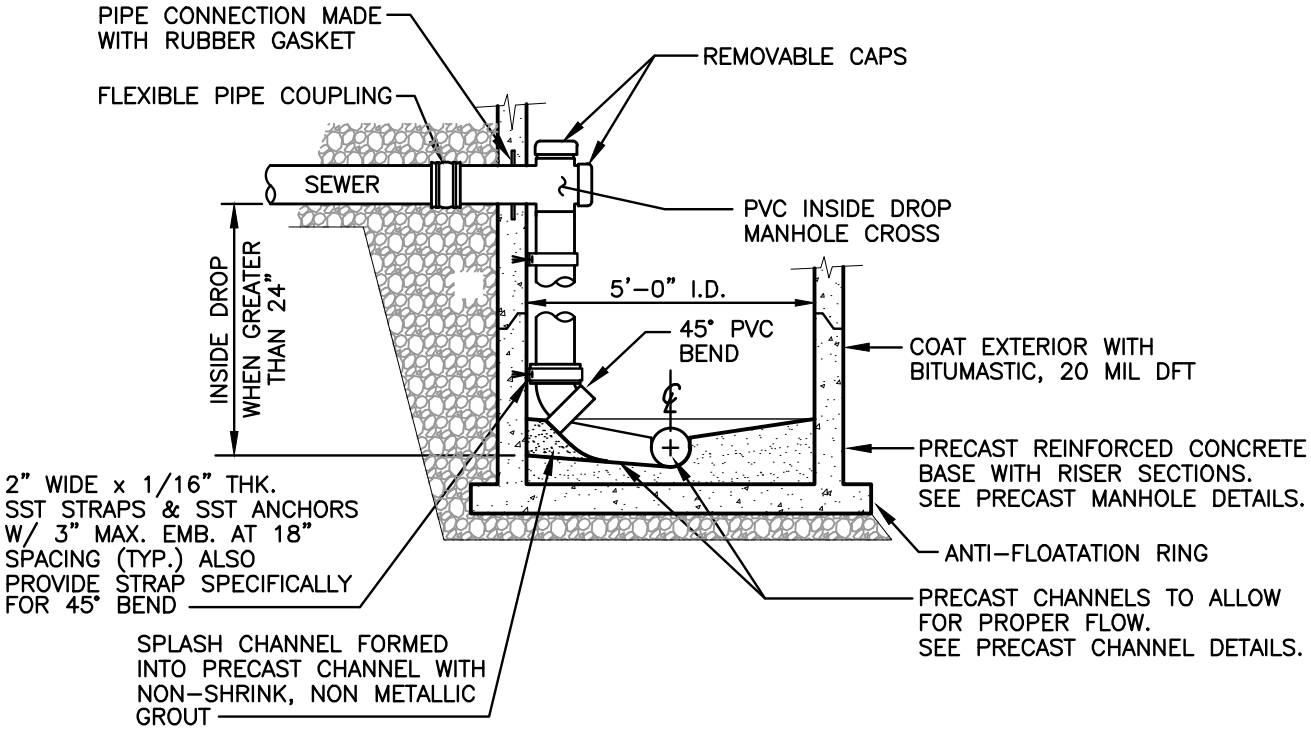
DATE: APRIL 2021

DETAIL: 7000SD06

NOTE:
MANHOLE DIAMETER SHALL BE 4' WHEN SPLASH IS 6" TO 12" & 5' WHEN SPLASH IS 12" TO 24".



INSIDE SPLASH-SECTION



INSIDE DROP-SECTION

REVISION	DATE
4	4/21
3	1/13
2	6/05
1	11/04

Upper Uwchlan Township Municipal Authority

STANDARD DETAIL - SEWER SYSTEM

MANHOLE OPTIONS
INSIDE SPLASH/INSIDE DROP

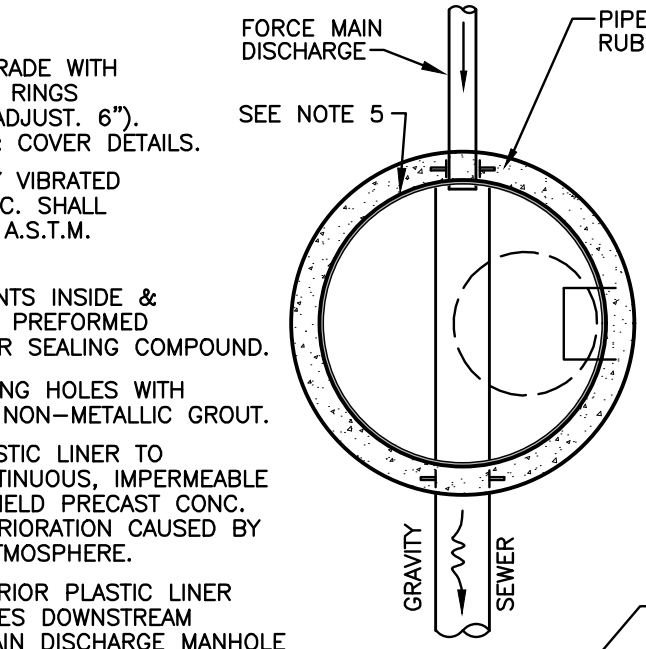
ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

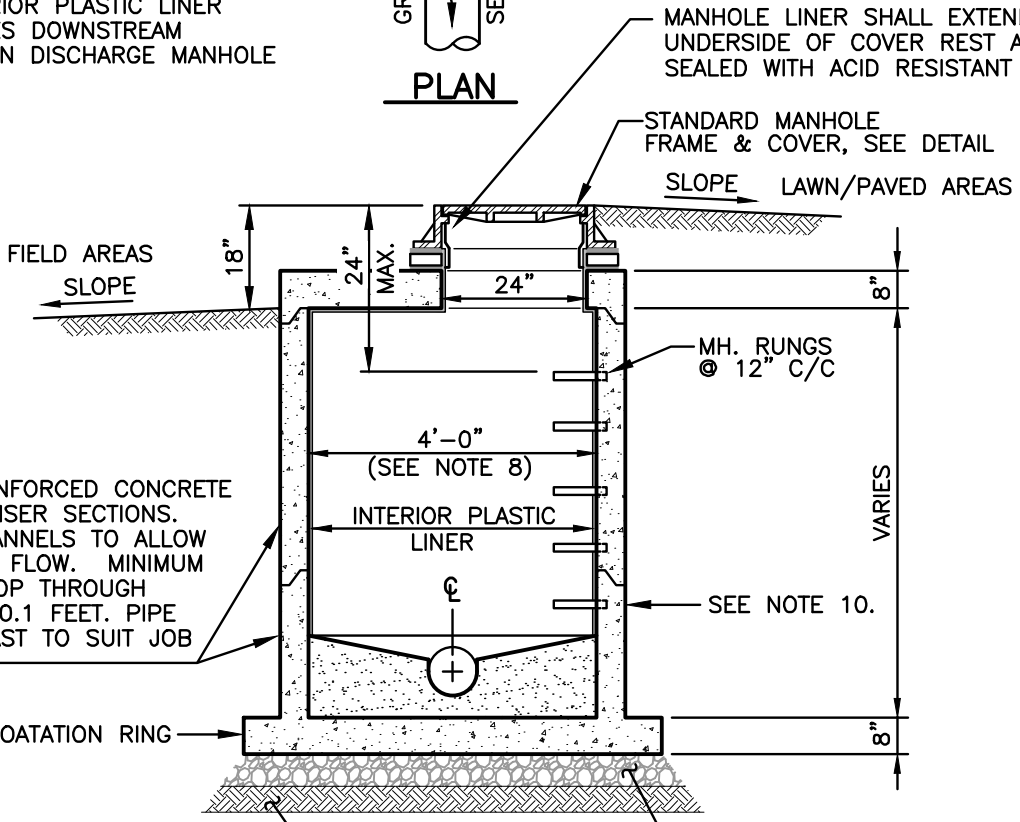
DETAIL: 7000SD07

NOTES:

1. ADJUST TO GRADE WITH CONC. GRADE RINGS (MAX. VERT. ADJUST. 6"). SEE FRAME & COVER DETAILS.
2. MECHANICALLY VIBRATED PRECAST CONC. SHALL CONFORM TO A.S.T.M. C-478.
3. SEAL ALL JOINTS INSIDE & OUTSIDE WITH PREFORMED BUTYL RUBBER SEALING COMPOUND.
4. FILL ALL LIFTING HOLES WITH NON-SHRINK NON-METALLIC GROUT.
5. INTERIOR PLASTIC LINER TO PROVIDE CONTINUOUS, IMPERMEABLE LINING TO SHIELD PRECAST CONC. AGAINST DETERIORATION CAUSED BY CORROSIVE ATMOSPHERE.
6. PROVIDE INTERIOR PLASTIC LINER IN 3 MANHOLES DOWNSTREAM OF FORCE MAIN DISCHARGE MANHOLE
7. IF FORCE MAIN DISCHARGE MANHOLE & 3 DOWNSTREAM MANHOLES ARE EXISTING, MANHOLES SHALL BE COATED AS SPECIFIED.
8. INSIDE DIAMETER DETERMINED BY PIPE SIZE & CONFIGURATION IN MANHOLE.
9. CHANNELS, BENCH AND ALL PENETRATIONS THROUGH LINER SHALL RECEIVE FACTORY APPLIED CORROSION RESISTANT COATING.
10. COAT EXTERIOR WITH BITUMASTIC 20 MIL DFT (TYP.)



PLAN



SECTION

REVISION	DATE
4	4/21
3	1/13
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1	11/04

Upper Uwchlan Township Municipal Authority

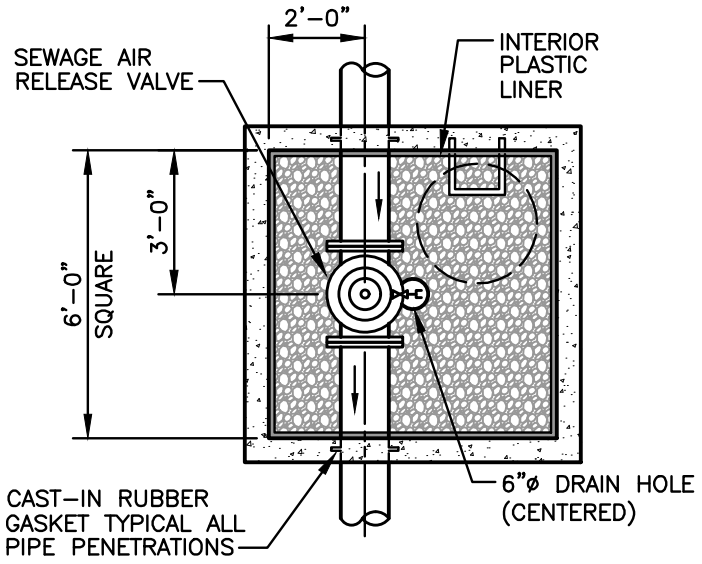
STANDARD DETAIL - SEWER SYSTEM

FORCE MAIN DISCHARGE MANHOLE

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

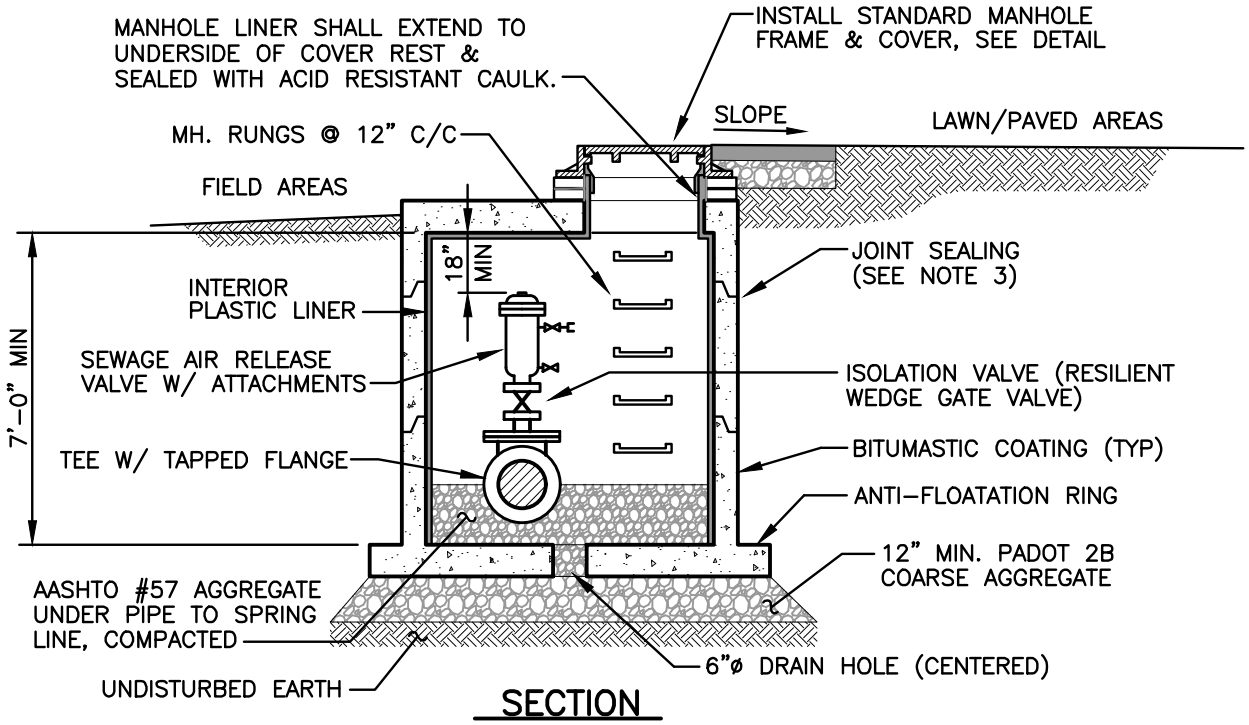
DETAIL: 7000SD08



NOTES:

1. ADJUST TO GRADE WITH CONCRETE GRADE RINGS (MAXIMUM VERTICAL ADJUSTMENT 6") SEE FRAME & COVER DETAILS.
2. MECHANICALLY VIBRATED PRECAST CONCRETE SHALL CONFORM TO A.S.T.M. SPEC. C-478.
3. PROVIDE 2 RINGS OF PREFORMED BUTYL RUBBER SEALING COMPOUND (INSIDE & OUTSIDE) AT ALL MANHOLE JOINTS.
4. FILL ALL LIFTING HOLES WITH NON-SHRINK, NON-METALLIC GROUT.
5. INTERIOR PLASTIC LINER TO PROVIDE CONTINUOUS, IMPERMEABLE LINING TO SHIELD CONCRETE AGAINST DETERIORATION CAUSED BY CORROSIVE ATMOSPHERE.

SECTIONAL PLAN



SECTION

SPECIAL NOTE:
DEPTH OF MAIN MUST BE INCREASED FROM THE 4'-0" STANDARD TO ALLOW FOR INSTALLATION OF THE AIR RELEASE VALVE WITH 18 INCH MINIMUM CLEARANCE. THE PIPE SHALL BE CONTINUOUSLY RISING WITH THE AIR RELEASE VALVE AT THE HIGHEST ELEVATION POINT IN THE PIPING.

REVISION	DATE
4	4/21
3	1/13
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1	11/04

Upper Uwchlan Township Municipal Authority

STANDARD DETAIL - SEWER SYSTEM

FORCE MAIN (D.I.P.) AIR RELEASE VALVE VAULT

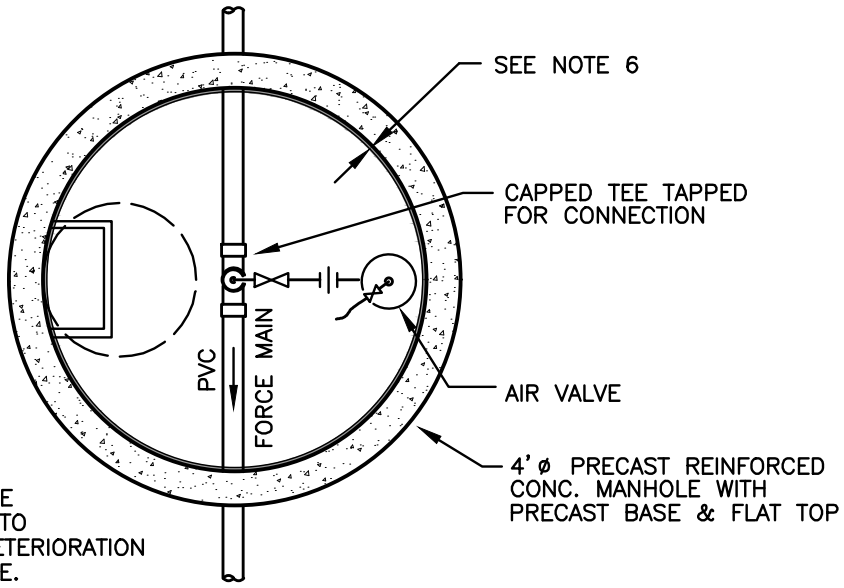
ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

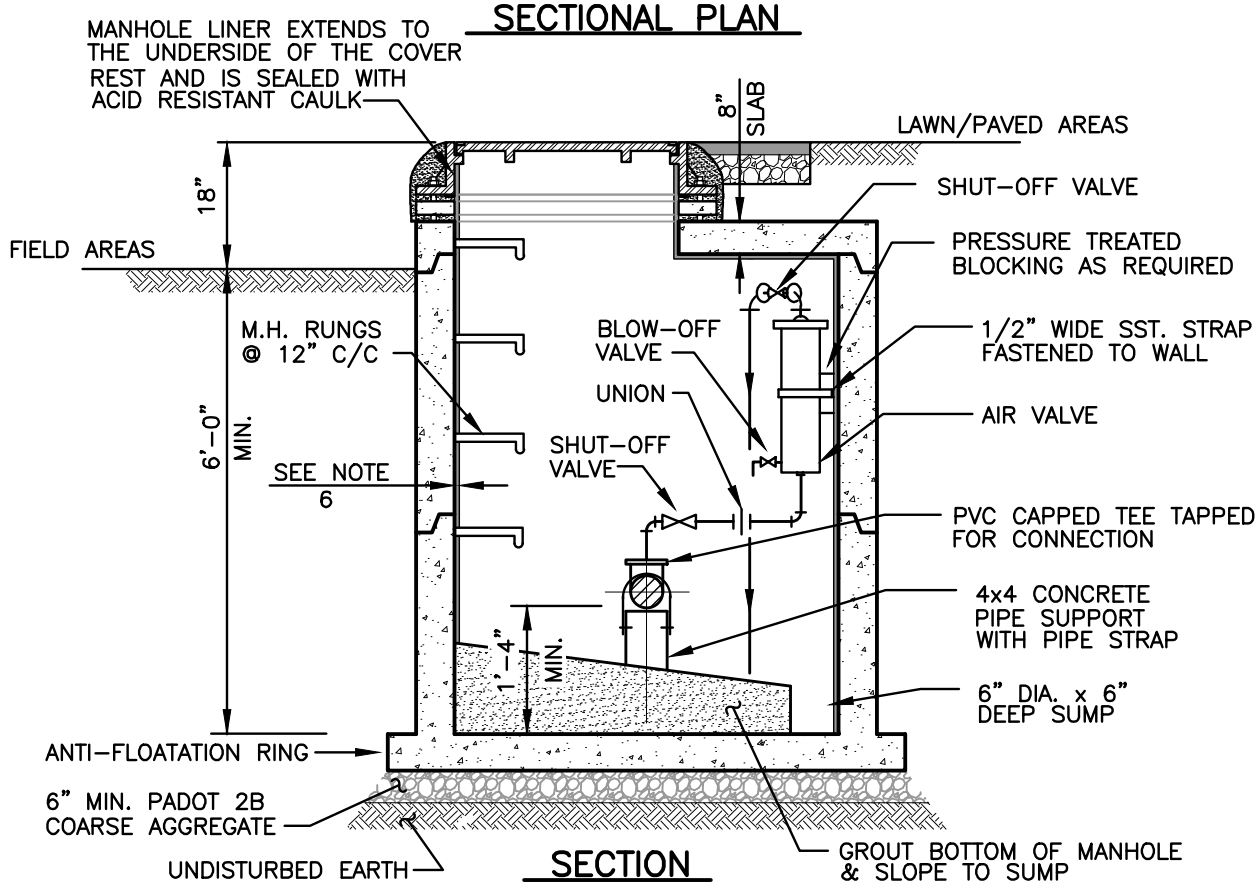
DETAIL: 7000SD09

NOTES:

1. ADJUST TO GRADE WITH CONC. GRADE RINGS, SEE STANDARD FRAME & COVER DETAILS.
2. MECHANICALLY VIBRATED PRECAST CONC. SHALL CONFORM TO A.S.T.M. C-478.
3. SEAL ALL JOINTS INSIDE & OUTSIDE WITH PREFORMED BUTYL RUBBER SEALING COMPOUND.
4. COAT EXTERIOR WITH BITUMASTIC EPOXY 20-MIL DFT (TYP.)
5. COAT GROUT FILL & SUMP AS SPECIFIED.
6. INTERIOR PLASTIC LINER TO PROVIDE CONTINUOUS, IMPERMEABLE LINING TO SHIELD PRECAST CONC. AGAINST DETERIORATION CAUSED BY CORROSIVE ATMOSPHERE.



SECTIONAL PLAN



SECTION

REVISION	DATE
4	4/21
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Upper Uwchlan Township Municipal Authority

STANDARD DETAIL - SEWER SYSTEM

FORCE MAIN (P.V.C.) AIR RELEASE VALVE MANHOLE (4" AND SMALLER)

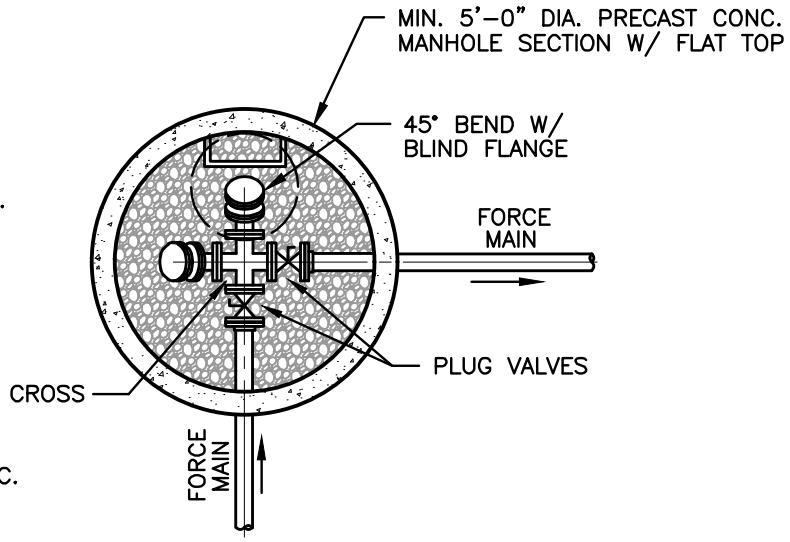
ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

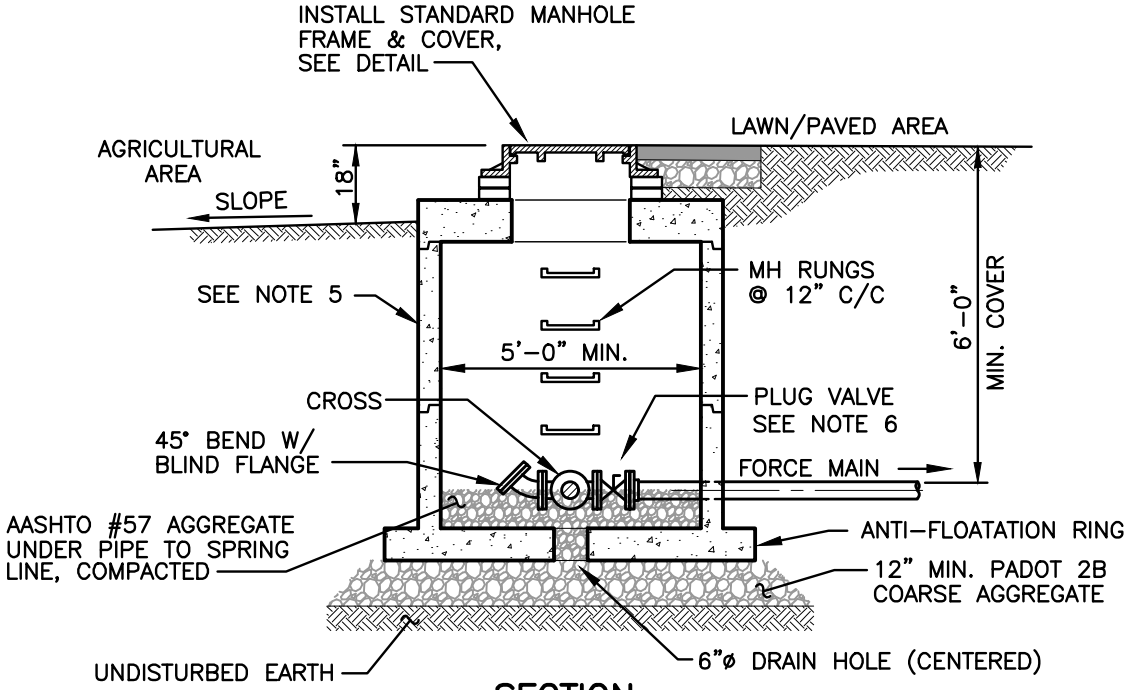
DETAIL: 7000SD10

NOTES:

1. ADJUST TO GRADE WITH CONC. GRADE RINGS, SEE STANDARD FRAME & COVER DETAILS.
2. MECHANICALLY VIBRATED PRECAST CONC. SHALL CONFORM TO A.S.T.M. C-478.
3. FILL ALL LIFTING HOLES WITH NON-SHRINK, NON-METALLIC GROUT.
4. PROVIDE 2 RINGS OF PREFORMED BUTYL RUBBER SEALING COMPOUND (INSIDE AND OUTSIDE) AT ALL MANHOLE JOINTS.
5. COAT EXTERIOR WITH BITUMASTIC EPOXY 20-MIL DFT (TYP.)
6. OUTSIDE DIAMETER OF FLANGES SHALL BE 6" ABOVE FLOOR.
7. ALL PIPE AND FITTINGS BETWEEN VALVES SHALL BE SCHEDULE 80 PVC.



SECTIONAL PLAN



SECTION

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REVISION	DATE

Upper Uwchlan Township Municipal Authority

STANDARD DETAIL - SEWER SYSTEM

FORCE MAIN CLEANOUT 45° BENDS WITH VALVES IN MANHOLE

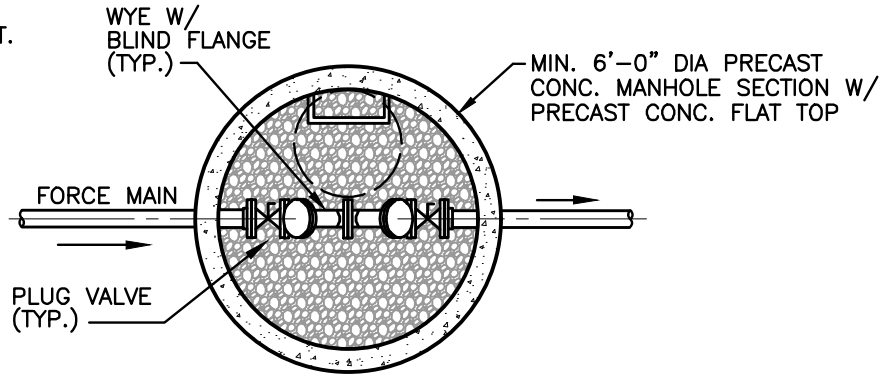
ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5285

DATE: APRIL 2021

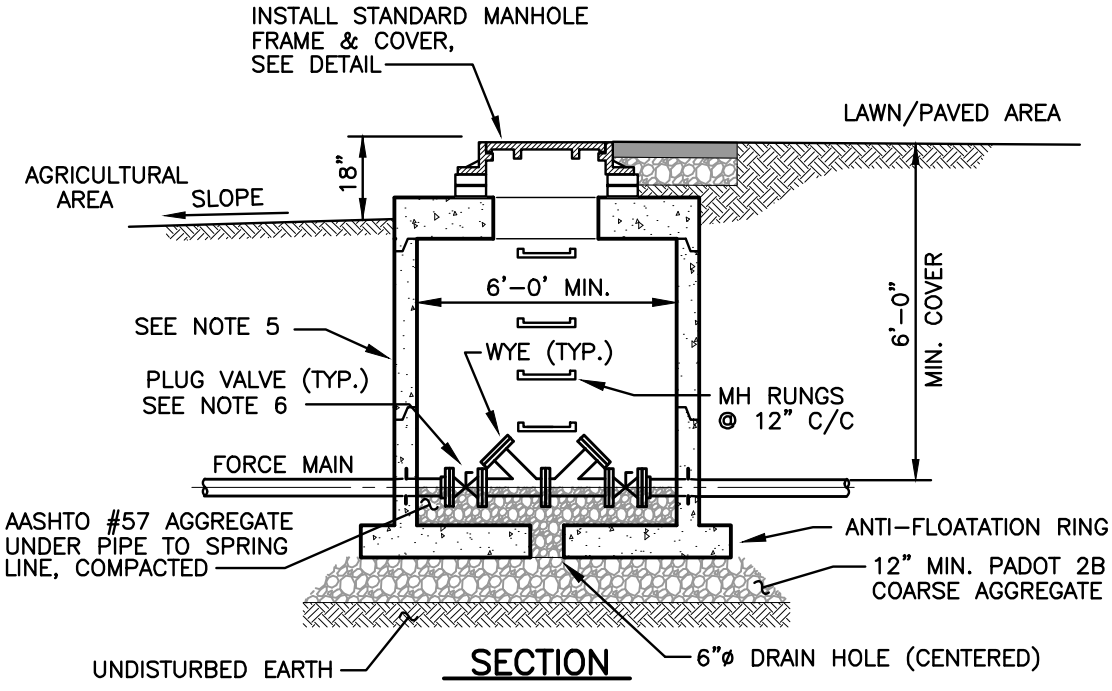
DETAIL: 7000SD11

NOTES:

1. ADJUST TO GRADE WITH CONC. GRADE RINGS, SEE STANDARD FRAME & COVER DETAILS.
2. MECHANICALLY VIBRATED PRECAST CONC. SHALL CONFORM TO A.S.T.M. C-478.
3. FILL ALL LIFTING HOLES WITH NON-SHRINK, NON-METALLIC GROUT.
4. PROVIDE 2 RINGS OF PREFORMED BUTYL RUBBER SEALING COMPOUND (INSIDE AND OUTSIDE) AT ALL MANHOLE JOINTS.
5. COAT EXTERIOR WITH BITUMASTIC EPOXY 20-MIL DFT.
6. OUTSIDE DIAMETER OF FLANGES SHALL BE 6" ABOVE FLOOR.
7. ALL PIPE AND FITTINGS BETWEEN SHALL BE 6" ABOVE FLOOR. PVC.



SECTIONAL PLAN



SECTION

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REVISION	DATE

Upper Uwchlan Township Municipal Authority

STANDARD DETAIL - SEWER SYSTEM

FORCE MAIN CLEANOUT
WYES WITH VALVES IN MANHOLE

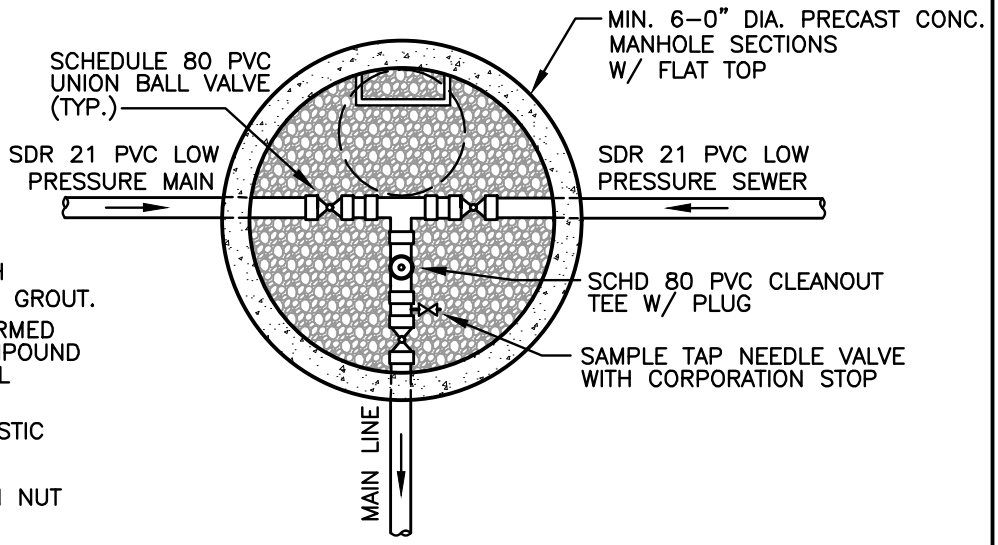
ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.375.5285
Fax 610.374.5287

DATE: APRIL 2021

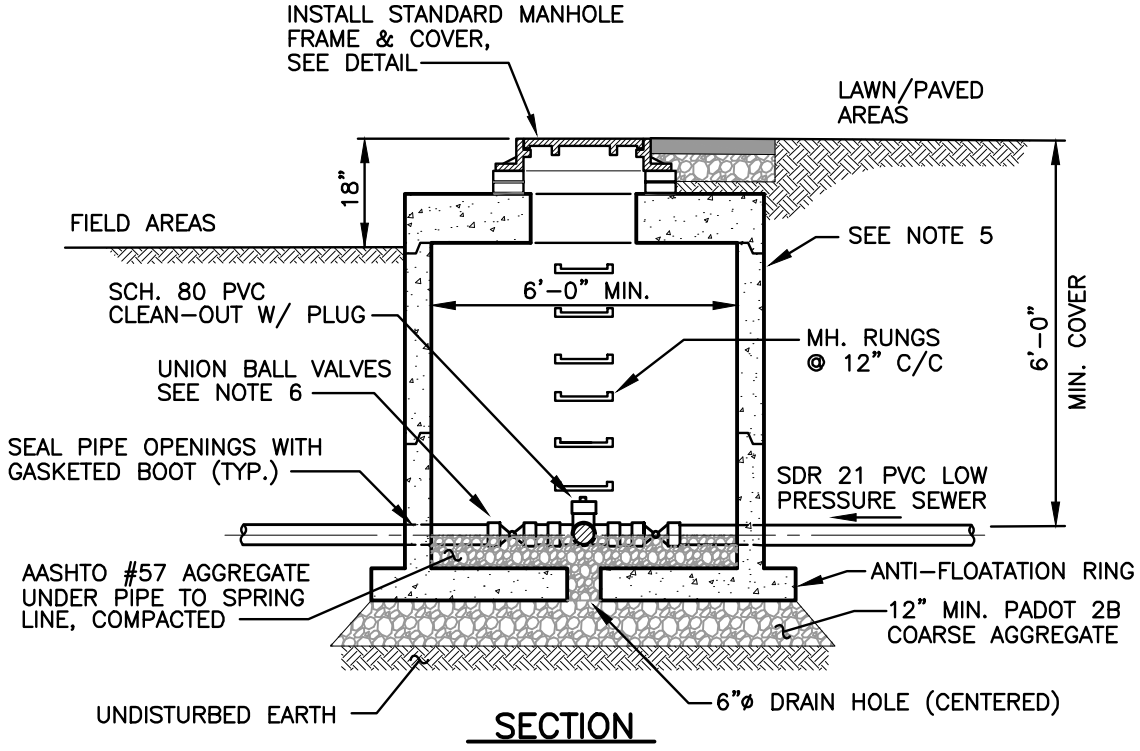
DETAIL: 7000SD12

NOTES:

1. ADJUST TO GRADE WITH CONC. GRADE RINGS, SEE STANDARD FRAME & COVER DETAILS.
2. MECHANICALLY VIBRATED PRECAST CONC. SHALL CONFORM TO A.S.T.M. C-478.
3. FILL ALL LIFTING HOLES WITH NON-SHRINK, NON-METALLIC GROUT.
4. PROVIDE 2 RINGS OF PREFORMED BUTYL RUBBER SEALING COMPOUND (INSIDE AND OUTSIDE) AT ALL MANHOLE JOINTS.
5. COAT EXTERIOR WITH BITUMASTIC EPOXY 20-MIL DFT (TYP.)
6. OUTSIDE DIAMETER OF UNION NUT SHALL BE 6" ABOVE FLOOR.
7. ALL PIPE AND FITTINGS BETWEEN VALVES SHALL BE SCHEDULE 80 PVC.



SECTIONAL PLAN



SECTION

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Upper Uwchlan Township Municipal Authority

STANDARD DETAIL - SEWER SYSTEM

PRESSURE SEWER CLEANOUT TEE WITH VALVES IN MANHOLE

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

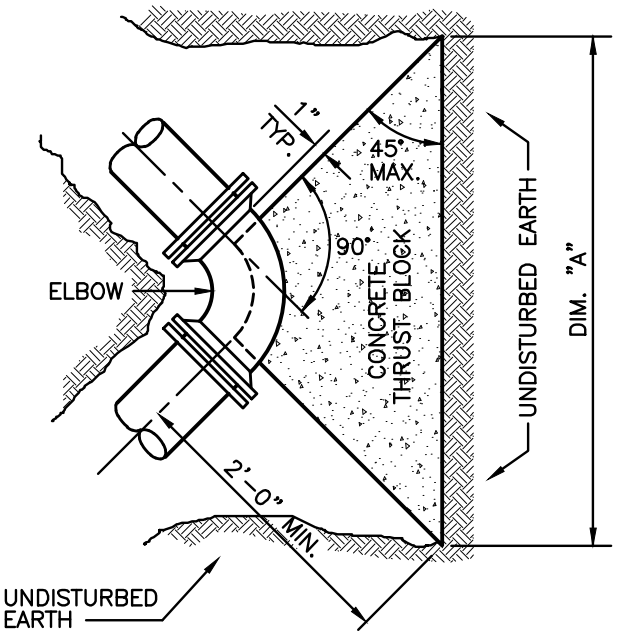
DATE: APRIL 2021

DETAIL: 7000SD13

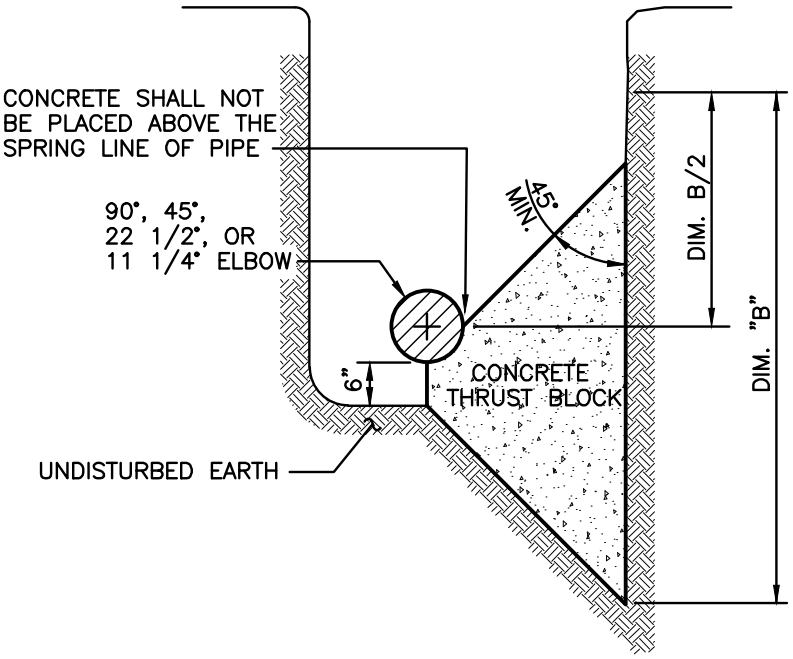
THRUST BLOCK DIMENSION SCHEDULE – ELBOWS(*)					
PIPE DIAM.	DIM.	ELBOW DEFLECTION ANGLE			
		11 1/4°	22 1/2°	45°	90°
1 1/2" THRU 4"	A	12"	18"	24"	24"
	B	12"	12"	12"	18"
6"	A	18"	24"	30"	42"
	B	12"	18"	24"	30"
8"	A	24"	24"	42"	60"
	B	12"	24"	30"	36"
12"	A	30"	42"	54"	90"
	B	24"	30"	36"	48"

(*) THRUST BLOCK DESIGN BASED ON THE MINIMUM SOIL HORIZONTAL BEARING STRENGTH OF 3000 PSF AND 150 PSI WORKING PRESSURE PLUS 50% WATER HAMMER ALLOWANCE.

FOR PIPE SIZES GREATER THAN 12", SUBMIT ENGINEERING CALCULATIONS TO VERIFY PROPOSED THRUST BLOCK SIZES.



SECTIONAL PLAN



SECTION

REVISION	DATE
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Upper Uwchlan Township Municipal Authority

STANDARD DETAIL – SEWER SYSTEM

FORCE MAIN THRUST BLOCK–ELBOWS HORIZONTAL & VERTICAL UP THRUST

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

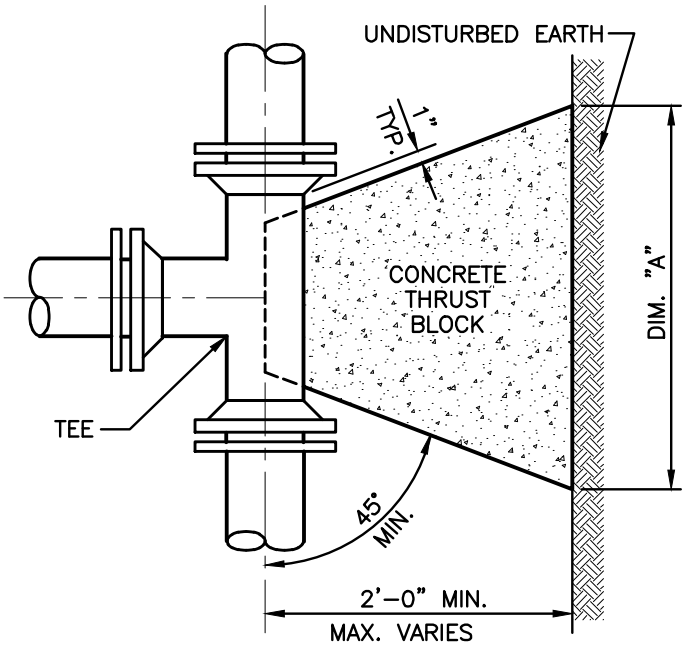
DATE: APRIL 2021

DETAIL: 7000SD14

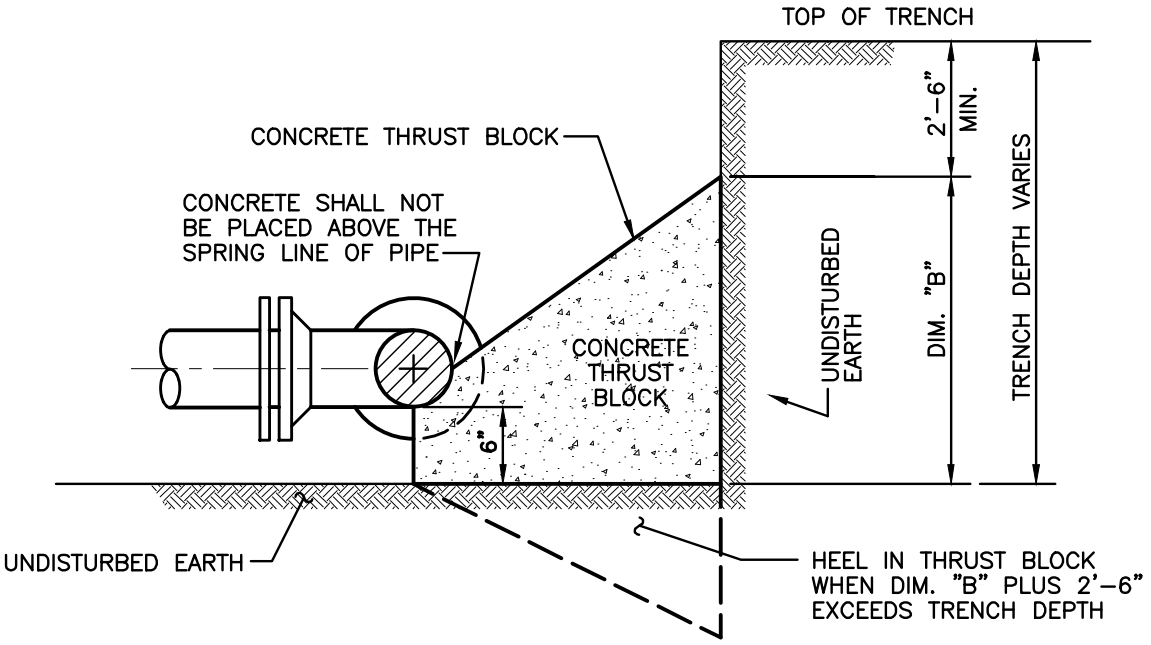
THRUST BLOCK DIMENSION SCHEDULE – TEES(*)				
DIM.	BRANCH SIZE			
	1 1/2" – 4"	6"	8"	12"
A	36"	42"	60"	96"
B	18"	24"	30"	42"

(*) THRUST BLOCK DESIGN BASED ON THE MINIMUM SOIL HORIZONTAL BEARING STRENGTH OF 3000 PSF AND 150 PSI WORKING PRESSURE PLUS 50% WATER HAMMER ALLOWANCE.

FOR PIPE SIZES GREATER THAN 12", SUBMIT ENGINEERING CALCULATIONS TO VERIFY PROPOSED THRUST BLOCK SIZES.



SECTIONAL PLAN



SECTION

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Upper Uwchlan Township Municipal Authority

STANDARD DETAIL – SEWER SYSTEM

FORCE MAIN THRUST BLOCK–TEES HORIZONTAL RESTRAINTS

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

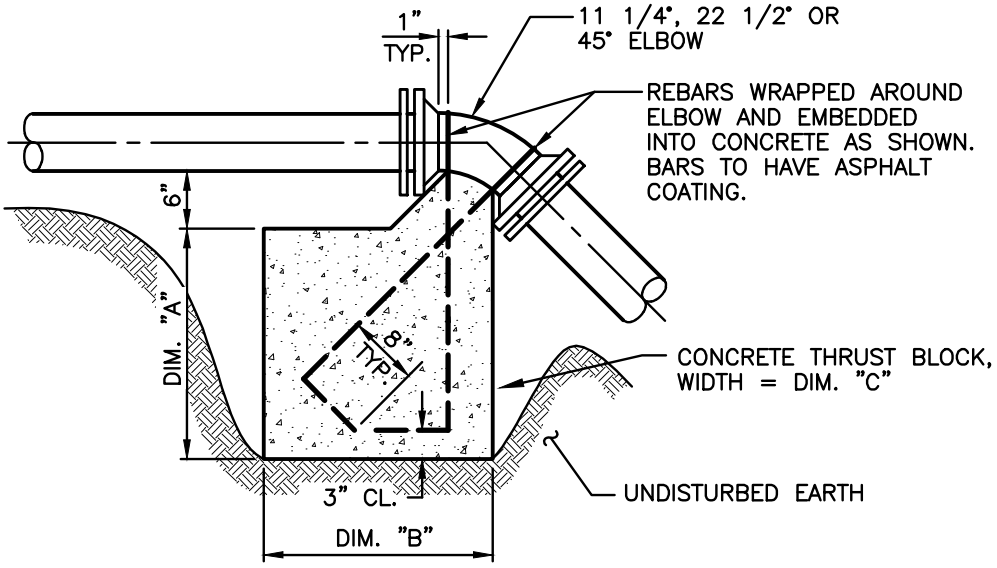
DATE: APRIL 2021

DETAIL: 7000SD15

THRUST BLOCK DIMENSION SCHEDULE – VERTICAL ELBOWS(*) (DUCTILE IRON PIPE)									
DIM.	1 1/2" - 6" 11 1/4°	8" 11 1/4°	12" 11 1/4°	1 1/2" - 6" 22 1/2°	8" 22 1/2°	12" 22 1/2°	1 1/2" - 6" 45°	8" 45°	12" 45°
A	12"	18"	36"	18"	36"	54"	36"	48"	54"
B	18"	24"	36"	24"	36"	48"	36"	48"	54"
C	18"	24"	24"	24"	24"	30"	24"	30"	48"
REBAR	#4	#4	#6	#4	#4	#6	#4	#4	#6

(*) THRUST BLOCK DESIGN BASED ON THE MINIMUM SOIL HORIZONTAL BEARING STRENGTH OF 3000 PSF AND 150 PSI WORKING PRESSURE PLUS 50% WATER HAMMER ALLOWANCE.

FOR PIPE SIZES GREATER THAN 12", SUBMIT ENGINEERING CALCULATIONS TO VERIFY PROPOSED THRUST BLOCK SIZES.



SECTION

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3	1/13
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Upper Uwchlan Township Municipal Authority

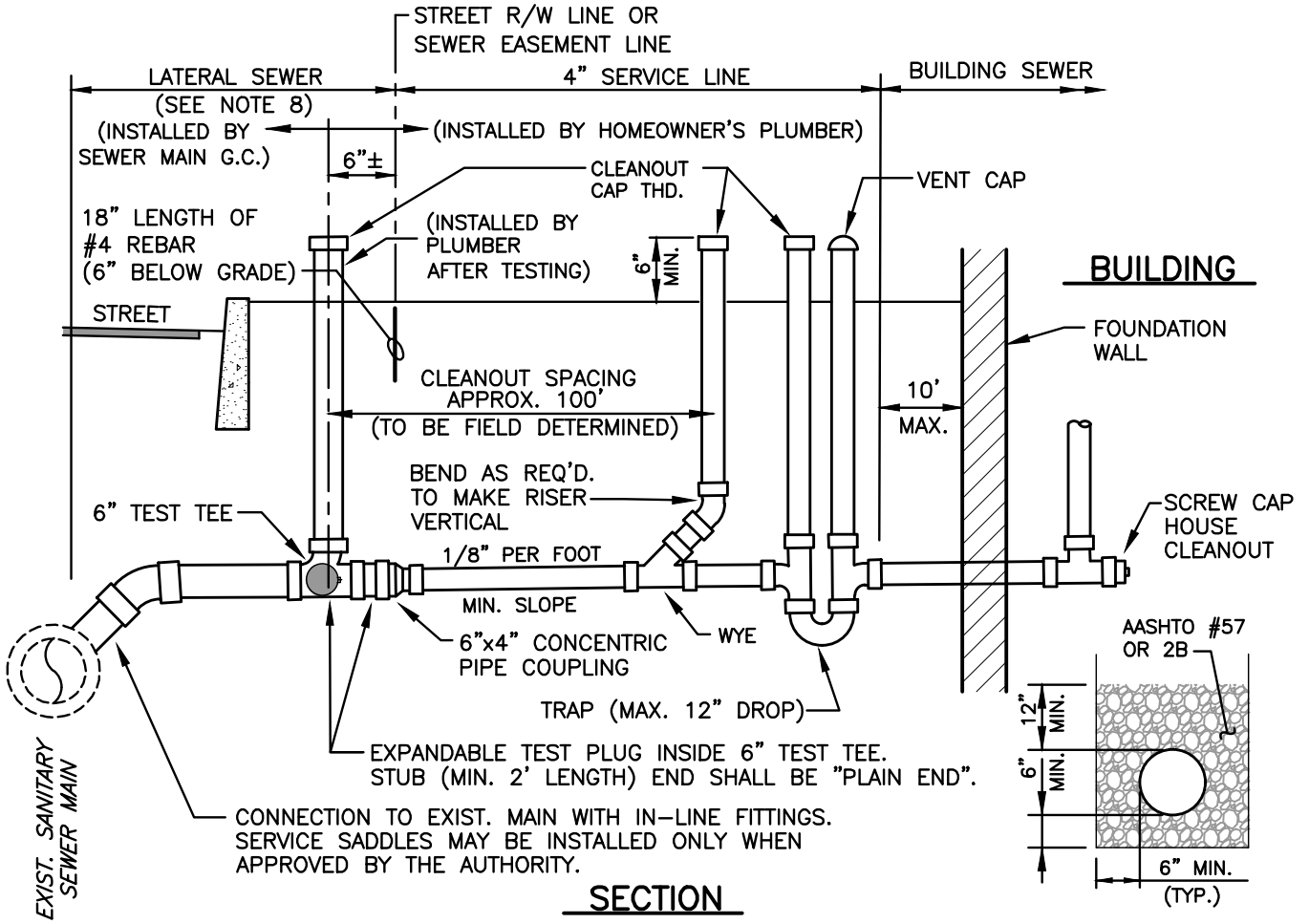
STANDARD DETAIL – SEWER SYSTEM

FORCE MAIN THRUST BLOCK–ELBOWS VERTICAL DOWN RESTRAINT

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

DETAIL: 7000SD16



NOTES:

1. PROVIDE 6" OF AASHTO NO. 57 STONE BELOW PIPE AND 12" ABOVE PIPE (TYPICAL ENTIRE LENGTH OF LATERAL AND SERVICE LINE)
2. MINIMUM SLOPE = 1/8" PER FT.
3. MINIMUM DEPTH OF COVER = 4 FT
4. PIPE MATERIALS:
   LATERAL SEWER – PVC SDR 35 OR DIP CLASS 52 WHEN INSTALLED IN FILL MATERIAL
   SERVICE LINE – PVC SDR 35 OR SCH. 40
5. TO CONDUCT AIR TESTING OF SERVICE LINE, INSTALL EXPANDABLE PLUGS AT LOCATIONS SHOWN.
6. NO SEWER SERVICE LINE VENT CAPS SHALL BE INSTALLED WITHIN A 100-YR FLOOD PLAIN OR WITHIN FLOOD PRONE AREAS.
7. NO VENT CAPS OR CLEANOUTS SHALL BE INSTALLED IN DRIVEWAYS OR OTHER PAVED AREAS, UNLESS SPECIFICALLY APPROVED BY UUTMA. VENTS AND CLEANOUTS LOCATED IN PAVED AREAS MUST BE PROVIDED WITH A FRAME AND COVER IN ACCORDANCE WITH VENT & CLEANOUTS IN PAVED AREAS DETAIL.
8. THE LATERAL SEWER SHALL BE INSTALLED TO THE EDGE OF THE SEWER EASEMENT FOR SEWERS LOCATED IN AN EASEMENT OR TO THE STREET RIGHT-OF-WAY AS A MINIMUM, OR TO SUCH POINT, AS REQUIRED, TO CLEAR STREET SIDEWALKS AND UNDERGROUND UTILITIES.
9. CLEANOUTS AND VENTS IN LAWN AREAS MUST BE 6" MINIMUM ABOVE GRADE.

REVISION	DATE
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Upper Uwchlan Township Municipal Authority

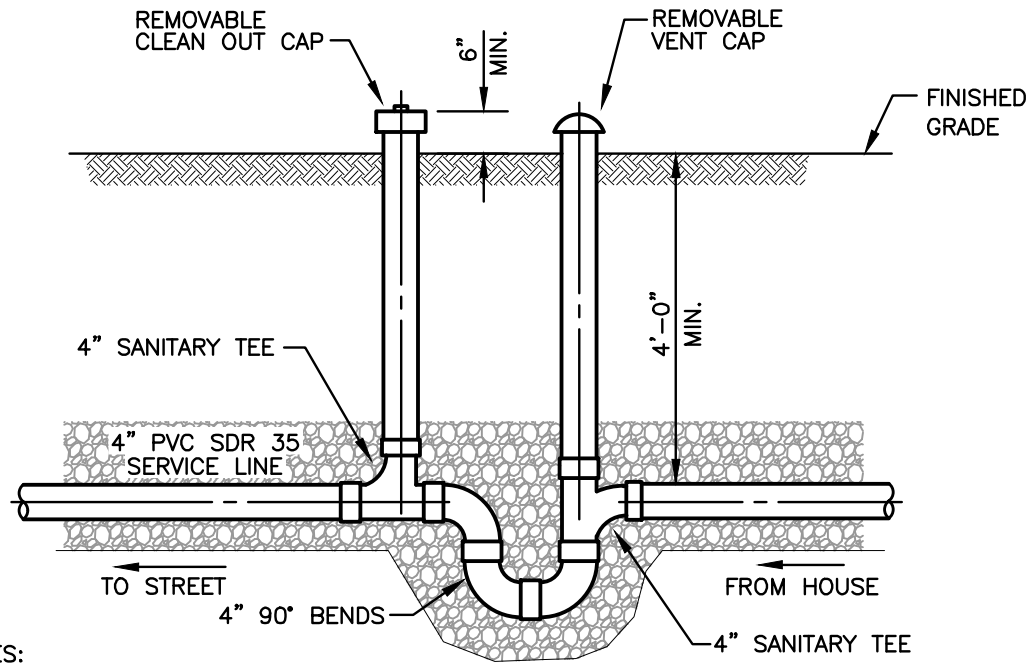
STANDARD DETAIL – SEWER SYSTEM

LATERAL & SERVICE LINE

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

DETAIL: 7000SD17



NOTES:

1. FOR CLEANOUTS LOCATED IN YARDS, CAPS TO REMAIN ABOVE GRADE AT ALL TIMES DURING & AFTER INSTALLATION.
2. CLEANOUTS LOCATED IN PAVED AREAS MUST BE PROVIDED WITH FRAME AND COVER SIMILAR TO CAPS SHOWN ON DETAIL 7000SD19.

SECTION

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Upper Uwchlan Township Municipal Authority

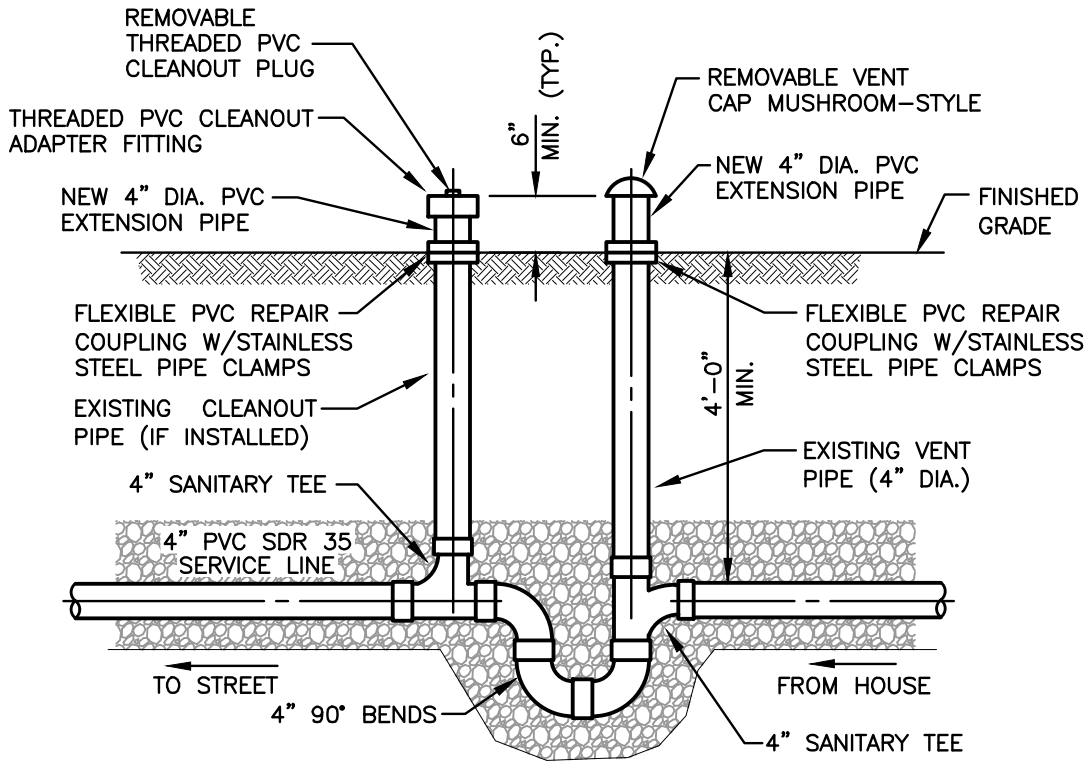
STANDARD DETAIL - SEWER SYSTEM

SERVICE LINE CLEANOUT & VENT

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

DETAIL: 7000SD18



NOTES:

1. FOR CLEANOUTS LOCATED IN YARDS, CAPS TO REMAIN ABOVE GRADE AT ALL TIMES.

SECTION

1	4/21
REVISION	DATE

Upper Uwchlan Township Municipal Authority

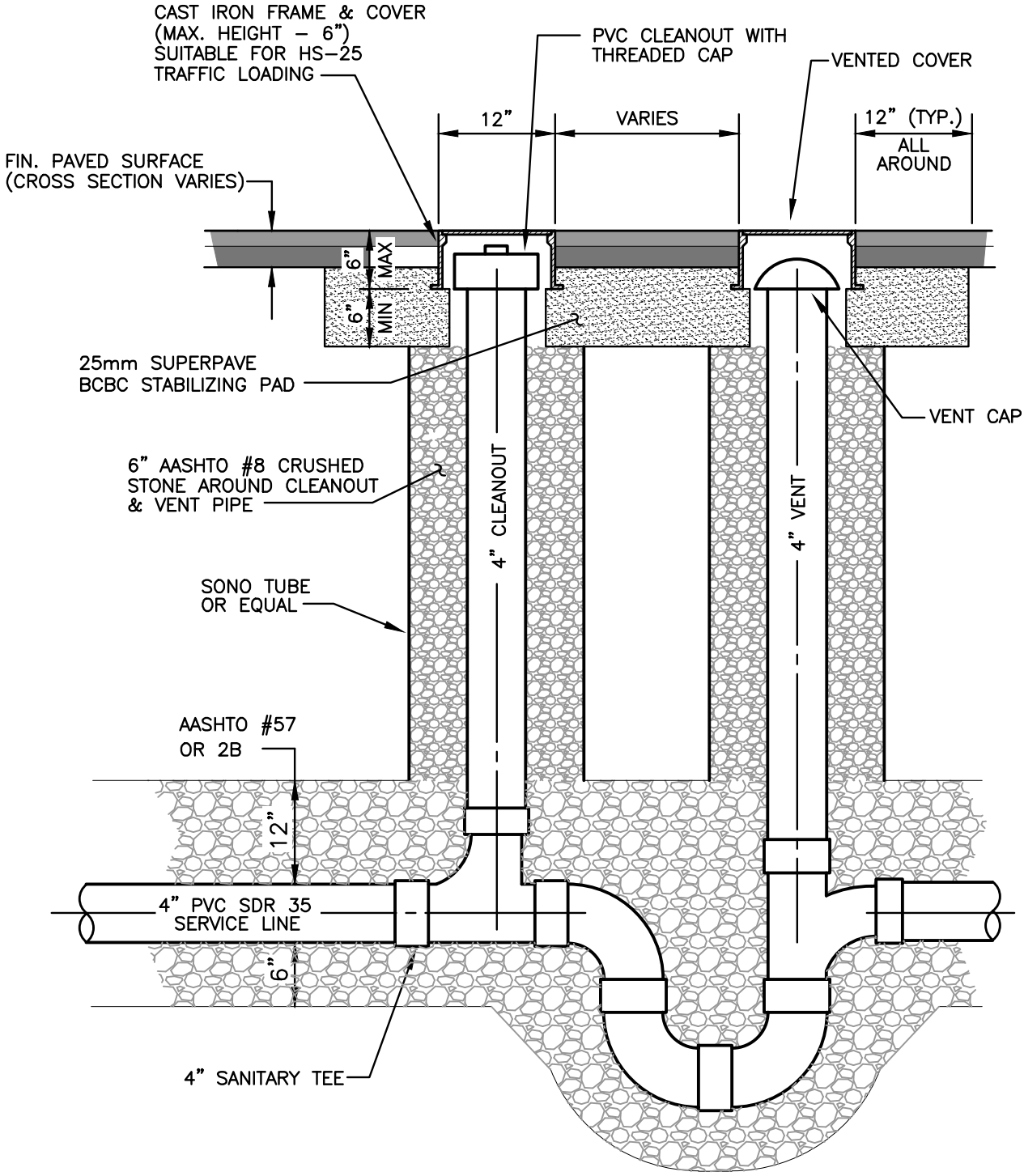
STANDARD DETAIL - SEWER SYSTEM

SERVICE LINE CLEANOUT & VENT PIPE REPAIR (RAISING ABOVE GRADE)

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

DETAIL: 7000SD18A



REVISION	DATE
3	4/21
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1	6/05

Upper Uwchlan Township Municipal Authority

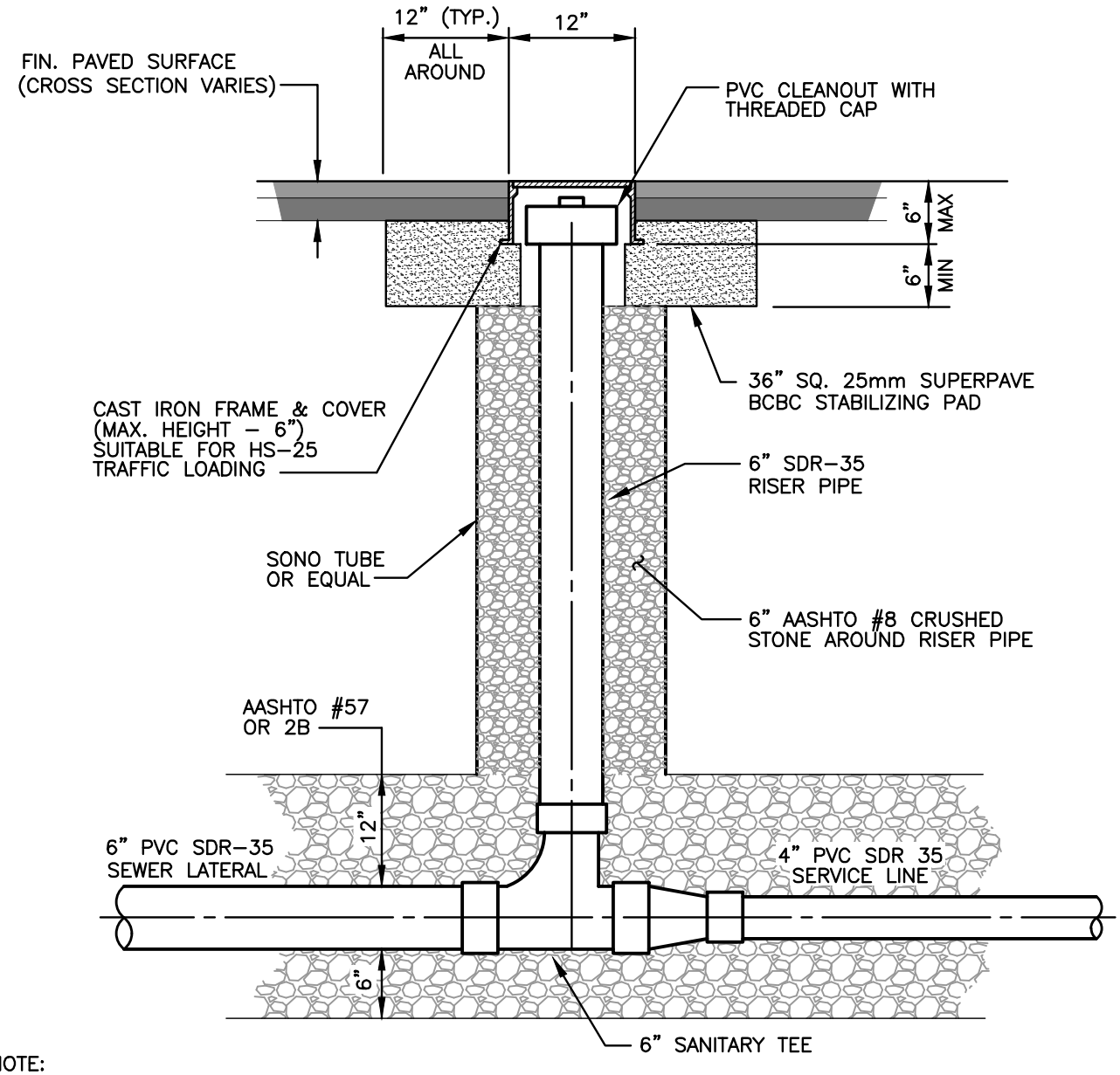
STANDARD DETAIL – SEWER SYSTEM

SERVICE LINE CLEANOUT & VENT IN PAVED AREAS

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

DETAIL: 7000SD19



NOTE:
1. FOR SEWER LATERALS INSTALLED IN FILL MATERIAL, USE CLASS 52 DUCTILE IRON PIPE.

SECTION

REVISION	DATE
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Upper Uwchlan Township Municipal Authority

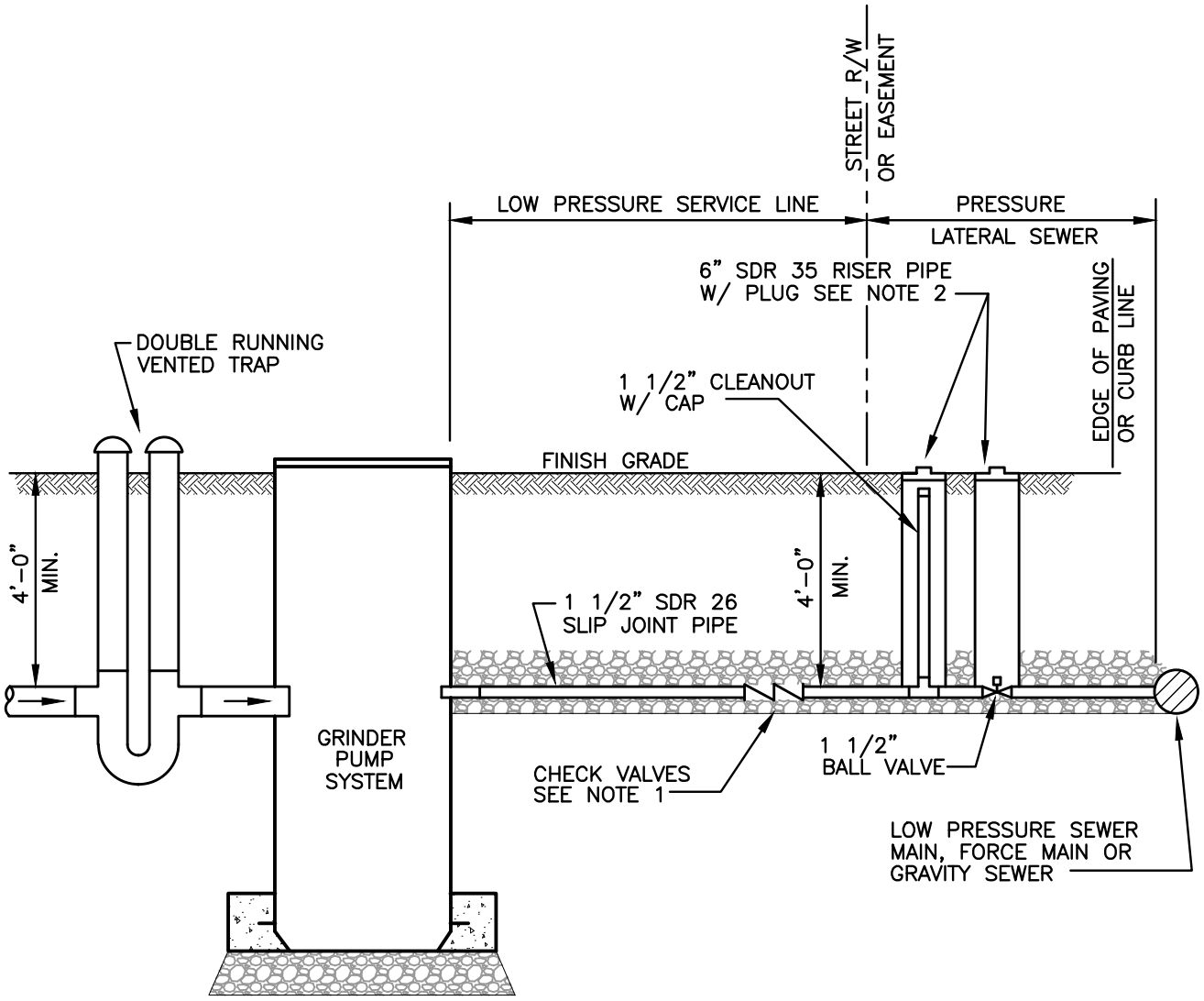
STANDARD DETAIL – SEWER SYSTEM

CLEANOUT/TEST TEE IN PAVED AREAS

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

DETAIL: 7000SD20



SECTION

NOTES:

1. PROVIDE TWO (2) CHECK VALVES IN SERIES BETWEEN GRINDER PUMP AND CLEANOUT LOCATED IN STREET RIGHT-OF-WAY WHEN DISCHARGING TO A LOW PRESSURE SEWER OR FORCE MAIN.
2. CLEANOUTS LOCATED IN PAVED AREAS MUST BE PROVIDED WITH FRAME AND COVER SIMILAR TO CAPS SHOWN ON DETAIL 7000SD19.
3. GRINDER SYSTEM TANK SHALL BE LOCATED OUTSIDE OF PAVED AREAS.

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REVISION	DATE

Upper Uwchlan Township Municipal Authority

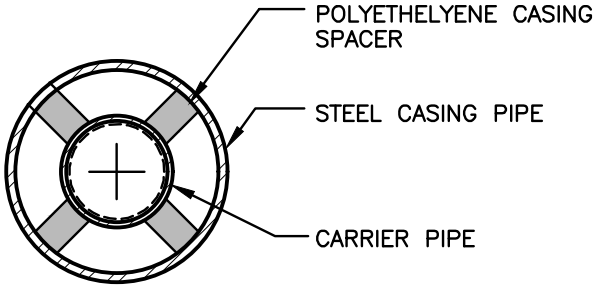
STANDARD DETAIL - SEWER SYSTEM

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

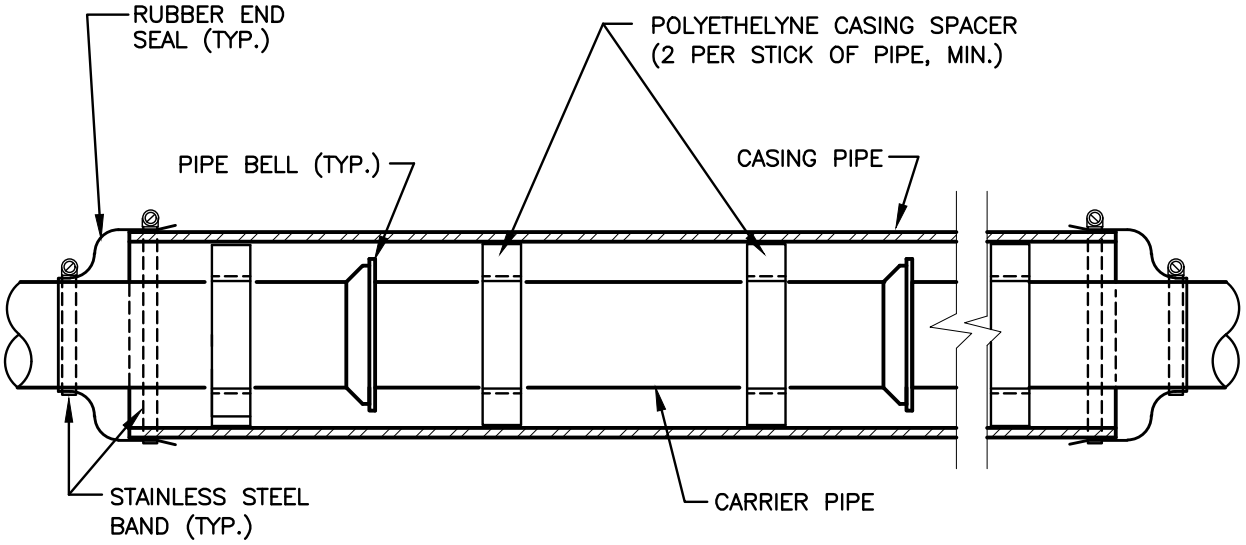
SIMPLEX GRINDER PUMP

DATE: APRIL 2021

DETAIL: 7000SD21



SECTION



ELEVATION

NOTE:
1. DETAILS SHOWN ARE INDICATIVE OF A STANDARD INSTALLATION. FOR SPECIFIC DETAILS, REFER TO STANDARD SPECIFICATIONS.

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Upper Uwchlan Township Municipal Authority

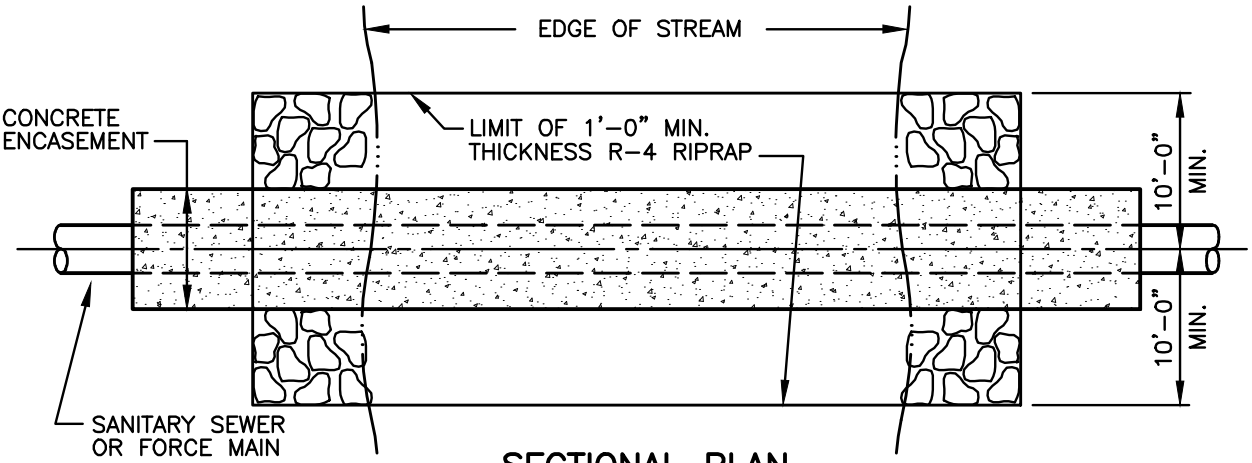
STANDARD DETAIL - SEWER SYSTEM

CASING CRADLE

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374. 5285
Fax 610.374.5287

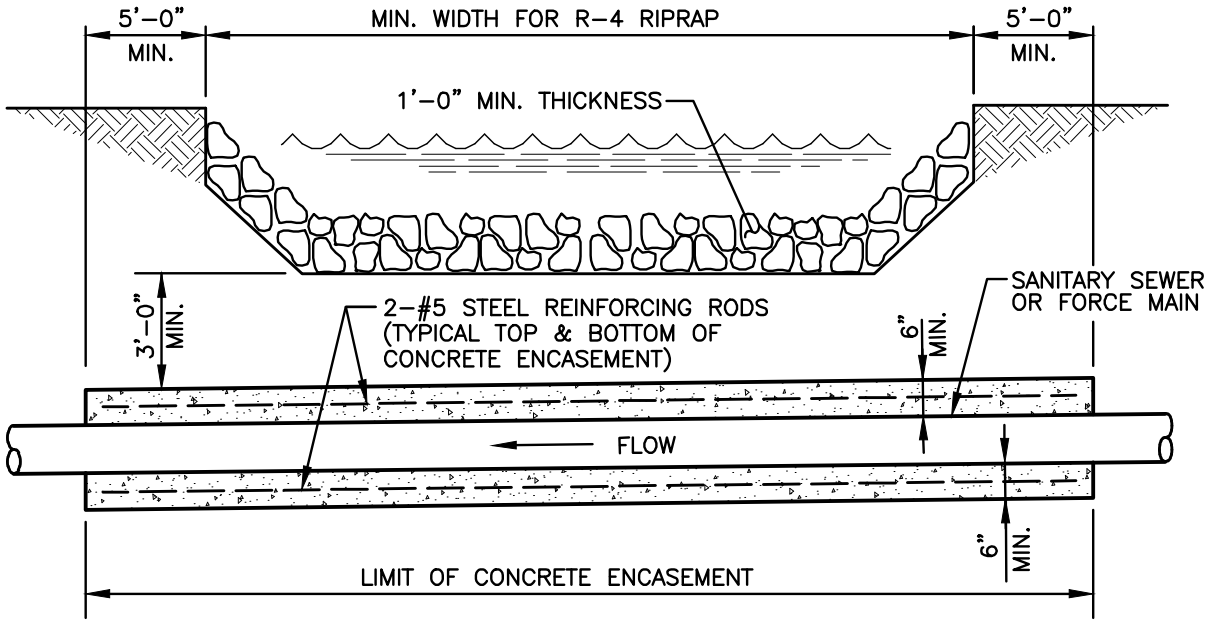
DATE: APRIL 2021

DETAIL: 7000SD22



SECTIONAL PLAN

NOTE:
ALL STREAM CROSSINGS SHALL BE IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF THE CHESTER COUNTY CONSERVATION DISTRICT.



SECTION

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3	1/13
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REVISION	DATE

Upper Uwchlan Township Municipal Authority

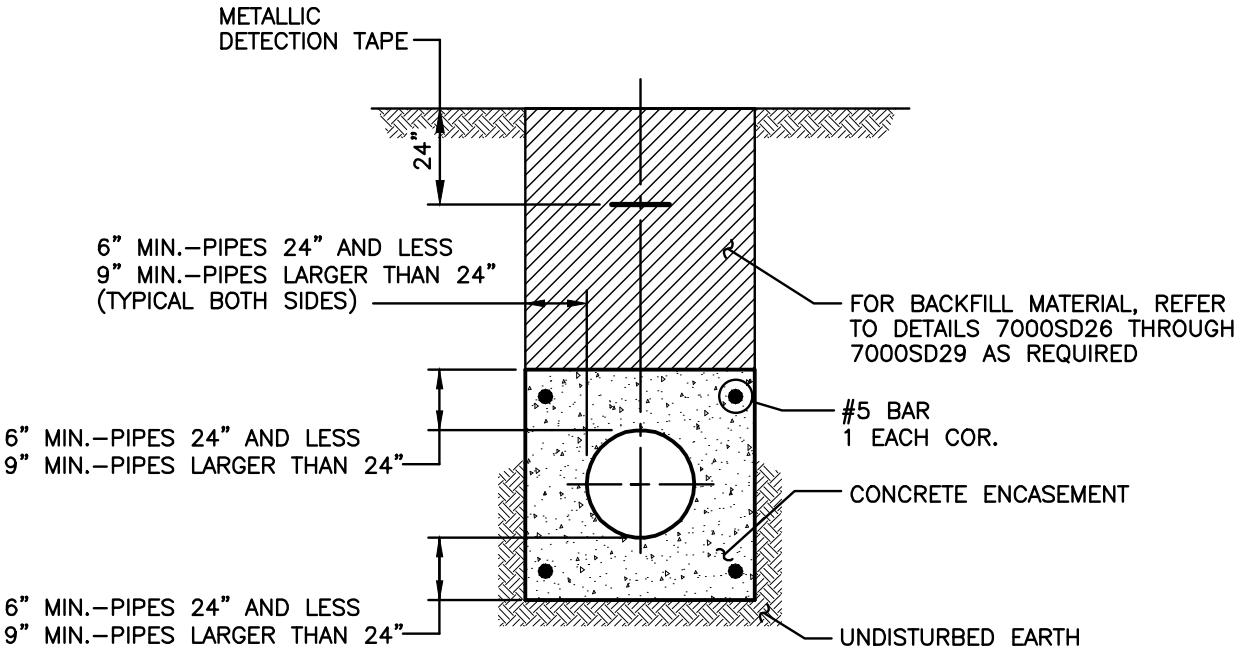
STANDARD DETAIL - SEWER SYSTEM

STREAM CROSSING

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

DETAIL: 7000SD23



SECTION

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1	11/04

Upper Uwchlan Township Municipal Authority

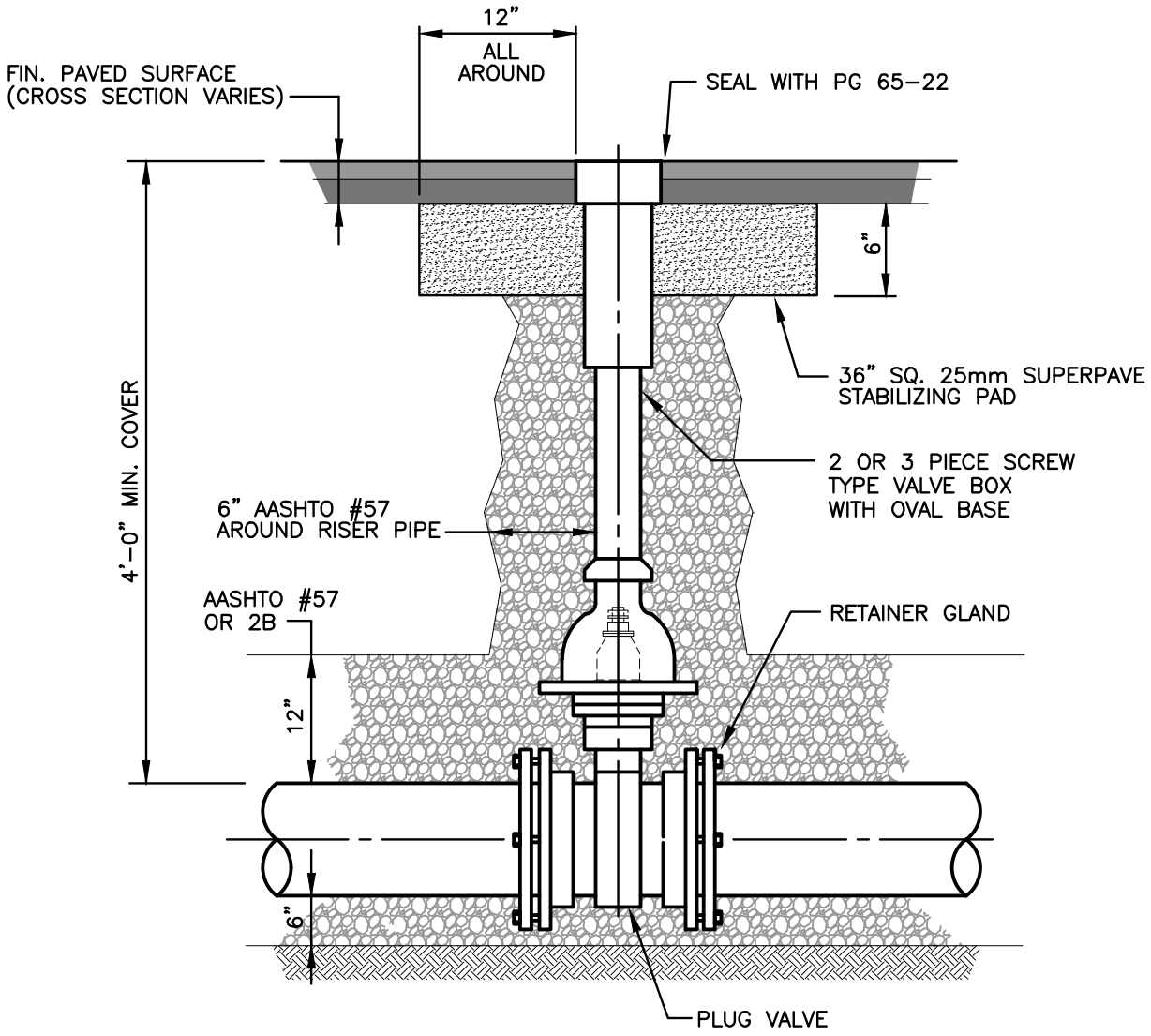
STANDARD DETAIL – SEWER SYSTEM

CONCRETE ENCASEMENT

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

DETAIL: 7000SD24



SECTION

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3	1/13
2	6/05
1	11/04
REVISION	DATE

Upper Uwchlan Township Municipal Authority

STANDARD DETAIL - SEWER SYSTEM

ARRO
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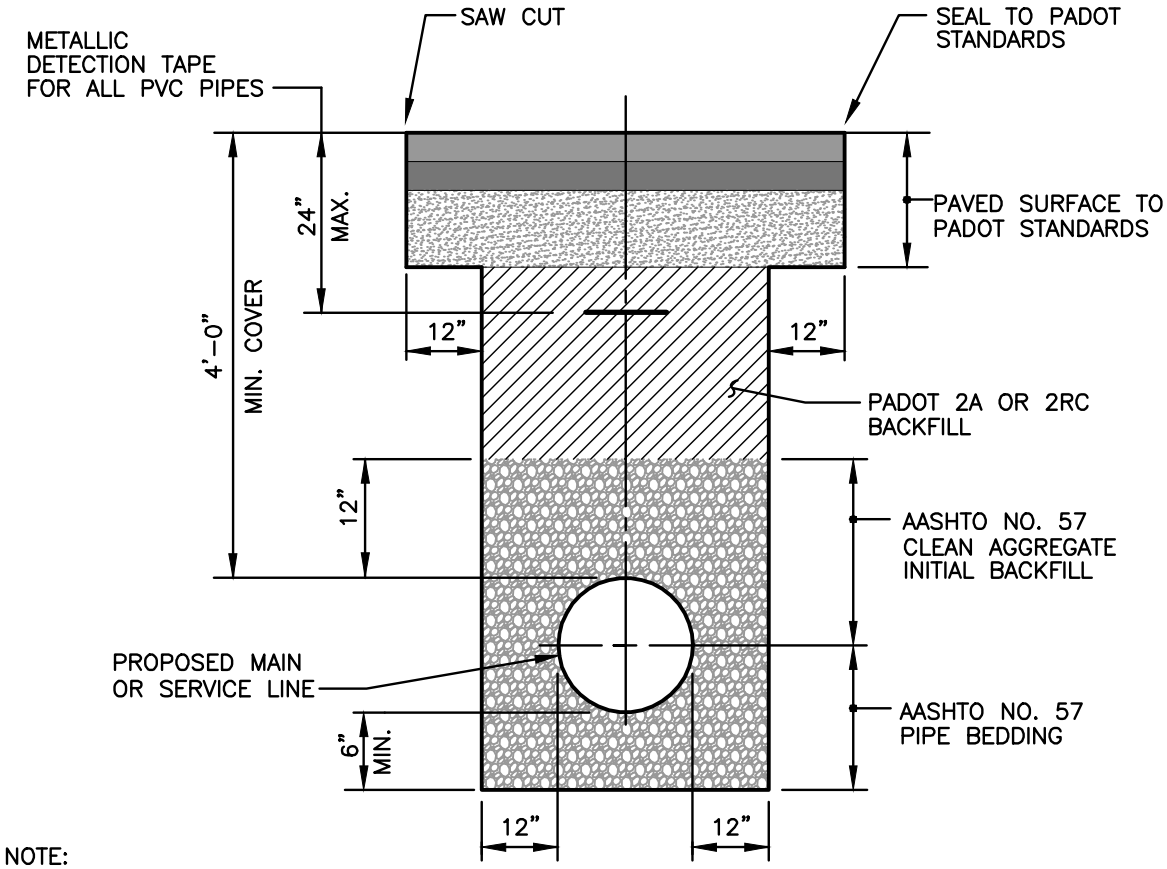
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

PLUG VALVE IN PAVED AREA

DATE: APRIL 2021

DETAIL: 7000SD25



NOTE:
SURFACE RESTORATION IN SHOULDERS SHALL BE PADOT STANDARDS.

SECTION

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Upper Uwchlan Township Municipal Authority

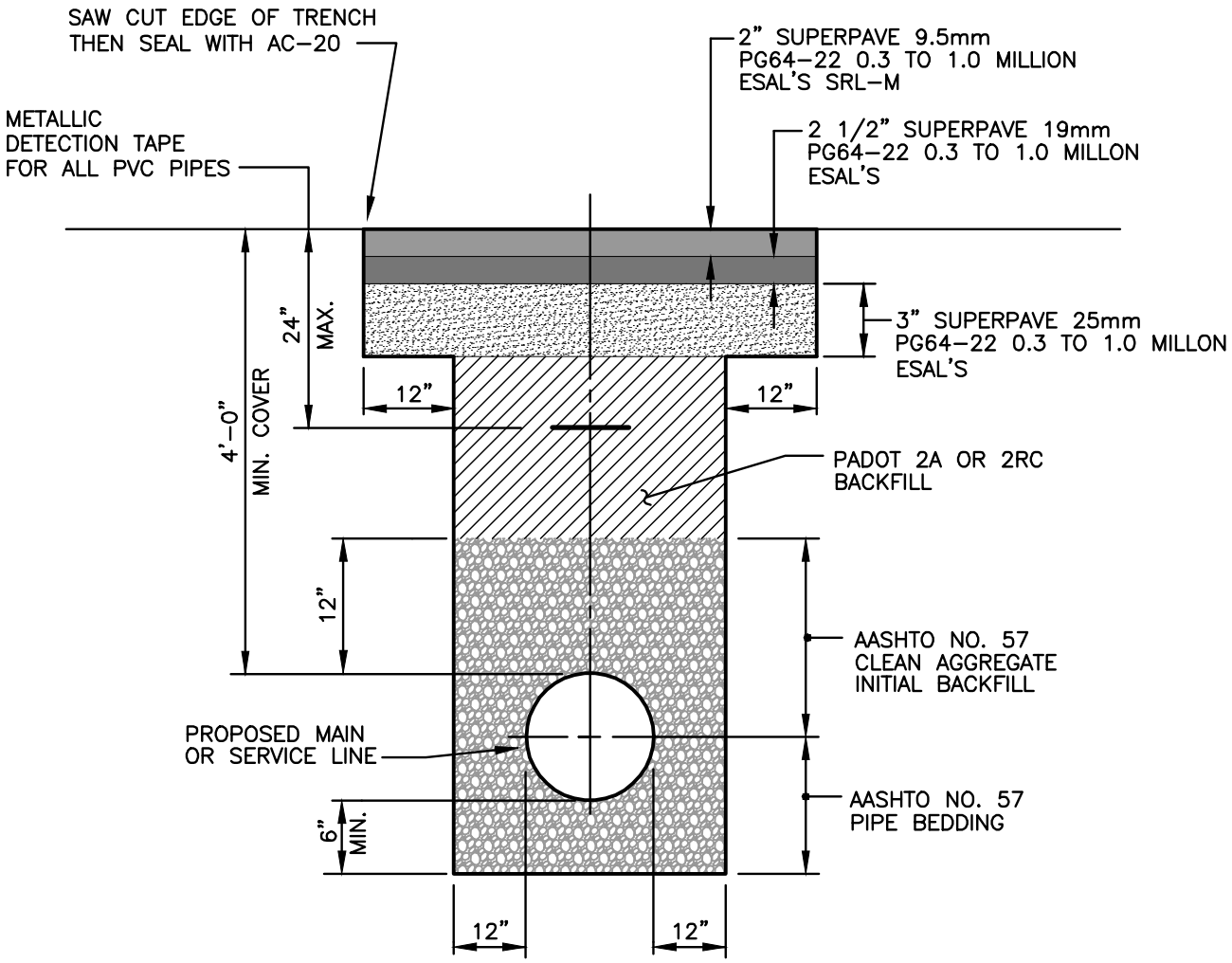
STANDARD DETAIL - SEWER SYSTEM

TRENCH RESTORATION STATE ROADS

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

DETAIL: 7000SD26



SECTION

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REVISION	DATE

Upper Uwchlan Township Municipal Authority

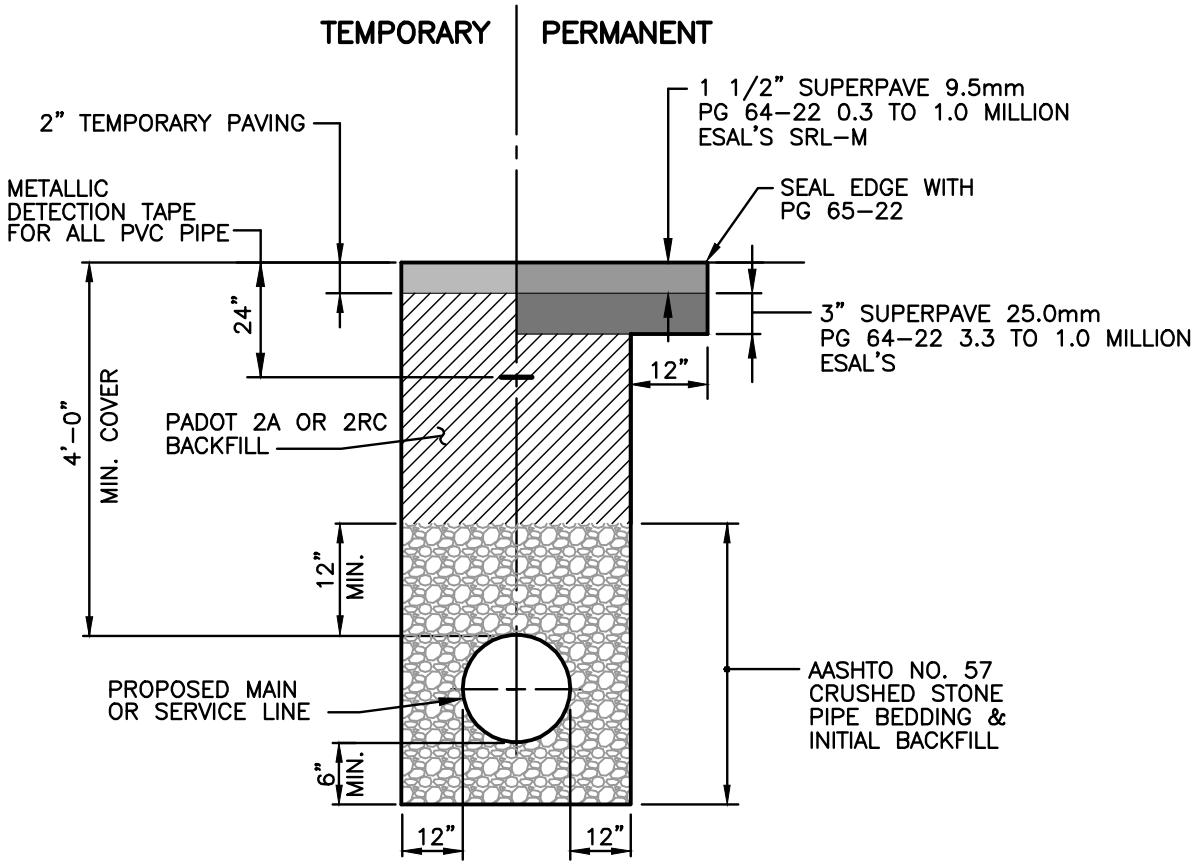
STANDARD DETAIL - SEWER SYSTEM

TRENCH RESTORATION TOWNSHIP ROADS

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

DETAIL: 7000SD27



SECTION

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REVISION	DATE

Upper Uwchlan Township Municipal Authority

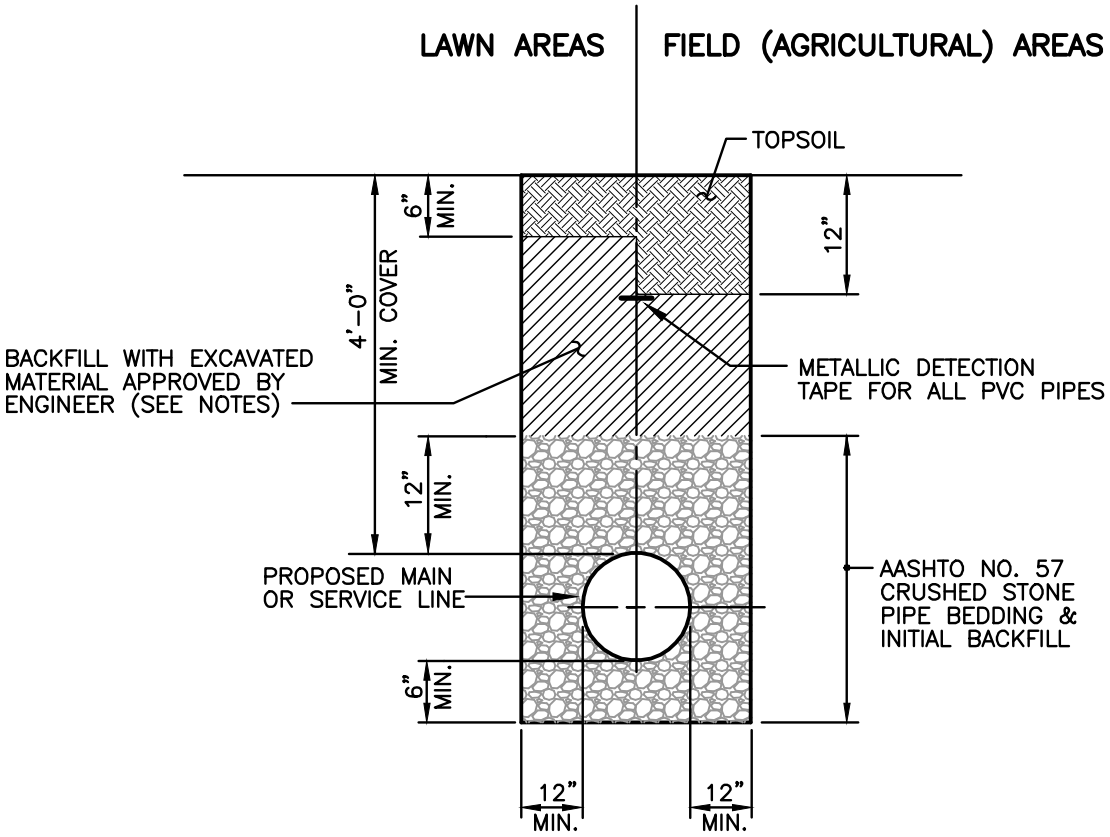
STANDARD DETAIL - SEWER SYSTEM

TRENCH RESTORATION PARKING AREAS & DRIVEWAYS

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

DETAIL: 7000SD28



SECTION

NOTES:

1. BACKFILL TRENCHES WITH EXCAVATED MATERIAL CONTAINING NO STONES LARGER THAN FOUR (4) INCHES IN ANY DIMENSION.
2. A MAXIMUM OF 20% OF BACKFILL CAN CONSIST OF STONES (NOTED ABOVE) IF EVENLY DISTRIBUTED THROUGHOUT BACKFILL.
3. BACKFILL MATERIAL SHALL BE FREE OF ORGANIC MATERIAL, REFUSE, AND FROZEN MATERIAL SUBJECT TO LIMITATIONS SPECIFIED.
4. BACKFILL SHALL BE PLACED IN 4" LOOSE LIFTS WITH THE USE OF A MECHANICAL TAMPER AND 8" LOOSE LIFTS WITH THE USE OF A VIBRATORY TAMPER.

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Upper Uwchlan Township Municipal Authority

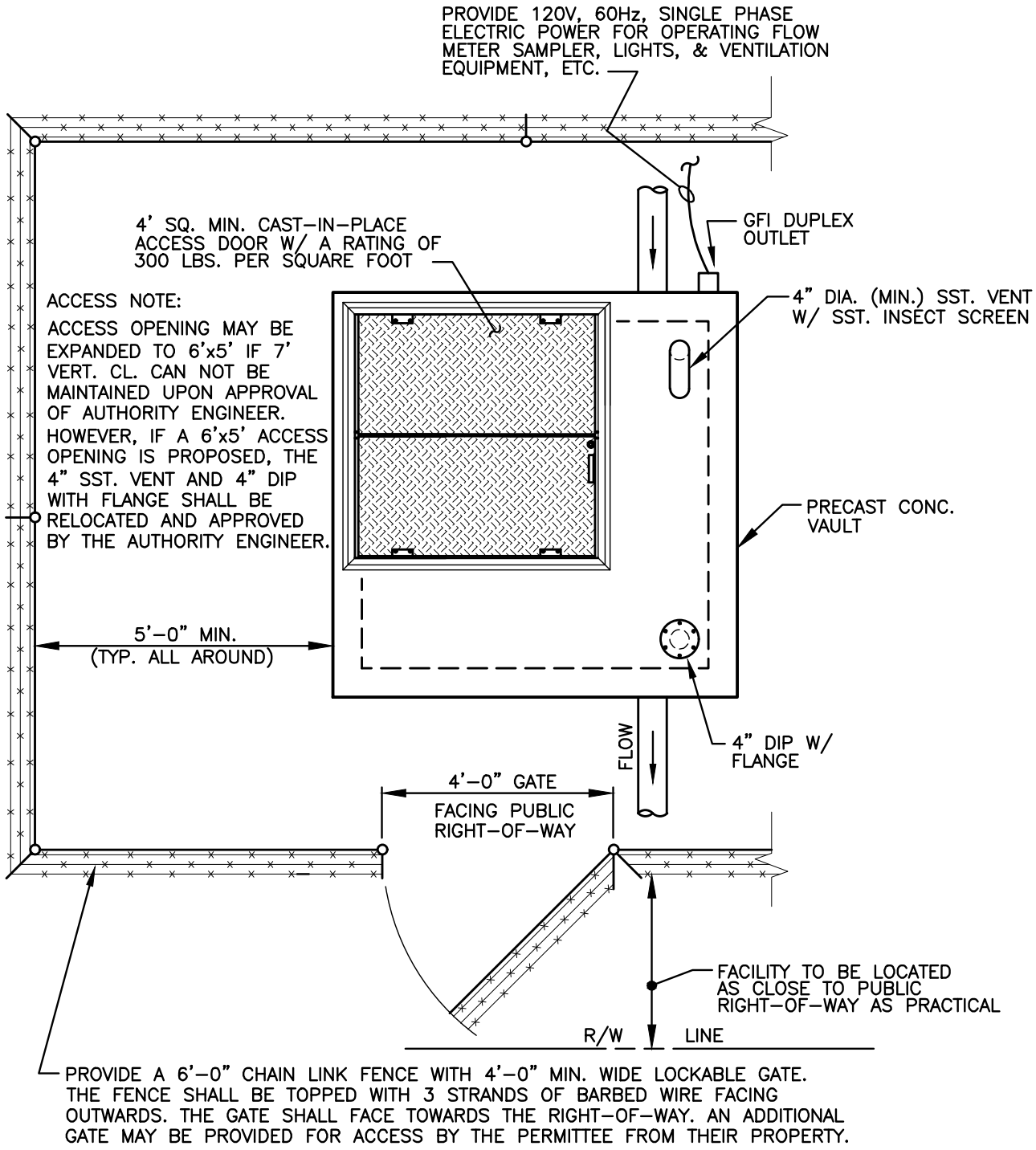
STANDARD DETAIL - SEWER SYSTEM

TRENCH RESTORATION LAWN/FIELD AREAS

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

DETAIL: 7000SD29



SITE PLAN

REVISION	DATE
3	4/21
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Upper Uwchlan Township Municipal Authority

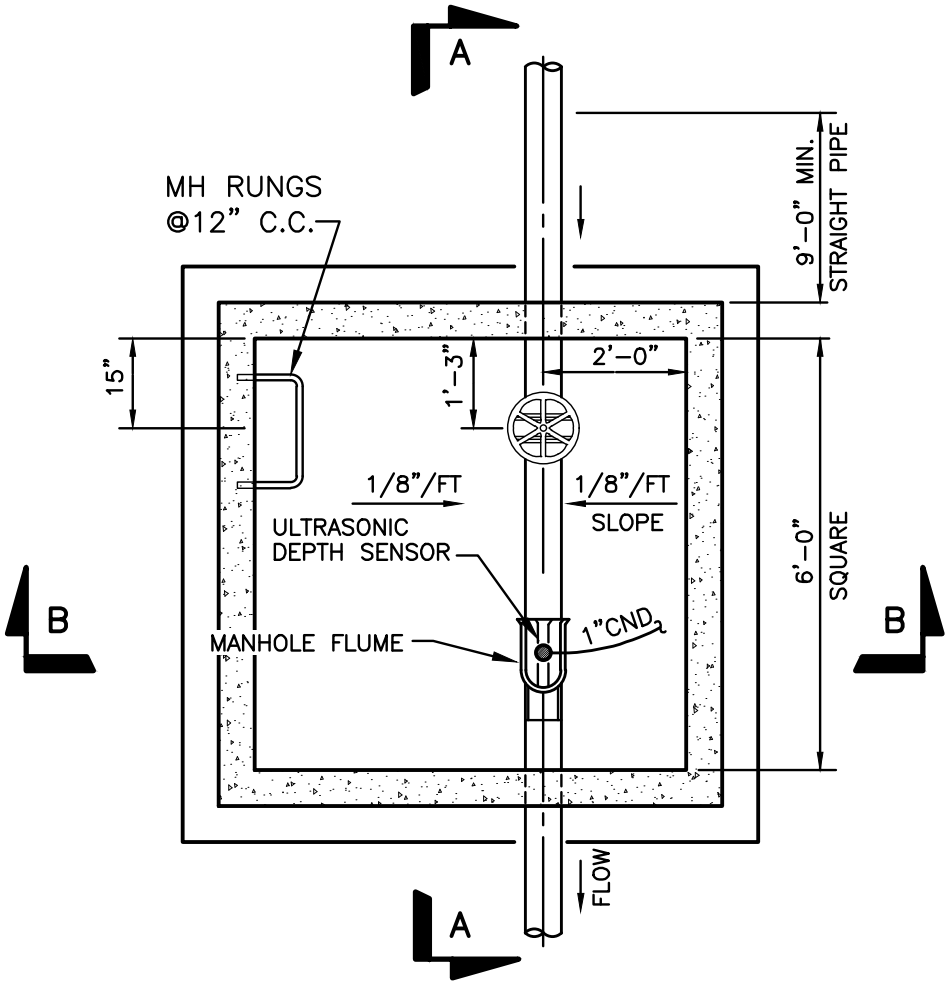
STANDARD DETAIL - SEWER SYSTEM

METERING/SAMPLING FACILITY SITE PLAN

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.375.5287

DATE: APRIL 2021

DETAIL: 7000SD30



SECTIONAL PLAN

NOTES:

1. THE METERING/SAMPLING FACILITY SHALL BE DESIGNED TO CONFORM TO THE LATEST PA DEP REGULATIONS, GUIDELINES & APPROPRIATE CODES.
2. THE AUTHORITY ENGINEER SHALL REVIEW & APPROVE THE PROPOSED DESIGN OF THE METERING/SAMPLING FACILITY PRIOR TO CONSTRUCTION.
3. PRECAST CONCRETE VAULT SHALL CONFORM TO SECTION 11.6.F UNLESS OTHERWISE SPECIFIED. THE EXTERIOR SHALL BE COATED WITH BITUMASTIC, 20 MIL DFT.
4. METERING EQUIPMENT SHALL BE REQUIRED FOR INDIVIDUAL DISCHARGERS WITH DAILY AVERAGE FLOWS GREATER THAN 12,500 GPD, OR FOR SUBDIVISIONS THAT GENERATE DAILY AVERAGE FLOWS GREATER THAN 12,500 GPD THAT DO NOT ENTER ON-SITE PUMPING STATIONS, OR AT OTHER LOCATIONS AS DETERMINED BY THE AUTHORITY ENGINEER.

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REVISION	DATE

Upper Uwchlan Township Municipal Authority

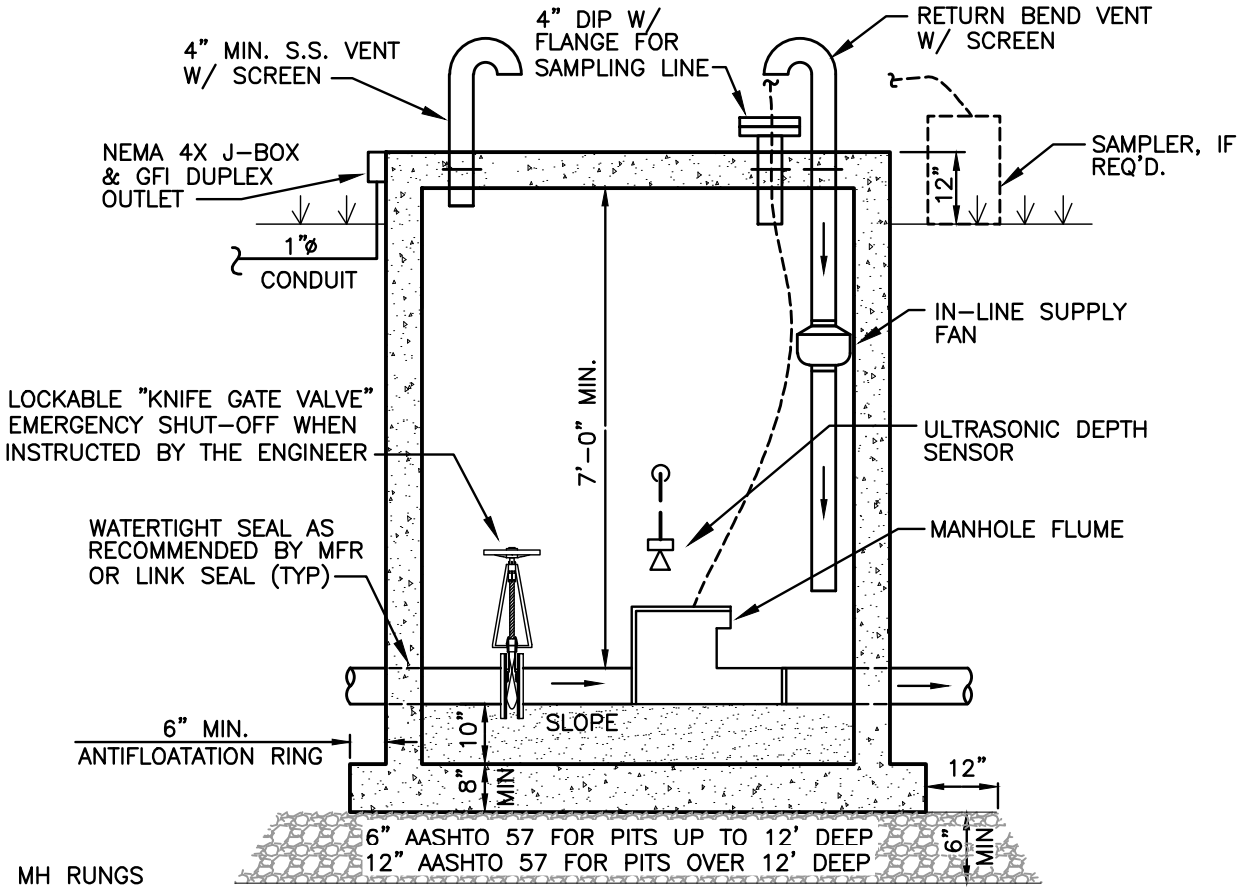
STANDARD DETAIL - SEWER SYSTEM

METERING/SAMPLING FACILITY SECTIONAL PLAN

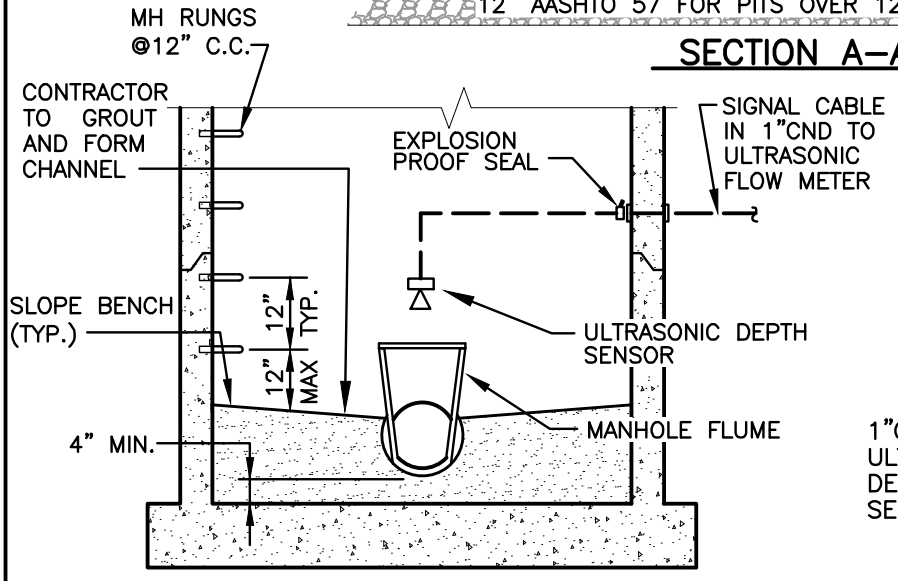
ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

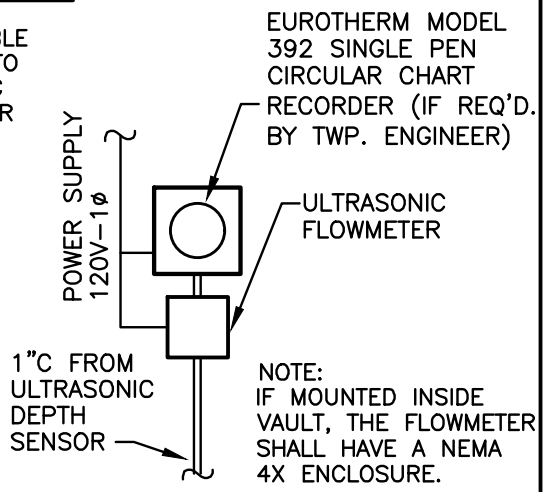
DETAIL: 7000SD31



SECTION A-A



SECTION B-B



FLOW METER ELEVATION

REVISION	DATE
3	4/21
2	1/13
1	6/05

Upper Uwchlan Township Municipal Authority

STANDARD DETAIL - SEWER SYSTEM

METERING/SAMPLING FACILITY SECTIONS

ARRO
Suite 200, 321 N. Furnace St.
Birdsboro, PA 19508
Tel 610.374.5285
Fax 610.374.5287

DATE: APRIL 2021

DETAIL: 7000SD32