

**CONSTRUCTION AND MATERIAL  
SPECIFICATIONS**

**FOR LAND DEVELOPMENT**

**AND**

**SANITARY SEWERAGE FACILITIES**

**FOR**

**SPRINGETTSBURY TOWNSHIP  
YORK COUNTY, PENNSYLVANIA**

**JULY 2008**

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SECTION 01000  
ADMINISTRATION

PART 1 – GENERAL

1.01 AUTHORITY

A. General Authority

To provide consistency of construction sustainability of installations and public safety, only the Township Engineer, Township Manager, or Board of Supervisors may authorize deviation from these specifications. Technical changes or alterations of approved plans must be submitted, in writing, to the Township Engineer for review and approval. Temporary work and/or material necessary to protect persons and property during this process are the responsibility of the contractor performing the work.

B. Permit Notifications

Notify the Township Engineer and other regulatory agencies 72 hours (3 business days) prior to beginning any work covered under the SALDO and 48 hours in advance for all required inspections. Notify the inspector immediately upon postponement or delays in schedule.

C. Preservation of Trees and Shrubbery (Section 02100) is the developer's responsibility. Developer shall replace trees and shrubbery not scheduled for removal.

D. Utility Notification is the responsibility of the contractor performing excavation.

E. Traffic Controls are the responsibility of contractor working in any active traffic lane public or private.

F. Securing of Site and Work Areas (Section 02100, Part 2A)

1.02 INSPECTIONS REQUIRED

A. Materials when delivered to site and properly stored.

B. Subgrade prior to construction or placement of any covering.

C. Structures or component installation prior to backfill being completed.

D. Covering and/or closing up prior to inspection shall subject the contractor/ developer to the cost of re-exposing the work.

E. Prior to release of Surety Bond, the contractor shall schedule a walk-through inspection of the entire project with the Township Engineer.

1.03 WORK STOPPAGE MANDATED

A. Work must be stopped upon orders of Township Engineer if work being

performed is in conflict with these specifications, contrary to the approved plans, if procedures employed do not meet requirements, or provide inadequate protection of personnel and public safety.

1.04 REFERENCES (use of most current edition required)

- A. PENNDOT PUB 408
- B. PENNDOT PUB 282 Highway Occupancy Permit Guidelines
- C. PUB 19 Field Test Manual
- D. PUB 72M Roadway Construction Standard
- E. Springettsbury Township Stormwater Ordinance
- F. Springettsbury Township Subdivision and Land Development Ordinance
- G. Springettsbury Township Zoning Ordinance

1.05 LAWS TO BE OBSERVED

- A. At all times, observe and comply with the following and post as required: all Federal, State, and local laws, ordinances, and regulations that have appropriate jurisdiction over the project and affect the conduct of the work or that apply to employees on the project; and all orders or decrees that have been or may be enacted by any legal bodies or tribunals having authority or jurisdiction over the work, material, employees, or contract. Protect and indemnify the Township and its representatives against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, including violations by Contractor employees.

1.06 RESTORATION OF SURFACE OPENED BY PERMIT

- A. Do not allow any opening to be made within the right of way unless a valid permit is presented authorizing the opening. For such an opening, made before the date upon which the work provided for in the contract is finally accepted, repair at the time and in the manner directed in writing by the Township Engineer.

1.07 SANITARY PROVISIONS

- A. Provide and maintain, in a neat and clean condition, sanitary facilities for the exclusive use of personnel on the project. Dispose of all wastes, both sewage and wastewater, in a manner approved by the DEP. As required, obtain permits from local municipalities to install temporary toilet facilities.

1.08 OCCUPATIONAL SAFETY AND HEALTH

- A. Comply at all times with applicable Federal, State, and local laws, provisions, and policies governing safety and health, including the Federal Construction Safety Act (Public Law 91-54), Federal Register, Chapter XVII, Part 1926 of Title 29 CFR, Occupational Safety and Health Regulations for Construction, and

subsequent publications updating these regulations.

- B. Take any other needed action or proceed as directed, to protect the life, health, and general occupational welfare of personnel employed on the project.
- C. If, in the Township Engineer's representative's opinion, employees are exposed to extraordinary conditions which could or do constitute a hazard, modify such equipment, devices, and job procedures to ensure protection against the hazard or to reduce the risk to the employees engaged in project work.

#### 1.09 RAILWAY-HIGHWAY PROVISIONS

- A. Conform to regulations stipulated in the Pennsylvania Public Utility Commission's order when work is indicated to be performed within, or adjacent to, the right of way or trackage belonging to, or upon which a common carrier operates. Observe strict adherence to all requirements pertaining to the work, safety, and movement of trains; to public and personal liability insurance; and to any other related matters.
- B. If it is necessary to use crossings other than those indicated, make arrangements for the use of the crossings.

#### 1.10 CARE OF PUBLIC AND PRIVATE PROPERTY

- A. Do not damage overhead and underground facilities and structures or property within or adjacent to the project. Use special care in the performance of the work in order to avoid interference or damage to operating utilities or plants; however, where there is any possibility of interference or damage, make satisfactory arrangements with responsible corporate officers of the utilities or plant, covering the necessary precautions to be used during the performance of the work. Make these arrangements, subject to review, before work is started.
- B. Protect all land monuments and property markers which are to be affected by the construction until the Township Engineer has correctly referenced them. Beyond the construction area, reset monuments and markers which are disturbed by contract operations, either during the construction of the project or otherwise, when and as directed.
- C. Promptly make restitution for or satisfactorily repair or restore damaged public or private property. Protect trees to be left standing. If these existing trees to be left standing are damaged, satisfactorily repair or replace them, at no expense to the Township, or compensate the Township for the damage by an equitable monetary amount as determined by, or agreed with, the Township.

#### 1.11 WORKERS' COMPENSATION INSURANCE

- A. Carry Workers' Compensation Insurance or file a proper Certificate of Exemption as provided for by the Workers' Compensation Act and execute a valid affidavit in accepting provisions of the Workers' Compensation Act as supplied with the contract.

#### 1.12 HAULING RESTRICTIONS

- A. General. Accept responsibility for the hauling done on the project and on

adjacent highways, in connection with the contract. Hauling restrictions on highways will be according to the applicable sections of the Pennsylvania Vehicle Code, Act of 1976, No. 81.

- B. Without written permission, do not move and/or operate heavy-duty construction grading and hauling equipment over existing or new pavements, subbase, base, and surface courses, and structures which will remain in service.
  - C. No special permits will be required for the transfer of oversize or overweight equipment or vehicles from one work area to another within project limits. However, the developer shall correct any damage caused by the transfer of equipment or vehicles.
- 1.13 ACCESSIBILITY OF FIRE HYDRANTS
- A. Make necessary arrangements with the local authorities to provide fire protection at all times. Keep the fire hydrants adjacent to the work readily accessible to fire apparatus and do not place material or other obstructions within 5 m (15 feet) of any hydrant.
- 1.14 EROSION AND SEDIMENT POLLUTION CONTROL PLANS AND PERMITS
- A. Install and maintain erosion and sediment pollution control devices as indicated or submit an alternate plan for accomplishing equal or better temporary and permanent erosion and water pollution control. If an alternate plan is submitted, do not start work until the plan is approved by the County Conservation District and the Township. If a National Pollutant Discharge Elimination System Permit is involved, do not start work until the plan is approved by the DEP and/or the DCNR or their designee and the Township.
- 1.15 CONTROL OF WORK
- A. The Township adopts PennDOT Publication 408, Section 105 with respect to control of work.

END OF SECTION

## SECTION 01010

### SANITARY SEWER GENERAL REQUIREMENTS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Developer shall provide all labor, materials, equipment and services and perform all operations required for complete installation of all items and work in these Specifications and as indicated on the Drawings. Drawings shall be considered construction drawings approved by the Township or its Engineer. No changes can be made to the approved drawings without the authorization of the Township and its Engineer.

##### 1.02 REFERENCED STANDARDS AND SPECIFICATIONS

- A. Standards and other publications referenced in these Specifications shall be of the issues in effect at time of bidding and form a part of this Contract.
- B. References are made to the Pennsylvania Department of Transportation specifications. Unless otherwise noted, the State specifications referred to are the Department of Transportation Publication 408 Specifications 2007, as Amended. Reference in the State Specifications to 'State', 'Chief Engineer', or 'Department' shall be interpreted as the ENGINEER as herein defined. When particular articles or sections are referred to, all paragraphs other than those relating to measurement and payment shall apply.

##### 1.03 WORK CONDITIONS

- A. Construct the work in stages to provide for public convenience.
  - 1. Do not close off public use of facilities until completion of one stage of construction will provide alternative usage.
- B. Conduct construction operations to ensure the least inconvenience to the general public.
- C. Take measures to control traffic when working on or near public roads and streets.
  - 1. Employ traffic control measures in accordance with Pennsylvania Department of Transportation Publication No. 213, "Work Zone Traffic Control".
- D. Restore existing paving outside the limits of the work that is damaged by the Developer's operations, to its original condition at the expense of the Developer.

- E. Continuously keep rights-of-way, storage areas, streets, roads, highways and adjacent properties free from accumulations of waste materials, excess excavation, rubbish and windblown debris resulting from construction operations.
- F. Protection of Existing Utilities and Structures:
  - 1. Notify Pennsylvania One Call by dialing 811 at least 3 working days in advance of intent to excavate, do demolition work or use explosives and give the location of the job site. Mark area to be excavated with white paint. Renew notification every 10 days.
  - 2. Advise each person in physical control of powered equipment or explosives used in excavation or demolition work of the type and location of utility lines at the job site, the Utility Company assistance to expect, and procedures to follow to prevent damage.
  - 3. Immediately report to the Utility Company and to the Township and its Engineer any break, leak or other damage to the lines or protective coatings made or discovered during the work and immediately alert the occupants of affected premises of any emergency created or discovered.
  - 4. Allow free access to Utility Company personnel at all times for purposes of maintenance, repair and inspection.
  - 5. Notify Traffax, all school districts affected, York County EMA and Springettsbury Township if any interference with the normal flow of traffic will be caused by this work.
  - 6. Developer must obtain a Highway Occupancy Permit from Springettsbury Township if the work affects a Township road.

#### 1.04 PENNDOT HIGHWAY OCCUPANCY PERMIT

- A. The Developer's attention is directed to Chapter 459, Occupancy of Highways by Utilities under Title 67 Transportation of the Pennsylvania Code. The Developer will pay the cost of the highway occupancy permit and the costs of inspection as per the current Springettsbury Township fee schedule resolution. The Developer must complete the highway occupancy permit and return the required number of copies to the Township for signing. Springettsbury Township will be designated as the permittee. The Developer shall pay all other costs in connection with the highway occupancy permit or permits, including but not limited to all costs for special insurances and bonds and state inspectors.

#### 1.05 PERMITS

- A. The Developer will secure and pay the cost for the Department of Environmental Protection Water Quality Management permit, if applicable.
- B. The Developer shall secure and pay for all other permits required to comply with Federal, State, and local ordinances and regulations.

- C. The Developer shall obtain and pay for a Springettsbury Township Highway Occupancy Permit when working on Township Roads.

#### 1.06 SEWAGE PUMPING STATIONS

- A. Design of pumping stations will be in accordance with the Engineer's recommendations. The type of station to be designed (precast, cast-in-place, submersible, wetwell/drywell) will be decided upon in a meeting with the Township's Engineer prior to commencing design on the station. The Developer is responsible for providing telephone and electrical service to the station. All pump stations shall be provided with a diesel powered, or if available, natural gas, emergency generator capable of powering all station functions and an automatic transfer switch. All pump stations shall be equipped with a totalizing flow meter as approved by the Engineer. All pumping stations must be capable of conveying design peak flow rates when one (1) pump is out of service. Smith and Loveless pump stations will be given preference in order to maintain compatibility with existing pump stations and to minimize spare parts inventories.

### PART 2 - EXECUTION

#### 2.01 PROCEDURE

- A. Confer and verify with other Developers as to locations and extent of their work, to the end that interferences and deletions between trades are prevented and embedded or required items are installed in conjunction with the work under this contract. Interconnections between work of other contracts shall be made by the Developer whose work is erected last unless otherwise specifically stated in an Agreement between the Developers, required by the Township's Engineer, or necessitated by the nature or extent of the work.

#### 2.02 DEVELOPER'S USE OF PREMISES

- A. Confine construction equipment, the storage of materials and equipment, and operations of workmen to within the permanent and temporary rights-of-way.
- B. Pipeline materials may be stored appropriately along the route of the Work provided such stored materials do not unduly restrict public use or infringe on private property.
- C. Assume full responsibility for materials stored on site.
- D. Transport materials remaining at the completion of the project for which the Owner has made payment to a storage area designated by the Owner.

## 2.03 SEWER AND WATER MAIN SEPARATION

### A. Horizontal Separation:

1. Sewers, including manholes, should be separated at least 10 feet, horizontally, from any existing or proposed water mains. Should local conditions prevent a lateral separation of 10 feet, a sewer may be 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. The elevation of the top (crown) of the sewer is at least 18 inches below the bottom of the bottom (invert) of the water main.

### B. Vertical Separation:

1. Whenever sewers cross under water mains, the top of the sewer shall be at least 18 inches below the bottom of the water main.
2. When the elevation of the sewer cannot be varied to provide the required 18" vertical separation, relocate the water main, for a distance of 10 feet extending on each side of the sewer, with one full length of water main centered over the sewer so that both joints will be as far from the sewer as possible.
3. Water main should be constructed of AWWA slip-on or mechanical joint ductile iron pipe. Sewers shall be constructed of AWWA mechanical-joint cast iron pipe for any portion within 10 feet of the water main with the sewer joints equidistant and as far as possible from the water main joints. Both sewer and water main services shall be pressure tested to assure watertightness prior to backfilling. Where a water main crosses under a sewer, provide adequate structural support for the sewer to prevent damage to the water main.

- C. A minimum of 12 inches of separation is required both horizontally and vertically between sewer mains and all other utilities (i.e. storm sewer, gas lines, etc.). Where it is not possible to achieve this 12 inches of separation minimum, the Developer must receive approval from the Township.

- D. Special Conditions: Where it is impossible to obtain proper horizontal and vertical separation as specified, construct the pipelines as specified above and, in addition, encase the sewer line with minimum 6" cement concrete or flowable fill for 10 feet on either side of the water main.

## 2.04 SOIL EROSION AND SEDIMENTATION CONTROL PLAN

- A. The Developer is required to provide soil erosion and sedimentation control measures as indicated in the Soil Erosion and Sedimentation Control Plan from the York County Conservation District which will be completed as necessitated by the nature or extent of the work. The Developer is responsible for obtaining

approval of the Erosion and Sediment Control Plan including any associated costs. Approval must be obtained prior to starting work.

## 2.05 FIELD INSPECTION

- A. Field inspection will be required and provided by the Township. Inspection will also include witnessing of testing. The Township's Inspector shall have the authority to halt construction if, in his opinion, construction is not being done according to specifications. The approved design may not be altered without written approval of the Township and/or its Engineer. A final inspection of all facilities is required before acceptance of flow or dedication to the Township. Any inspection costs incurred by the Township will be the responsibility of the Developer.

## 2.06 SAFETY

- A. The Developer is responsible for compliance with all laws, codes, and regulations relating to safety provisions at the construction site. The Township and its representatives will not be responsible for the safety of construction personnel, persons visiting the site, or the general public nor will it be responsible for the enforcement of any laws, codes, or regulations relating to safety. Enforcement of safety regulations will be the responsibility of the appropriate agency.

## 2.07 PLANS AND SPECIFICATIONS

- A. The design of the sewers must be approved by the Township and the construction must be to the Township's specifications. Plans shall be prepared by the Registered Engineer or Registered Land Surveyor, on plan and profile paper, 24" x 36" size. The drawing shall be to a scale of 1" = 50' horizontal and 1" = 5' vertical. The Township's specifications include the standard details attached. Extensions should be designed to accommodate further extension. Plans shall include lateral locations, manhole numbers as provided by the Township, elevation datum, stationing, all other pertinent information. All plans will be reviewed by the Township's Engineer at the Developer's expense. Reproducible record (as-built) drawings will be prepared by the Developer's engineer at the Developer's expense. Provide one mylar, two prints of as-built drawings and an electronic copy on a compact disk in a format acceptable to the Township.

## 2.08 EASEMENT AGREEMENTS

- A. Easement agreements are required where facilities are located outside public rights-of-way. The Developer must supply at his cost plats and descriptions prepared by the Developer's engineer for the Township's use in obtaining the easement. A written agreement will be prepared by the Township's solicitor at the Developer's expense. Easement agreements must clearly prohibit the placing of buildings, trees, pools, fences or other impediments to access within 15 feet of the

centerline of the sanitary sewer. Fences must not interfere with the free ingress or egress on the easement. Provide on mylar, two prints of easement drawings and an electronic copy on a compact disk in a format acceptable to the Township.

## 2.09 SUBDIVISION ESCROWS OR BONDS

- A. The Springettsbury Township Subdivision Ordinance provides, in certain cases, that proposed subdivisions be provided with a Sewage Collection System and be connected with the sewer system. The supervisors will not approve and stamp subdivisions plans until the Subdivider has made satisfactory arrangements for such sewerage. The Supervisors will not accept any completed sanitary sewer for dedication to the Township until that sewer meets all requirements of this specification.
- B. To assure such construction, the Subdivider must either submit a bond with a nationally recognized surety company as surety or escrow money or acceptance securities. Cash or an irrevocable letter of credit is also acceptable. The amount of the bond or escrow should be equal to the estimated cost to the Township of performing the construction. The Developer should secure the concurrence of the Township's Engineer in the cost estimate and the approval of the Township's solicitor of the bond or escrow agreement. All Township requirements related to bonding must be satisfied. Additional bonds may be required at the Township's discretion. All bonds shall be held in force until the end of the required contractor's maintenance period. Any damage claims filed during this time must be satisfied for the bond to be released.
- C. Bonds for construction to be performed in PennDOT right-of-ways will be held in force for the required maintenance period which is presently two (2) years. This two (2) year period shall begin from the date of PennDOT's final inspection of the restoration.

## 2.10 FEES OWED

- A. Any and all costs shall be the responsibility of the Developer. These costs include but may not be limited to: all permitting fees, all engineering review fees, all inspection fees. All costs associated with having As-Built drawings and/or property plats prepared by the Developer's Engineer.

## 2.11 SEWER SYSTEM DESIGN

- A. All systems must be gravity sewers in their design and not include low pressure sewers.
- B. The Developer can request to the Township for an exception to this to allow for low pressure sewers, when it is not feasible to use gravity lines.

- C. The Township will review these requests on a case-by-case basis. Only after approval is received from the Township can low pressure sewers be used in the design of a development.
- D. Where existing non-serviced lots are adjacent to a new development, it is the responsibility of the Developer to provide a service wye on the sewer main and a lateral across the road to the edge of right-of-way of the unserviced property.
- E. The required depth of the lateral must be determined by a basement survey conducted by the Developer of the dwelling on the non-serviced lot.
- F. The Developer is responsible for the wye, lateral (including excavation), backfill, basement survey, placing marker stake and road restoration.

END OF SECTION

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SECTION 02100  
CLEARING AND GRUBBING

PART 1 – GENERAL

1.01 DESCRIPTION

A. The work of this section includes, but is not limited to:

1. Clearing
2. Grubbing
3. Stripping and stockpiling topsoil
4. Debris disposal

B. Related Work Specified Elsewhere:

1. Trenching, backfilling, and compacting: Sections 02221a&b
2. Roadway excavation, fill, and compaction: Section 02230
3. Finish grading, seeding, and sodding: Section 02485

C. Definitions:

1. Clearing is defined as the removal of trees, brush, down timber, rotten wood, rubbish, any above original ground elevation not designated to be saved. Clearing also includes removal of fences, walls, guard posts, guiderail, signs, and other obstructions interfering with the proposed work.
2. Grubbing is defined as the removal from below the surface of the natural ground of stumps, roots and stubs, brush, organic materials and debris.

D. Applicable Standard Details: NONE

1.02 QUALITY ASSURANCE – Contractor must warrant that work is/has been properly performed and completed.

1.03 SUBMITTALS

A. Permits for Disposal of Debris:

1. Arrange for disposal of debris resulting from clearing and grubbing to locations outside the Township's property and obtain written agreements with the owners of the property where the debris will be deposited.
2. Submit two copies of the agreement with each property owner releasing the Township from responsibility in connection with the disposal of the debris.
3. Submit two copies of each on-site burning permit if such permits are required. Open burning is generally prohibited in the Township.

- B. Product Data: Submit manufacturer's product data for all products specified herein.

#### 1.04 JOB CONDITIONS

- A. The Developer may clear all obstructions within the permanent and construction rights-of-way or property except those specifically indicated on the drawings or specified to be saved, or restored.
- B. Obstructions specifically designated to be saved or restored will be marked by the Township.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Temporary Fencing:
  - 1. Undamaged picket snow fence, 4' high, formed of wooden slats, tightly woven with wire cable.
  - 2. Orange construction safety fence with grid openings no larger than 2" x 2" and supports spaced no more than 10 feet apart.
  - 3. Soil-set fence posts, studded "T" type, 6' high, minimum 24" in-ground.
- B. Tree Wound Dressing:
  - 1. Antiseptic and waterproof, asphalt base.
- C. Wood Tree Guards:
  - 1. Wood posts: 2"x4"
  - 2. Wood stringers: 2"x2"
- D. Wrapping Materials:
  - 1. Burlap: AASHTO M182, Class 1
  - 2. Krinkle-kraft waterproof paper: 4" width

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Notify the Township Engineer and other regulatory agencies at least 72 hours prior to beginning any clearing work.
- B. Mark areas to be cleared, the areas to be grubbed, and items to be saved with stakes, flags, paint or plastic colored ribbon for the approval of the Township.
- C. Protect benchmarks, utilities, existing trees, shrubs and other landscape features designated for preservation with temporary fencing or barricades satisfactory to the Township Engineer. No material shall be stored or

construction operation carried on within 4-feet of any tree or shrubbery to be saved or within the tree protection fence as designated by the landscape architect, whichever is greater.

- D. When a private enclosure fence encroaches on the work area, notify the property owner at least 5 days in advance of the clearing/grubbing operations to permit the owner to remove it, construct a supplemental fence, or make such other arrangements as may be necessary for security purposes; in failure of the property owner to reasonably proceed with the work required to secure his property, carefully remove the fence, in whole or in part, and neatly pile the materials onto the owner's property.

### 3.02 UTILITY RELOCATIONS

- A. Inform all companies, individuals and others owning or controlling facilities or structures within the limits of the work which have to be relocated, adjusted or reconstructed in sufficient time for the utility to organize and perform such work in conjunction with or in advance of the Contractor's operations.
- B. Comply with the provisions of Act 199, Underground Utility Protection Act, PA One Call, 1-800-248-1786.

### 3.03 CLEARING

- A. Confine clearing to within the construction limits.
- B. Township reserves the right to specify and designate which trees, shrubs, and other installations are to be retained. The Township shall be contacted 48 hours before any clearing of trees, shrubs and other installations.
- C. Clear in a manner that will avoid damage to trees, shrubs, structures, and other installations which are to be retained.
- D. Where stumps are not required to be grubbed, flushcut with ground elevation or below the proposed finish grade.

### 3.04 GRUBBING

- A. Grub areas within the construction limits to remove roots and other objectionable material to a minimum depth of 12".
- B. Remove all stumps within the cleared areas.

### 3.05 STRIPPING AND STOCKPILING TOPSOIL

- A. Strip topsoil to whatever depth it may occur from areas to be excavated, filled, or graded and stockpile in accordance with state and local erosion and sedimentation control regulations.
- B. Topsoil shall not be used as backfill or fill ground except as or within the top surface layers.

3.06 DEBRIS DISPOSAL

- A. Trees, logs, branches, brush, stumps, and other debris resulting from clearing and grubbing operations shall be legally disposed of.
- B. Do not deposit or bury on the site debris resulting from the clearing and grubbing work unless authorized in writing by the Township.
- C. Items identified in A. above may not be placed, burned, or buried on the site. Imported fill must be approved by the Township Engineer.

3.07 RESTORATION

- A. Repair all injuries to bark, trunk, limbs, and roots or remaining plants by properly cutting, dressing, and painting, using approved arboricultural practices and materials.
- B. Replace trees, shrubs and plants designated to be saved which are permanently injured or die during the warranty period as a result of construction operations with like species acceptable to the Township Engineer.
- C. Remove protective fences, enclosures and guards upon the completion of the project.
- D. Restore guard posts, guiderail, signs and other interferences to the condition equal to or better than that existing before construction operations.

END OF SECTION

## SECTION 02150

### BORING AND JACKING

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Work of this section includes, but is not limited to:
  - 1. Approach trench excavation
  - 2. Installation of casing pipe
  - 3. Installation of carrier pipe
- B. Related Work specified elsewhere:
  - 1. Section 02221b - Trenching, Backfilling & Compacting

##### 1.02 QUALITY ASSURANCE

- A. Reference Standards:
  - 1. ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  - 2. ASTM A139 Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)
  - 3. ASTM C144 Specification for Aggregate for Masonry Mortar
  - 4. ASTM C150 Specification for Portland Cement
  - 5. ANSI/AWWA Ductile Iron Pipe, Centrifugally Cast for Water or C151/A21.51 Other Liquids
  - 6. AASHTO M6 Fine Aggregate for Portland Cement Concrete
- B. Developer's Qualifications - Construction operations shall be undertaken only by a developer well experienced in operations of similar magnitude and having had similar experience boring and jacking under transportation arteries and under surface areas which cannot be disturbed.
- C. Design Criteria:
  - 1. Pipe and joints of leakproof construction design for the earth and/or other pressures present, plus highway H20 live loading with the associated recommended impact loading.
  - 2. Design bracing, backstops, and use jacks of sufficient rating so that the jacking can proceed without stoppage, except for adding pipe sections and, as conditions permit, to minimize the tendency of the ground material to "freeze" around the casing pipe.
- D. Allowable Tolerances:
  - 1. Do not overcut excavation by more than 1" greater than the outside diameter of the casing pipe.

2. Install casing pipe with the determined vertical and horizontal alignment prior to installation of the carrier pipe.
3. Maintain a minimum 1" design clearance between casing spacer runner O.D. and the casing I.D.

E. Reference Codes and Specifications:

1. Comply with applicable Federal, State and local ordinances, codes, statutes, rules and regulations, and affected jurisdictional bodies.
2. Pennsylvania Department of Transportation (PennDOT): Publication 408/2007 Specifications, as amended.

### 1.03 SUBMITTALS

- A. Certificates: Submit certification from materials manufacturers attesting that the materials provided and installed conform to specification requirements.
- B. Submit history of previous work completed of equivalent nature and scope. Include qualification and experience of key personnel.
- C. Submit description of proposed construction methods, including methods to establish and maintain vertical and horizontal alignment.
- D. Submit installation detail to Owner for approval in regards to boring and jacking operation.
  1. All boring must conform to State and railroad (as needed) requirements.

### 1.04 JOB CONDITIONS

- A. Conduct operations so as not to interfere with, interrupt, damage, destroy, or endanger the integrity of surface or subsurface structures or utilities and landscape in the immediate or adjacent areas.
- B. When boring and jacking under State highways and public rights-of-way, comply with applicable right-of-way occupancy permits.
- C. If boring is obstructed, relocate or jack crossing as approved by the Township's Engineer.

## PART 2 - PRODUCTS

### 2.01 STEEL CASING PIPE

- A. ASTM A53; Grade 8, Black, Asphalt Coated; minimum thickness 0.375 inches; minimum yield strength 35,000 psi.

- B. Coat pipe, inside and outside, with a petroleum asphaltic coating 1 mil thick; coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun and adhere to pipe.
- C. Full circumference welded joints.
- D. Diameter and wall thickness as indicated on the Drawings.

## 2.02 CARRIER PIPE

- A. Ductile iron, ANSI/AWWA C151/A21.51, class as indicated on the Drawings.

## 2.03 TIMBER SKIDS

- A. Pressure treated, cut to a cross-sectional size to allow placement of the carrier pipe in the casing and to support the barrel of the carrier pipe. Provide with notches to accommodate fastening. Treat notches at time of pipe installation.

## 2.04 SAND (FINE AGGREGATE)

- A. AASHTO M6, Latest Edition

## 2.05 GROUT

- A. One part portland cement (ASTM C150) and 6 parts mortar sand (ASTM C144) mixed with water to a consistency applicable for pressure grouting.

## PART 3 - EXECUTION

### 3.01 APPROACH TRENCH

- A. Excavate approach trench using methods as site conditions require.
- B. Ensure pipe entrance face as near perpendicular to alignment as conditions permit.
- C. Establish a vertical entrance face at least 1 foot above top of casing.
- D. Install adequate excavation supports as specified in Section 02221b, Trenching, Backfilling, and Compacting.

### 3.02 CASING PIPE INSTALLATION METHODS

- A. Boring:
  1. Push the pipe into the ground with a boring auger rotating within the pipe to remove the soil.

2. Do not advance the cutting head ahead of the casing pipe except for that distance necessary to permit the cutting teeth to cut clearance for the pipe.
3. The machine bore and cutting head arrangement shall be removable from within the pipe.
4. Arrange the face of the cutting head to provide a barrier to the free flow of soft material.
5. If unstable soil is encountered during boring, retract the cutting head into the casing to permit a balance between the pushing pressure and the ratio of pipe advancement to quantity of soil.
6. If voids should develop greater than the outside diameter of the pipe by approximately one inch, grout to fill voids; grouting to fill voids will be at the expense of the Developer.

B. Jacking:

1. Construct adequate thrust wall normal to the proposed line of thrust.
2. Impart thrust load to the pipe through a suitable thrust ring that is sufficiently rigid to ensure distribution of the thrust load on the pipe.

C. Drilling and Jacking:

1. Use an oil field type rock roller bit or plate bit made up of individual roller cutter units solidly welded to the pipe which is turned and pushed for its entire length by the drilling machine to give the bit the necessary cutting action.
2. Inject a high density slurry (oil field drilling mud) to the head as a cutter lubricant.
3. Inject slurry at the rear of the cutter units to prevent jetting action ahead of the pipe.

D. Mining and Jacking: Utilize manual hand-mining excavation from within the casing pipe as it is advanced with jacks, allowing minimum ground stand up time ahead of the casing pipe.

### 3.03 DEWATERING

- A. Intercept and divert surface drainage precipitation and groundwater away from excavation through the use of dikes, curb walls, ditches, pipes, sumps or other means.
- B. Develop a substantially dry subgrade for the prosecution of subsequent operations.
- C. Comply with Federal and State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

### 3.04 PRESSURE GROUTING

- A. Pressure grout the annular space between the casing pipe and surrounding earth.

### 3.05 CARRIER PIPE INSTALLATION

- A. All provisions regarding cleaning, inspection and handling specified under pipe material sections apply to this work.
- B. Exercise care to prevent damage to pipe joints when carrier pipe is placed in casing.
- C. Support pipeline within casing so that no external loads are transmitted to carrier pipe; attach timber skids to barrel of carrier pipe; do not rest carrier pipe on bells.
- D. Space timber skids approximately three per joint of pipe or one timber skid per every 6'-7'.
- E. After the carrier pipe has been installed in the encasing pipe and has been tested, fill the encasing pipe with sand or lean concrete.
  - 1. Close one end of encasing pipe with brick and mortar before filling encasing pipe. Close other end of encasing pipe with brick and waterproofed mortar after filling encasing conduit or as the filling operation dictates.

END OF SECTION

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SECTION 02210

SITE EXCAVATION AND PLACEMENT OF FILL MATERIAL

PART I - GENERAL

1.01 DESCRIPTION

A. The work of this section includes, but is not limited to:

1. Excavation
2. Blasting
3. Placement and compaction of fill material

B. Related work specified elsewhere:

1. Clearing and grubbing: Section 02100
2. Trenching, backfilling, and compacting: Sections 02221a&b
3. Roadway excavation, fill, and compaction: Section 02230
4. Finish grading, seeding, and sodding: Section 02485

C. Definitions: NONE

D. Applicable Standard Details: NONE

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. Pennsylvania Department of Transportation:

Regulations Governing Occupancy of Highways by Utilities (67 PA Code, Chapter 459)  
Publication 408 Specifications  
Pennsylvania Test Method, PTM 106  
Pennsylvania Test Method, PTM 402  
Publication 203, Work Zone Traffic Control

2. American Society for Testing and Materials (ASTM):

ASTM D698 Tests for Moisture-Density Relations of Soils  
ASTM D2922 Test for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)  
ASTM D1557 Modified Proctor Compaction Test

3. American Association of State Highway and Transportation Officials:

AASHTO Designation T89	Determining Liquid Limit of Soils
AASHTO Designation T90	Determining Plastic Limit and Plasticity Index of Soils

B. Testing Agency:

1. Compaction testing shall be performed by a Soils Testing Laboratory engaged and paid for by the Contractor and approved by the Township Engineer.

C. Compaction Testing:

1. Determine compaction by the testing procedure contained in ASTM D698 or ASTM D1557 at the locations and frequencies specified in Section VIII.

1.03 SUBMITTALS

A. Soils Analysis

1. Copies of soils analysis and test results shall be submitted to the Township Engineer upon request.

1.04 JOB CONDITIONS

A. Control of Traffic:

1. Employ traffic control measures in accordance with Pennsylvania Department of Transportation Publication 203, "Work Zone Traffic Control".
2. Work must be stopped upon orders of the Township Engineer if traffic control does not meet requirements or is determined inadequate for existing traffic conditions.

B. Protection of Existing Utilities and Structures:

1. Take all precautions and utilize all facilities required to protect existing utilities and structures in compliance with Pennsylvania Act 287. Request cooperative steps of the Utility and suggestions for procedures to avoid damage to its lines.
2. Allow free access to Utility personnel at all times for purposes of maintenance, repair and inspection.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MATERIALS

For purposes of construction control, the following materials may be deemed acceptable for use in placement of fills:

- A. Soil. Soil shall include all inorganic material having a maximum size that can be readily placed and compacted in loose 8 inch layers and of which more than 35

percent shall pass the No. 200 sieve. Soil shall have a minimum dry weight density of 98 pounds per cubic foot as determined in accordance with PTM No. 106, Method B and a maximum liquid limit of 65 as determined in accordance with AASHTO Designation T89. The plasticity index, as determined by AASHTO Designation T90 for soils having liquid limits of 41 to 65 inclusive, shall be not less than that determined by the formula: Plasticity Index = Liquid Limit - 30.

- B. Granular Material. Granular material shall include all natural or synthetic mineral aggregates having a maximum size that can be readily placed and compacted in loose 8 inch layers and of which 35 percent or less shall pass the No. 200 sieve.
- C. Shale. Shale shall include all rock-like materials formed by the natural consolidation of mud, clay, silt and fine sand and usually thinly laminated, comparatively soft and easily split, having a maximum size that can be readily placed and compacted in loose 8 inch layers.
- D. Rock. Rock shall include all igneous, metamorphic and sedimentary rock having a maximum size that can be readily placed and compacted in loose 8 inch layers and which generally has sufficient fines to normally fill all the voids in each layer.
- E. Random Materials. Random material shall include any combination of the above classifications and may include old concrete, brick, etc., from demolition having a maximum size that can be readily placed and compacted in loose 8 inch layers, and which have been approved by the Engineer.
- F. Organic Materials. In no case shall organic materials be permitted as fill.

### PART 3 - EXECUTION

#### 3.01 MAINTENANCE AND PROTECTION OF TRAFFIC

- A. Coordinate the work to ensure the least inconvenience to traffic and maintain traffic on one or more unobstructed lanes unless closing of the roadway is authorized.
- B. Maintain access to all streets and private drives and for emergency vehicles.
- C. Provide and maintain signs, flashing warning lights, barricades, markers, and other protective devices required to conform with construction operations and to keep traffic flowing with minimum restrictions.
- D. Comply with State and local codes, permits and regulations.
- E. Notify emergency services (911) at least 48 hours prior to performing any work affecting the public ways.

#### 3.02 SALVAGE TOPSOIL

- A. Within the areas indicated for grading, strip topsoil to the depth of suitable topsoil material and stockpile for subsequent topsoiling operations. See Section 02100, Clearing and Grubbing.

### 3.03 PLACEMENT OF FILL MATERIAL

- A. After removal of topsoil, areas to receive fill shall be thoroughly rolled, and any soft spots disclosed by rolling shall be excavated and the unsuitable material removed and disposed of in a waste area. The excavated area shall be filled with suitable fill material approved by the Township Engineer and recompactd. Suitable fill material shall be spread in layers of not more than 8 inches (loose) over the full area of the fill, and compacted to the required density by the use of compaction equipment. All fill material shall be compacted to not less than 95% of its maximum dry weight density at its optimum moisture content, plus or minus 2%, as determined by ASTM D698. When the material is too coarse to satisfactorily use these methods, compaction will be determined by the Township Engineer based on non-movement of the material under the compaction equipment.
- B. Fill material placed in areas inaccessible to the compaction equipment shall be placed in uniform loose layers not exceeding 4 inches in depth and compacted by means of approved mechanical tampers to the density requirements herein specified.
- C. When a previously constructed fill requires additional material to bring it to required elevation, the top of the fill shall be thoroughly scarified before the required additional material is placed.
- D. Material containing moisture in excess of that percentage which will ensure satisfactory compaction shall not be placed in the fill and fill material shall not be placed on material that has become unstable due to excessive moisture.
- E. Frozen fill material shall not placed in fills, and fill material shall not be placed on frozen material. If during construction the top of the fill freezes, all frozen material shall be removed before additional material is placed.
- F. Wet or frozen materials which would be suitable when dried or when thawed and dried, may be wasted by the Contractor for his convenience only with the written permission of the Township Engineer, and subject to replacement in equivalent volume, at the expense of the Contractor. However, in no case shall waste material be disposed of in the flood channel area of any stream.
- G. Shale and random material containing an excessive quantity of large fragments shall be so placed that the coarser material is in areas where no building foundations or utility trenches are to be located. The large pieces shall then be broken down by the use of approved equipment until all voids are filled. Mixtures of shale and rock shall be placed in accordance with the requirements for placing shale.
- H. Where fill is to be constructed on a slope, the slope shall be benched to the width and depth shown on the drawings or as approved by the Township Engineer.

### 3.04 EXCAVATION

- A. Perform excavation of borrow material in a manner satisfactory to the Township Engineer. Strip borrow pits of brush, trees, roots, grass and other vegetation prior to removal of material for use in fill. During the excavation operation, grade

the borrow area to ensure free drainage of water from the area. Place and maintain erosion control devices after completion of the excavation, grade the excavated area, including side slopes, to drain and present a uniformly trim appearance merging into the surrounding terrain. After borrowing operations are complete, regrade area, if necessary, to prevent erosion.

3.05 BLASTING

- A. Blasting is prohibited in the Township.

3.06 CONTROL OF EXCAVATED MATERIAL

- A. Provide temporary barricades to prevent excavated material from encroaching on private property, walks, gutters, and storm drains.
- B. Maintain accessibility to all fire hydrants, valve pit covers, valve boxes, curb boxes, fire and police call boxes, and other utility controls at all times. Keep gutters clear or provide other satisfactory facilities for street drainage. Do not obstruct natural water courses. Where necessary, provide temporary channels to allow the flow of water either along or across the site of the work.

3.07 DEWATERING

- A. Keep excavations dry and free of water. Dispose of precipitation and subsurface water clear of the work.
- B. Intercept and divert surface drainage away from excavations. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water.
- C. Comply with Federal and State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

3.08 TOPSOILING

- A. Topsoiling as specified in Section 02485, Finish Grading, Seeding and Sodding.

3.09 DISPOSAL OF EXCAVATED MATERIAL

- A. Excavated material remaining after completion of placement of fills shall remain the property of the Contractor, removed from the construction area, and properly disposed of.

3.10 FOREIGN BORROW MATERIAL

- A. Foreign borrow consists of excavation, placement and compaction in fill areas of approved material obtained from sources outside the project limits.
- B. The Contractor shall make his own arrangements for obtaining all foreign borrow material and pay all costs involved.

END OF SECTION

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## SECTION 02220

### EARTHWORK

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Work Of This Section Includes, but is not limited to:
  - 1. Excavation and Backfill for Structures
  - 2. Dewatering
  - 3. Sheet piling and Shoring
  - 4. Site Grading
  
- B. Related Work Specified Elsewhere:
  - 1. Sections 02221a&b - Trenching, Backfilling, & Compacting
  - 2. Section 02485 - Finish Grading, and Seeding

##### 1.02 QUALITY ASSURANCE

- A. Testing Agency:
  - 1. A qualified independent testing agency or agencies will be under Contract and paid for by the Developer and approved by the Township during construction of this project on a periodic basis for observation of earthwork activities and performance of in-place soil testing and laboratory testing of soil materials.
  
- B. Developer's Failure to Meet Contract Requirements:
  - 1. The Township reserves the right to reject any items which do not meet the requirements of the plans and specifications and will require the Developer to replace these items and bear all expenses in connection with such replacements.
  - 2. The Developer shall pay all costs incurred in providing additional testing and/or analysis (including engineering fees) required because of deficient test results or construction not in compliance with these requirements.
  
- C. Referenced Standards:
  - 1. American Society for Testing and Materials (ASTM):
    - a. D698 Test for Laboratory Compaction Characteristics of Soil Using Standard Effort
    - b. D1556 Test for Density and Unit Weight of Soil in Place by the Sand Cone Method
    - c. D2922 Test for Density of Soil and Soil Aggregate in Place by Nuclear Methods
    - d. D5080 Test for Rapid Determination of Percent Compaction

2. Pennsylvania Department of Transportation (PennDOT): Publication 408/2007 Specifications, as amended

D. All materials used in the PennDOT Road right-of-way must be from a certified PennDOT supplier.

### 1.03 JOB CONDITIONS

A. Classification of Excavation: All excavation, trenching, boring, jacking and tunneling work under this Contract shall be UNCLASSIFIED, and includes excavation and removal of all soil, rock, boulders, fill, and other materials encountered of whatever nature.

B. Department of Environmental Protection Bureau of Land Recycling and Waste Management - Clean Fill Policy:

1. See Department of Environmental Protection Bureau of Land Recycling and Waste Management Document No. 258-2182-773.

2. Imported Fill: The Contractor will perform environmental due diligence to determine whether imported fill is clean or regulated as specified in DEP Clean Fill Policy. The Contractor will manage the fill following the guidelines of the policy including the furnishing of any certifications, testing or permits that may be required.

3. Exported Fill: The Contractor will perform environmental due diligence and testing to determine that the excavated material scheduled to be spoiled off site qualifies as clean fill under DEP Clean Fill Policy. Should materials be uncovered that are suspected of being other than clean fill, the Contractor will immediately notify the Owner. If evidence of release of regulated substance is found, material shall be disposed of as regulated fill.

C. The locations shown for utility facilities are approximate. Proceed with caution in the areas of utility facilities and expose them by hand or other excavation methods acceptable to the utility owner.

D. Erect sheeting, shoring, and bracing as necessary for protection of persons, improvements, and excavations.

E. Furnish and maintain barricades, signs and markings for excavated areas.

F. Select and install a system of dewatering to accomplish groundwater control in excavations.

G. Preserve, protect and maintain operable existing drainage ways, drains and sewers.

## 1.04 SUBMITTALS

- A. Certificates:
  - 1. Submit a Certificate of Compliance, together with supporting data, from the materials supplier attesting that the composition analysis of backfill materials meets specification requirements.
  - 2. Compaction Equipment List: Submit a list of all equipment to be utilized for compacting, including the equipment manufacturer's lift thickness limitations.
  - 3. Submit certified density testing results from the soils testing laboratory.
- B. Qualification Data:
  - 1. Submit evidence of qualifications for the testing agency.

## PART 2 - PRODUCTS

### 2.01 MATERIALS - GENERAL

- A. On site or imported natural soils as approved by Township.
- B. Load bearing fill is defined as earth fill or rock fill required for bearing loads imposed by structures or pavement subject to motor traffic and all earth materials necessary to raise the grade from an existing elevation or prepared foundation elevation to the finished elevation in a designated fill area which cannot tolerate settlement. All load bearing fill and backfill shall be compacted to 95% of the standard proctor maximum dry density as determined by ASTM D698.
- C. Nonbearing fill shall be free of roots, rock larger than 3" in size and building debris, capable of minimum compaction of 90% standard proctor density at optimum moisture content established for the soil material by ASTM D698.

### 2.02 MATERIALS FOR BACKFILLING, LOAD BEARING FILLS OR EMBANKMENTS

- A. Well-graded soil aggregate mixture, consisting of inorganic on-site cut soils with rock fragments less than 3 inches nominal diameter and less than 20% by weight of the mass, less than 30% of particles finer than No. 200 sieve, liquid limits less than 50, and plasticity indices greater than 10. Alternatively, PennDOT 2RC and No. 2A coarse aggregate would be acceptable.
- B. Total content of gravel or rock fragments larger than 1/2" shall not exceed 20% by weight of the mass.
- C. Backfill shall not contain topsoil, organic matter, debris, cinders, or frozen material.

## 2.03 SELECT STONE FILL

- A. Compacted stone under slabs.
- B. Stone shall be a coarse aggregate material and shall comply with AASHTO #57(PennDOT 2B), Section 703.2 (C) of Publication 408/2007 Specifications.

## 2.04 SELECT GRANULAR MATERIAL

- A. Compacted in areas of overexcavation in load bearing areas.
- B. Crushed stone or gravel aggregate conforming to Select Granular Material (PennDOT 2RC), Section 703.3, Publication 408/2007 Specifications.

## 2.05 PERVIOUS MATERIAL

- A. Natural clean, free-draining sand or gravel conforming to the requirements of ASTM C33 except:
  - 1. Materials passing a No. 100 sieve not to exceed 8%.
  - 2. Materials not passing a No. 200 sieve not to exceed 5%.

## 2.06 SOURCE OF MATERIALS

- A. Use materials for fill only if they meet the requirements specified herein. If sufficient material meeting these requirements is not available from required excavation, obtain requisite material from other sources.
- B. Use only material which has been approved as to quality, location of source and zone of placement in the fill.
- C. The Township has the right to reject material at the job site by visual inspection, pending sampling and testing.

## 2.07 EARTHWORK EQUIPMENT

- A. The Developer shall submit a list of the compaction equipment to be utilized on the project and the recommendations of the equipment manufacturer as to the maximum lift thickness which can be placed and the method of compaction to be used with this equipment to achieve the required compaction.
- B. Lift Thickness Limitations:
  - 1. In no case shall maximum lift thickness placed exceed the maximum limits specified by the manufacturer's recommendations.
  - 2. However, if the equipment manufacturer's lift thickness recommendation is followed and the specified density is not obtained, the Developer shall,

at his own expense, remove, replace, and retest as many times as is required to obtain the specified density.

## PART 3 - EXECUTION

### 3.01 PREPARATION AND LAYOUT

- A. Establish and identify required lines, levels, contours and datum.
- B. Maintain bench marks, monuments and other reference points.
- C. Protect trees, shrubs, lawns and other features remaining as portion of final landscaping.
- D. Refer to Section 02100 - Clearing and Grubbing.

### 3.02 ROUGH GRADING

- A. Rough grade to uniform contours; form foundations for embankments and load bearing fills.
- B. Construct the finished subgrade to vary not more than 1" above or below the elevation shown.
- C. Rough grade to prevent ponding of water in any area; install temporary swales if necessary to improve surface drainage.
- D. Complete embankment slopes to vary not more than 6" from the slope line shown.
- E. In saturated areas indicating sponginess and instability during earth moving operations shall be excavated and prepared to receive acceptable fill materials as specified; material excavated due to unsuitability shall be removed from site.
- F. Excavated subsoil materials to be used for fill materials shall be approved by Township; materials rejected by Township shall be removed from the site.

### 3.03 FOUNDATION PREPARATION OF NEW LOAD BEARING AREAS

- A. A load bearing area is defined as an area supporting loads of a structure or pavement area subject to motor traffic.
- B. After excavating to foundation subgrade elevation, the independent testing agency shall perform soil bearing tests, under the direction of the Township's Engineer, to confirm bearing capacity of the subgrade meets or exceeds the

minimum safe bearing capacity. If the subgrade does not meet the minimum safe bearing capacity, the Township's Engineer will review and provide direction for change in the work.

- C. Proofrolling should be performed by a piece of heavy, rubber-tired equipment such as a loaded tri-axle dump truck. The piece of equipment used for proof rolling should weigh at least 70,000 pounds, and should be operated with tire pressures of at least 60 pounds per square inch (psi). The proof rolling equipment should traverse the subgrade at 2 to 3 miles per hour (the pace of a slow walk), making at least one pass in each direction. Proofrolling should be observed by an experienced construction inspector who can evaluate the suitability of the subgrade soils and direct the removal and replacement of any unsuitable soils; all soft spots or irregularities within the natural soil, disclosed as the proof-rolling progresses, shall be excavated to sound material and then backfilled or leveled to grade as hereinafter specified; Township shall be so advised by Developer that additional excavation is necessary to achieve satisfactory proof-rolling. Suitable backfill to replace unacceptable soil in load bearing areas shall be select granular material.
- D. If rock is exposed at design footing grades, the rock shall be over-cut one foot and replaced with select stone fill. No additional payment will be made for this work.

#### 3.04 SHORING, SHEETING AND BRACING

- A. Install shoring, sheeting and bracing to comply with Federal, State and local code requirements. Responsibility for the safety of the work, personnel and structures rests solely with the Developer.
- B. Carry the bottom of the support system to depth below the main excavation, adequate to prevent ground movement.
- C. Follow the excavation closely with sheeting and shoring placement.
- D. Perform excavation for the installation of sheeting carefully to minimize the formation of voids.
- E. If unstable material is encountered during excavation, take measures to contain it in place and prevent ground displacement.
- F. Have sufficient quantity of material on hand at all times for sheeting, shoring, bracing and other operations for the protection of the work and for use in case of accident or emergency.
- G. Leave sheeting and shoring in place as long as possible, compatible with the placing and compacting of backfill.

### 3.05 EXCAVATION - GENERAL

- A. Excavate to the neat lines or setback lines for mixed face conditions and grades indicated on the Drawings.
- B. Excavate in sequence and stages which will not subject permanent or temporary structures, installations, or surfaces to unstable conditions.
- C. Excavate as required to provide sufficient working space to permit placing, inspection, and completion of the structures.
- D. Shape excavations accurately to the cross-sections and grades indicated.
- E. Support the sides of excavations as specified or required.
- F. Keep excavations free from water.
- G. Fill all openings and fractures in the excavation bottom and sides with cement grout to preclude potential development of soil piping and pinholes. Obtain Township's written approval of the foundation excavation before placing any foundation stone bedding or construction concrete.
- H. The Developer's failure to maintain dewatering operations for structure excavations shall not be a basis for payment for removal and replacement of unsuitable materials.

### 3.06 BLASTING

- A. Blasting is prohibited in the Township.

### 3.07 BACKFILLING STRUCTURES

- A. Do not commence backfilling around any structure until such structure has been examined and approved by the Township. Unexamined structures will be re-excavated so proper inspection can take place.
- B. Do not place backfill until the requirements for concrete curing and waterproofing have been complied with and, if required, test cylinders for the particular structure indicate that the concrete has attained the compressive strength specified.
- C. When backfilling against structures and where applicable, place backfill material in equal lifts and to similar elevations on opposite sides of structures in order to equalize opposing horizontal pressures. Place material in uniform increments over fill area.

- D. Protect structures from damage by construction activity, equipment, and vehicles. Repair or replace damaged structures to the satisfaction of the Owner.

### 3.08 DISPOSAL OF EXCAVATED MATERIAL

- A. Surplus excavated materials shall become the property of the Developer and be removed from the project site.

### 3.09 EMBANKMENT AND FILLS

- A. Do not place fill on any part of the embankment foundation until such areas have been examined and approved.
- B. Do not place fill on frozen surface.
- C. Place embankment fill in layers of uniform thickness for entire width so that each layer can be uniformly compacted.
- D. Avoid accumulation of large pieces of material at one location; fill voids and interstices with fine materials.
- E. Compact embankment materials of fills within 5 feet of structures using lightweight compactors; do not overstress the structures.
- F. Construct the finished subgrade to vary not more than 1/2" above or 1" below the elevation shown; complete embankment slopes to vary not more than 6" from the slope line shown.
- G. Place fill material over the fill areas and spread in loose horizontal layers, not exceeding equipment manufacturer's recommended uncompacted thickness; cobble size rock fragments may be placed in the lower three feet in areas where the fill is greater than eight feet; all rock shall have interstices filled with smaller rock sizes; work fill material in a direction parallel to the long axis of the fill section unless otherwise approved by the Township; the gradation and distribution of fill material shall be such that the area will be free from lenses, pockets, and layers of material differing substantially in texture or gradation from surrounding material; after spreading, harrow fill material if necessary to break up large pieces and blend materials.
- H. Where compacted fill is to be placed on a slope, bench the slope in horizontal and vertical faces of such width and depth as to provide adequate keying of the fill into the slope; in places where the movement of large equipment is restricted, place fill material in maximum 4" layers and compact with smaller vibratory rollers or power tampers; take particular care to thoroughly compact in areas where fill is placed against exposed bedrock.

- I. Density Testing:
  1. Under the direction of the Township, the Developer's testing agency shall conduct density tests at locations as follows during backfilling operations:
    - a. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one (1) test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
    - b. Foundation Wall Backfill: At each compacted backfill layer, at least one (1) test for each 100 feet or less of wall length, but no fewer than 2 tests.
  2. Determine density by ASTM D1556 or ASTM D2922.

### 3.10 MOISTURE CONTROL

- A. Control moisture content of fill materials to  $\pm 2\%$  of the optimum moisture content as determined by ASTM D698; material that is too wet may be spread and scarified on the fill surface and permitted to dry, until the moisture content is within specified limits; when fill material is too dry, sprinkle each layer of the fill and work moisture into the material until a uniform distribution within the specified limits is obtained; if, in the opinion of the Township, the top surface of a partial fill section becomes too dry to permit a suitable bond, scarify loosen the dried surface, dampen the loosened material and compact the moistened material.
- B. Keep the top plane of load bearing fill areas under construction sloped for drainage; when rain or inclement weather is expected, flat roll the top of embankment to seal it.

### 3.11 SURFACE DRAINAGE

- A. Intercept and divert surface drainage away from the excavation by the use of dikes, curb walls, ditches, pipes, sumps or other means.
- B. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water.
- C. Remove the surface drainage system when no longer required.
- D. Remove debris and restore the site or sites to original condition.

### 3.12 DRAINAGE AND DEWATERING OF EXCAVATED AREAS

- A. Provide and maintain ditches to collect surface water and seepage which may enter the excavations and divert.
- B. Install a dewatering system to keep excavations dry and free of water.

- C. Maintain water level below subgrade until concrete work or backfill, or both, have been completed to offset uplift pressures.
- D. Dispose of precipitation and subsurface water clear of the work. Provide necessary sediment and erosion control requirements.
- E. During dewatering operations, water discharged to a watercourse must be clear and free of silt, mud and other deleterious materials. Construct and maintain settling ponds to prevent stream degradation. Comply with the requirements for dewatering or discharging to a watercourse as required by Federal, State or local codes.
- F. Backfill drainage ditches, sumps, and settling basins when no longer required with granular material or other material as approved by the Township.

### 3.13 FINISHING

- A. On completion of the work, clean ditches and channels and finish the site in a neat and presentable condition. Slope areas to provide positive drainage.
- B. Place topsoil and seed all areas disturbed by construction as specified in Section 02485, Finish Grading and Seeding, unless otherwise indicated.

END OF SECTION

SECTION 02221a

TRENCHING, BACKFILLING, AND COMPACTING  
(See Section 02221b for Sanitary Sewer Lines)

PART 1 – GENERAL

1.01 DESCRIPTION

A. The work of this section includes, but is not limited to:

1. Cutting paved surfaces
2. Support of excavation
3. Pipe bedding requirements
4. Control of excavated material
5. Rough grading
6. Restoration of unpaved surfaces

B. Applicable Standard Details

1. Pipe Bedding Detail, Type IV Section 02221-1
2. Pipe Trench Detail Section 02221-2
3. Stream Crossing Detail Section 02221-3
4. Clay Dike Detail Section 02221-4
5. Size and Grading Requirements for Coarse Aggregate Section 02221b-12

1.02 QUALITY ASSURANCE - Section Not Used

1.03 SUBMITTALS - Section Not Used

1.04 JOB CONDITIONS

A. Protection of Existing Utilities and Structures:

1. Take all precautions and utilize all facilities required to protect existing utilities and structures. Comply with Act 287 of the General Assembly of Pennsylvania. Request cooperative steps of the utility company and suggestions for procedures to avoid damage to its lines.
2. Advise each person in physical control of powered equipment or explosives used in excavation or demolition work of the type and location of utility lines at the job site, the utility company assistance to expect, and procedures to follow to prevent damage.
3. Immediately report to the utility company and the Township Engineer any break, leak or other damage to the lines or protective coatings made or discovered during the work and immediately alert the occupants of premises of any emergency created or discovered.
4. Allow free access for utility company personnel at all times for purposes of maintenance, repair and inspection.

5. Television is lines both pre-construction and post-construction is a requirement.
6. Notify Township Engineer at least 72 hours in advance in order for a Township Inspector to be onsite for the duration of work with the respective easements.

B. Control of Traffic:

1. Employ traffic control measures in accordance with Pennsylvania Department of Transportation Publication 203, "Work Zone Traffic Control".
2. Notify Township Engineer and Emergency Departments at least 72 hours in advance of any operations requiring constriction of any traffic lane or changes to existing traffic patterns.
3. Notify Township and Emergency Departments immediately upon reopening travel lanes and restoration of traffic patterns.

## PART 2 - PRODUCTS

### 2.01 PIPE BEDDING MATERIAL

- A. Type IV Bedding Material: ASTM C33, AASHTO Size 8, crushed stone or gravel aggregate or Type 1B, Table B, Section 703.3(c) of Publication 408 Specifications. 3/8" maximum size. Do not use slag or cinders.

### 2.02 BACKFILL MATERIAL

- A. Suitable Material Stone Backfill: Size 2RC stone or gravel aggregate conforming to Section 703.3 of Publication 408 Specifications.
- B. Suitable Backfill Materials (State Highways, shoulders and embankment):
  1. From top of pipe bedding material to 12" over top of pipe: Material conforming to Section 206.2(b)1 of Publication 408 Specifications except that material shall have a maximum size that can be readily placed and compacted in 4" loose layers and free of wet, frozen, or organic material.
  2. From 12" above pipe to subgrade elevation: Material conforming to Section 206.2(b)1 of Publication 408 Specifications and free of wet, frozen or organic material.
- C. Suitable Backfill Materials (Other than State Highways, shoulders and embankment):
  1. From top of pipe bedding material to 24" over top of pipe: Material excavated from the trench if free of stones larger than 2" in size and free of wet, frozen, or organic materials.
  2. From 24" above pipe to subgrade elevation: Material excavated from the trench if free of stones larger than 8" in size and free of wet, frozen, or organic materials.

## PART 3 - EXECUTION

### 3.01 CUTTING PAVED SURFACES

- A. Where installation of pipelines, miscellaneous structures, and appurtenances necessitate breaking a paved surface, make cuts in a neat uniform fashion forming straight lines parallel with the centerline of the trench. Cut offsets at right angles to the centerline of the trench.
- B. Protect edges of cut pavement during excavation to prevent raveling or breaking; square edges prior to pavement replacement.
- C. The requirement for neat line cuts, in other than State Highways, may be waived if the final paving restoration indicates overlay beyond the trench width.

### 3.02 TRENCH EXCAVATION:

- A. Depth of Excavation:
  - 1. Gravity Pipelines:
    - a. Excavate trenches to the depth and grade shown on the profile drawings for the invert of the pipe plus that excavation necessary for placement of pipe bedding material.
    - b. Excavation for laterals shall provide a straight uniform grade from the main pipeline or riser stack to the elevation at the right-of-way line, plus that excavation necessary for placement of pipe bedding material.
  - 2. Where unsuitable bearing material is encountered in the trench bottom, continue excavation until the unsuitable material is removed, solid bearing is obtained or can be established, or concrete cradle can be placed. If no concrete cradle is to be installed, refill the trench to required pipeline grade with bedding material.
  - 3. Where the Contractor, by error or intent, excavates beyond the minimum required depth, backfill the trench to the required pipeline grade with Type II bedding material.
- B. Width of Excavation:
  - 1. Excavate trenches, including laterals, to a width necessary for placement and jointing of the pipe and for placing and compacting pipe bedding and trench backfill, but not less than 16" plus the pipe outside diameter.
  - 2. Shape trench walls completely vertical from trench bottom to at least 2' above the top of pipe. Trench walls from 2' above the top of the pipe to grade shall be benched and sloped to comply with federal and state laws and codes.

- C. Length of Open Trench:
  - 1. Do not advance trenching operations more than 100' ahead of completed pipeline backfilled to rough grade.

### 3.03 SUPPORT OF EXCAVATION

- A. Support excavation with sheathing, shoring, and bracing or a "trench box" as required to comply with federal and state laws and codes.
- B. No excavated material shall be placed within two feet of trench walls.
- C. Install adequate excavation supports to prevent ground movement or settlement to adjacent structures, pipelines or utilities. Damage due to settlement because of failure to provide support or through negligence or fault of the Contractor in any other manner, shall be repaired at the Contractor's expense.
- D. Withdraw shoring, bracing, and sheathing as backfilling proceeds unless otherwise directed by the Township Engineer.

### 3.04 CONTROL OF EXCAVATED MATERIAL

- A. Keep the ground surface on both sides of the excavation free of excavated material to comply with federal, state, and local laws and codes.
- B. Provide temporary barricades to prevent excavated material from encroaching on private property, walks, gutters, storm drains, swales, and basins.
- C. Maintain accessibility to all fire hydrants, valve pit covers, valve boxes, curb boxes, fire and police call boxes, and other utility controls at all times. Keep gutters clear or provide other satisfactory facilities for street drainage. Do not obstruct natural water courses. Where necessary, provide temporary channels to allow the flow of water either along or across the site of the work.
- D. In areas where pipelines parallel or cross streams, ensure that no material slides, is washed, or is dumped into the stream course. Remove cofferdams immediately upon completion of pipeline construction.

### 3.05 DEWATERING

- A. Keep excavations dry and free of water. Dispose of precipitation and subsurface water clear of the work.
- B. Maintain pipe trenches dry until pipe has been jointed, inspected, and backfilled, and concrete work has been completed. Preclude trench water from entering pipelines under construction.
- C. Intercept and divert surface drainage away from excavations. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water.
- D. Comply with federal and state requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

### 3.06 PIPE BEDDING REQUIREMENTS

- A. Type IV Bedding:
  - 1. Depth of bedding material aggregate as shown on Standard Detail 02221-1.
  - 2. Provide Type IV bedding for all types of pipe.
  - 3. Shape recesses for the joints or bell of the pipe by hand. Assure that the pipe is supported on the lower quadrant for the entire length of the barrel.

### 3.07 BACKFILLING TRENCHES

- A. After pipe installation and inspection, backfill trenches in accordance with Standard Detail 02221-2. Refer to Backfill and Surface Restoration Requirements Table in Section 02575 for compaction requirements.
- B. Exposed joints for Testing:
  - 1. The Contractor has the option to test the pipe prior to backfilling the trench. If this option is selected, install reaction blocks where required and place 2' of thoroughly compacted backfill over the pipe leaving pipe joints partially exposed.
  - 2. If the Contractor elects to completely backfill the trench prior to testing, he shall be responsible for locating and uncovering leaks which may cause the test to fail.
- C. Jetting:
  - 1. When approved by the Township Engineer in writing, jetting methods may be used to consolidate backfill into a firm compact mass.
- D. Uncompacted Backfill:
  - 1. Where uncompacted backfill is indicated on the Drawings, backfill the trench from one foot above the pipe to the top of the trench with acceptable material excavated from the trench, crowned over the trench to a sufficient height to allow for settlement to grade after consolidation. Provide for surface water drainage.
- E. Unsuitable Backfill Material:
  - 1. Where the Township Engineer deems backfill material to be unsuitable and rejects all or part thereof due to conditions prevailing at the time of construction, remove the unsuitable material and replace with select material stone backfill or suitable foreign backfill material.
- F. Lift Thickness Limitations:
  - 1. In no case shall maximum lift thickness placed exceed the maximum limits specified by the manufacturer's recommendations. However, if the

equipment manufacturer's lift thickness recommendation is followed and the specified density is not obtained, the Developer shall, at his own expense, remove, replace, and retest as many times as is required to obtain the specified density.

2. Compact each layer of backfill to 95% of the standard proctor maximum dry density as determined by ASTM D698 for roads and load bearing areas and 90% for all other areas.
3. Lift thickness limitations specified for state highways, shoulders, or embankments govern over the compaction equipment manufacturer's recommendations.
4. Notwithstanding the specified requirements for trench backfill compaction, trenches that settle below the surrounding grade prior to final completion shall be filled to surrounding grade level with appropriate materials.

### 3.08 RESTORATION OF UNPAVED SURFACES

- A. Restore unpaved surfaces disturbed by construction to equal the surface condition prior to construction.
- B. Restore grassed areas in accordance with Section 02485, Finish Grading and Seeding.

END OF SECTION

## SECTION 02221b

### TRENCHING, BACKFILLING, AND COMPACTING OF SANITARY SEWER LINES

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Work of This Section Includes, but is not limited to:
  - 1. Trench excavation, backfill and compaction
  - 2. Support of excavation
  - 3. Pipe bedding requirements
  - 4. Control of excavated material
  - 5. Restoration of unpaved surfaces
  
- B. Related Work Specified Elsewhere:
  - 1. Section 02100 - Clearing and Grubbing
  - 2. Section 02150 - Boring and Jacking
  - 3. Section 02220 - Earthwork
  - 4. Section 02485 - Finish Grading and Seeding
  - 5. Section 02610 - Sanitary Sewer Pipe
  
- C. Applicable Standard Details:
  - 1. 2575 Trench Repaving Detail
  - 2. 5177 Pipe Bedding Details
  - 3. 5178A Pipe Trench Detail
  - 4. 5179 Concrete Cradle and Encasement Details
  - 5. 5180 Vertical Water Main Clearance
  - 6. 5180A Stream Crossing Detail
  - 7. 5190 Clay Dike Detail
  - 8. 5195 Thrust Block for Vertical Bends
  - 9. 5196 Thrust Block for Bends, Tees, and Caps
  - 10. 5196A Concrete Anchors for Steeply Sloped Pipe

##### 1.02 QUALITY ASSURANCE

- A. Testing Agency: Density testing shall be performed by an independent soils testing laboratory engaged and paid for by the Developer and approved by the Township's Representative.
  
- B. Referenced Standards:
  - 1. Pennsylvania Department of Transportation (PENNDOT):
    - a. Regulations Governing Occupancy of Highways by Utilities (67 PA Code, Chapter 459)
    - b. Publication 408/2007 Specifications

- c. Pennsylvania Test Method, PTM 106
- d. Pennsylvania Test Method, PTM 402
- e. Publication 213, Work Zone Traffic Control
- 2. American Society for Testing and Materials (ASTM):
  - a. D698 Test for Laboratory Compaction Characteristics of Soil Using Standard Effort
  - b. D1556 Test for Density and Unit Weight of Soil in Place by the Sand Cone Method
  - c. D2922 Test for Density of Soil and Soil Aggregate in Place by Nuclear Methods

A. All materials used in the PennDOT Road right-of-way must be from a certified PennDOT supplier.

B. Density Testing:

- 1. Conduct a minimum of two (2) density tests per manhole section or pipeline. Conduct one (1) test in the lower half of the trench and one (1) test in the upper half of the trench at locations as directed by the Township's Engineer during backfilling operations. If any test fails, the Developer shall take remedial steps to correct the compaction and rerun the test until compliance with the density requirements are shown. A density test that fails does not count toward the number of tests to be taken. The cost of the initial test and any required retesting is the responsibility of the Developer.
- 2. Determine density by ASTM D1556 or ASTM D2922.

### 1.03 SUBMITTALS

A. Certificates:

- 1. Submit, prior to delivery of the material to the job site, a Statement of Compliance from the materials supplier, together with supporting data, attesting that the composition analysis of pipe bedding and select material stone backfill materials meets specification requirements. Should a change in source of materials be made during construction, submit a new Statement of Compliance from the new source for approval before the material is delivered to the job site.
- 2. Submit certified density testing results from the soils testing laboratory.
  - a. Compaction testing equipment must have a current calibration certificate.

B. Compaction Equipment List: Submit a list of all equipment to be utilized for compacting, including the equipment manufacturer's lift thickness limitations.

C. Agreements with Property Owners: Prior to storing or disposing of excavated materials on private property, submit a copy of the written agreement with the property owner.

#### 1.04 JOB CONDITIONS

- A. Classification of Excavation: All excavation, trenching, boring, jacking and tunneling work under this Contract shall be UNCLASSIFIED, and includes excavation and removal of all soil, rock, boulders, fill, and other materials encountered of whatever nature.
- B. Control of Traffic: Employ traffic control measures in accordance with Pennsylvania Department of Transportation Publication 213, "Work Zone Traffic Control".
- C. Protection of Existing Utilities and Structures:
  - 1. Take all precautions and utilize all facilities required to protect existing utilities and structures. In compliance with Act 199 of the General Assembly of Pennsylvania, advise each Utility at least 3 working days in advance of intent to excavate, do demolition work or use explosives and give the location of the job site. Request cooperative steps of the Utility and suggestions for procedures to avoid damage to its lines.
  - 2. Advise each person in physical control of powered equipment or explosives used in excavation or demolition work of the type and location of utility lines at the job site, the Utility assistance to expect, and procedures to follow to prevent damage.
  - 3. Immediately report to the Utility and the Township and the Township's Engineer any break, leak or other damage to the lines or protective coatings made or discovered during the work and immediately alert the occupants of premises of any emergency created or discovered.
  - 4. Allow free access to Utility personnel at all times for purposes of maintenance, repair and inspection.
  - 5. Television is lines both pre-construction and post-construction is a requirement.
  - 6. Notify Township Engineer at least 72 hours in advance in order for a Township Inspector to be onsite for the duration of work with the respective easements.
- D. Department of Environmental Protection Bureau of Land Recycling and Waste Management - Clean Fill Policy:
  - 1. See Department of Environmental Protection Bureau of Land Recycling and Waste Management Document No. 258-2182-773.
  - 2. Imported Fill: The Developer will perform environmental due diligence to determine whether imported fill is clean or regulated as specified in DEP Clean Fill Policy. The Developer will manage the fill following the guidelines of the policy including the furnishing of any certifications, testing or permits that may be required.
  - 3. Exported Fill: The Developer will perform environmental due diligence and testing to determine that the excavated material scheduled to be spoiled off site qualifies as clean fill under DEP Clean Fill Policy. Should materials be

uncovered that are suspected of being other than clean fill, the Developer will immediately notify the Township. If evidence of release of regulated substance is found, material shall be disposed of as regulated fill.

## PART 2 - PRODUCTS

### 2.01 PIPE BEDDING MATERIAL

- A. Type IV Pipe Bedding Material: Crushed stone or gravel aggregate conforming to AASHTO No. 8 (PennDOT 1B) as specified in Section 703.2, Publication 408/2007 Specifications, as shown in Standard Detail 5177.

### 2.02 BACKFILL MATERIAL

- A. Select Granular Material Backfill: Crushed stone or gravel aggregate conforming to Select Granular Material (PennDOT 2 RC), Section 703.3, Publication 408/2007 Specifications.
- B. Suitable Backfill Material (All Roads and Highways):
  - 1. From top of pipe bedding material to subgrade elevation:
    - a. Select Material Stone Backfill as specified in paragraph 2.02.A or
    - b. Flowable backfill as specified in Section 220, Publication 408/2007 Specifications.
  - 2. See Standard Detail 5178A for pipe trench detail.
- C. Suitable Backfill Material (Other than Roads and Highways):
  - 1. From top of pipe bedding material to 24" over top of pipe:
    - a. Material excavated from the trench if free of stones larger than 2" in size and free of wet, frozen, or organic materials.
  - 2. From 24" above pipe to subgrade elevation:
    - a. Material excavated from the trench if free of stones larger than 8" in size and free of wet, frozen, or organic materials.
  - 3. See Standard Detail 5178A for pipe trench detail.
- D. Unsuitable Backfill Material: Where the Township's Engineer deems backfill material to be unsuitable and rejects all or part thereof due to conditions prevailing at the time of construction, remove the unsuitable material and replace with select material stone backfill as specified in paragraph 2.02.A or suitable foreign backfill material.

### 2.03 CLAY DIKE MATERIAL

- A. Clay dike material conforming to the following:
  - 1. Percent passing the #200 sieve - 70%
  - 2. Unified Soil Classification - Soils CL & CH
  - 3. Plastic Index - > 10

## 2.04 DETECTABLE UNDERGROUND UTILITY MARKING TAPE

A. Tape shall consist of a minimum 5-mil (0.005") overall thickness, with no less than a 35 gauge (0.00035") solid aluminum foil core. The foil must be visible from BOTH sides. The layers shall be laminated together with the extrusion lamination process, not adhesives. Further, there shall be NO inks or printing extending to the edges of the tape. The adhesive will NOT contain any dilutants, pigments or contaminants and is specially formulated to resist degradation by elements normally encountered in the soil. All printing shall be encased to avoid ink rub-off.

B. Test Data:

<u>Property</u>	<u>Method</u>	<u>Value</u>
Thickness	ASTM D2103	5.0 mils
Tensile strength	ASTM D 882	25 lbs./inch (5500 psi)
Elongation	ASTM D 882-88	< 50% at break
Printability	ASTM D2578	> 50 dynes/cm <sup>2</sup>
Flexibility	ASTM D 671-81	Pliable hand
Inks	Mfg. specs.	Heat set Mylex
Message repeat	Mfg. specs.	Every 20"
Foil	Mfg. specs.	Dead soft/annealed
Top Layer	Mfg. specs.	Virgin PET
Bottom layer	Mfg. specs.	Virgin LDPE
Adhesives	Mfg. specs.	> 30%, solid 1.5#/R
Bond strength	Boiling H <sup>2</sup> O @ 100EC	5 hours w/o peel
Colors	APWA code	See below

C. Color Code shall be as follows:

1. Safety Red: Electric power, distribution and transmission and municipal electric systems.
2. High Visibility Safety Yellow: Gas and oil distribution and transmission, dangerous materials, product and steam.
3. Safety Alert Orange: Telephone and telegraph systems, police and fire communications, and cable television.
4. Safety Precaution Blue: Water systems and slurry pipelines.
5. Safety Green: Sanitary and storm sewer systems.
6. Safety Brown: Force mains, reclaimed water lines and effluent reuse lines.
7. Alert Purple: Reclaimed non-potable water lines.

## PART 3 - EXECUTION

### 3.01 MAINTENANCE AND PROTECTION OF TRAFFIC

- A. Coordinate the work to ensure the least inconvenience to traffic and maintain traffic in one or more unobstructed lanes unless closing the street is authorized.
- B. Maintain access to all streets and private drives.
- C. Provide and maintain signs, flashing warning lights, barricades, markers, and other protective devices as required to conform with construction operations and to keep traffic flowing with minimum restrictions.
- D. Comply with State and local codes, permits and regulations.

### 3.02 CUTTING PAVED SURFACES

- A. Where excavation includes breaking a paved surface, make cuts in a neat uniform fashion forming straight lines parallel with the centerline of the trench. Cut offsets at right angles to the centerline of the trench. Saw cut concrete surfaces; saw cut other hard surfaces or make straight cuts with jackhammer. No paving shall be broken except that which has been previously cut.
- B. Protect edges of cut pavement during excavation to prevent raveling or breaking; square edges prior to pavement replacement.

### 3.03 BLASTING

- A. Blasting is prohibited in the Township.

### 3.04 TRENCH EXCAVATION

- A. Topsoil Stripping and Stockpiling: Strip topsoil encountered during trench excavation to its full depth and stockpile for reuse.
- B. Depth of Excavation:
  - 1. Gravity Pipelines:
    - a. Excavate trenches to the depth and grade shown on the profile drawings for the invert of the pipe plus 6 inches for placement of pipe bedding material.
    - b. Excavation for laterals shall provide a straight uniform grade from the main pipeline or riser stack to the elevation at the right-of-way line, plus 6 inches for placement of pipe bedding material. The minimum slope of laterals shall be 1% except that laterals shall connect to the

sewer main by means of a 1/8 bend. See Section 02610, Sanitary Sewer Pipe.

2. Pressure Pipelines:

- a. Excavate trenches to the minimum depth necessary to place required pipe bedding material and to provide 4' from the top of the pipe to the finish ground elevation, except where specific depths are otherwise indicated on the Drawings.
- b. Where unsuitable bearing material is encountered in the trench bottom, continue excavation until the unsuitable material is removed, solid bearing is obtained or can be established, or concrete cradle can be placed. If no concrete cradle is to be installed, refill the trench to required pipeline grade with pipe bedding material.
- c. Where the Developer, by error or intent, excavates beyond the minimum required depth, backfill the trench to the required pipeline grade with pipe bedding material.

C. Width of Excavation:

1. Excavate trenches, including laterals, to a width necessary for placing and jointing the pipe and for placing and compacting bedding and backfill around the pipe.
2. Shape trench walls completely vertical from trench bottom to at least 24" above the top of the pipe.
3. For pressure pipeline fittings, excavate trenches to a width that will permit placement of concrete thrust blocks. Provide earth surfaces for thrust blocks that are perpendicular to the direction of thrust and are free of loose or soft material.
4. Where rock is encountered in the sides of the trench, remove the rock to provide a minimum clearance between the pipe and rock of 6".

- D. Length of Open Trench: Do not advance trenching operations more than 400' ahead of completed pipeline. Trenches may not remain open during non-working hours. All pipe ends and clean outs must be securely capped or plugged at the end of each day. Duct tape will not be acceptable.

### 3.05 SUPPORT OF EXCAVATION

- A. Support excavations with approved shoring or a "trench box" as required to comply with Federal and State laws and codes. Install adequate excavation supports to prevent ground movement or settlement to adjacent structures, pipelines or utilities. Damage due to settlement because of failure to provide support or through negligence or fault of the Developer in any other manner shall be repaired at the Developer's expense.
- B. Withdraw shoring as backfilling proceeds unless otherwise directed by the Township.

### 3.06 CONTROL OF EXCAVATED MATERIAL

- A. Keep the ground surface within a minimum of 2' of both sides of the excavation free of excavated material.
- B. In areas where pipelines parallel or cross streams, ensure that no material slides, is washed, or dumped into the stream course. Remove cofferdams immediately upon completion of pipeline construction.
- C. Maintain accessibility to all fire hydrants, valve pit covers, valve boxes, curb boxes, fire and police call boxes, and other utility controls at all times. Keep gutters clear or provide other satisfactory facilities for street drainage. Do not obstruct natural watercourses. Where necessary, provide temporary channels to allow the flow of water either along or across the site of the work.
- D. Provide temporary barricades to prevent excavated material from encroaching on private property, walks, gutters, and storm drains.
- E. Do not place or store excavated material on private property without a written agreement signed by the property owner.

### 3.07 DEWATERING

- A. Keep excavations dry and free of water. Remove precipitation and subsurface water clear of the work area.
- B. Maintain pipe trenches dry until pipe has been jointed, inspected, and backfilled, and concrete work has been completed. Prevent trench water from entering pipelines under construction. All pipe ends and cleanouts must be securely capped or plugged at the end of each day. Duct tape is not acceptable.
- C. Intercept and divert surface drainage away from excavations. Maintain storm drainage facilities, gutters, and natural surface watercourses open and in operation. Provide and install temporary facilities to maintain excavations free of water as required. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water. When mechanical equipment is utilized to control water conditions, provide and maintain sufficient standby units onsite.
- D. Comply with all Federal, State and Local requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

### 3.08 PIPE BEDDING REQUIREMENTS

- A. Type IV Bedding:
  - 1. Depth and type of bedding material aggregate as shown on Standard Detail 5177.
  - 2. Provide Type IV bedding for all pipes.
- B. Shape recesses for the joints or bell of the pipe by hand. Assure that the pipe is supported on the lower quadrant for the entire length of the barrel.

### 3.09 PIPE LAYING

- A. Lay pipe as specified in the appropriate Section of these Specifications for pipeline construction.

### 3.10 THRUST RESTRAINT

- A. Provide pressure pipe with concrete thrust blocking or use restrained joint fittings at all bends, tees, valves, and changes in direction, in accordance with the Specifications, Drawings and Standard Details 03300-2, 5195, and 5196.

### 3.11 BACKFILLING TRENCHES

- A. After pipe installation and inspection, backfill trenches from the top of pipe bedding material with specified backfill material hand placed and carefully compacted with hand-operated mechanical tampers in layers of suitable thickness to provide specified density. Backfill and compact the remainder of the trench with specified backfill material.
- B. Exposed Joints for Testing:
  - 1. The Developer has the option to test the pipe prior to backfilling the trench. If this option is selected, install reaction blocks where required and place 2' of thoroughly compacted backfill over the pipe leaving pipe joints partially exposed.
  - 2. If the Developer elects to completely backfill the trench prior to testing, he shall be responsible for locating and uncovering leaks which may cause the test to fail.
- C. Lift Thickness Limitations:
  - 1. In no case shall maximum lift thickness placed exceed the maximum limits specified by the manufacturer's recommendations. However, if the equipment manufacturer's lift thickness recommendation is followed and the specified density is not obtained, the Developer shall, at his own expense, remove, replace, and retest as many times as is required to obtain the specified density.

2. Compact each layer of backfill to 95% of the standard proctor maximum dry density as determined by ASTM D698 for roads and load bearing areas and 90% for all other areas.
3. Lift thickness limitations specified for state highways, shoulders, or embankments govern over the compaction equipment manufacturer's recommendations.
4. Notwithstanding the specified requirements for trench backfill compaction, trenches that settle below the surrounding grade prior to final completion shall be filled to surrounding grade level with appropriate materials.

- D. **Uncompacted Backfill:** Where uncompacted backfill is indicated on the Drawings, backfill the trench from one foot above the pipe to the top of the trench with material excavated from the trench, crowned over the trench to a sufficient height to allow for settlement to grade after consolidation.

### 3.12 STREAM CROSSINGS

- A. Construct pipeline stream crossings as shown on Standard Detail 5180A.
- B. After backfilling, protect the surfaces of the disturbed area within the stream channel with a 1 foot thick layer of rip rap stone.

### 3.13 CLAY DIKES

- A. Install clay dikes adjacent to stream crossings as shown on Standard Detail 5180A and where indicated on the Drawings.
- B. Construct dikes impervious to the flow of water by backfilling the trench with compacted clay as shown on Standard Detail 5190.

### 3.14 UTILITY MARKING TAPE

- A. Install magnetically detectable utility marking tape as specified above all non-ferrous pipelines, 12"-18" below final grade.

### 3.15 DISPOSAL OF EXCAVATED MATERIAL

- A. Excavated material remaining after completion of backfilling shall remain the property of the Developer. The Developer shall remove said material from the job site and legally dispose of it.

### 3.16 RESTORATION OF UNPAVED SURFACES

- A. Restore unpaved surfaces disturbed by construction to equal the surface condition prior to construction.

- B. Restore grassed areas in accordance with Section 02485, Finish Grading and Seeding.

(SEE ATTACHED TABLE)

END OF SECTION

**Size and Grading Requirements for Coarse Aggregates (Based on Laboratory Sieve Tests, Square Openings)**

		Total Percent Passing													
PADOT Number	AASHTO Number	100 mm (4")	90 mm (3-1/2")	63 mm (2-1/2")	50 mm (2")	37.5 mm (1-1/2")	25.0 mm (1")	19.0 mm (3/4")	12.5 mm (1/2")	9.5 mm (3/8")	4.75 mm (No. 4)	2.36 mm (No. 8)	1.18 mm (No. 16)	150 pm (No. 100)	75 pin (No. 200)
4	1	100	90-100	25-60		0-15		0-5							
3A	3			100	90-100	35-70	0-15		0-5						
	467				100	95-100		35-70		10-30	0-5				
	5					100	90-100	20-55	0-10	0-5					
2B	57					100	95-100		25-60		0-10	0-5			
2	67						100	90-100		20-55	0-10	0-5			
	7							100	90-100	40-70	0-15	0-5			
1B	8								100	85-100	10-30	0-10	0-5		
Screenings	10									100	85-100			10-30	
2A					100			52-100		36-70	24-50	16-38*	10-30		
OGS					100			52-100		136-65	8-40		0-12		
2RC					100						15-60			0-30	

\* Applies only for bituminous mixtures.

Note A: A combination of No. 7 and No. 5 may be substituted for No. 57, provided that not more than 50% or less than 30% of the combination is No. 7 size.

Note B: Provide No. OGS material that has a minimum average coefficient of uniformity of 4.0. The average coefficient of uniformity is defined as the average of the sublots within each lot. Determine the coefficient of uniformity according to PTM No. 149 each time the gradation is determined. The required minimum coefficient of uniformity for individual samples is 3.5. If the coefficient of uniformity of any sample falls below 3.5, reject the lot. Do not use the coefficient of uniformity in the multiple deficiency formula.

SECTION 02230

ROADWAY EXCAVATION, FILL, AND COMPACTION

PART I - GENERAL

1.01 DESCRIPTION

A. The work of this Section includes but is not limited to:

1. Excavation
2. Compaction
3. Fill
4. Subgrade Preparation
5. Base Preparation

B. Related Work Specified Elsewhere:

1. Site excavation and placement of fill material: Section 02210
2. Finish grading, seeding, and sodding: Section 02485
3. Bituminous paving and surfacing: Section 02500

C. Definitions:

1. Roadway: Area under and within ten feet of the edge of paving.
2. Roadway Subgrade: The prepared earth surfaces on or over which additional roadway materials will be placed or work is to be performed.

D. Applicable Standard Details:

1. The "Backfill and Surface Restoration Requirements" Table in Section 02575 lists the specific paving requirements.

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. American Association of State Highway and Transportation Officials:
  - a. AASHTO T99, Moisture-Density Relations of Soils, Using a 5.5-lb. Rammer and a 12-in. Drop
  - b. AASHTO T191, Standard Method of Test for Density of Soil In-Place by the Sand Cone Method
2. American Society for Testing and Materials:
  - a. ASTM D2167, Density of Soil in Place by the Rubber-Ballon Method

b. ASTM D2922, Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

3. Pennsylvania Department of Transportation Publication 408 Specifications - Section 703.2 Coarse Aggregate

B. Inspections:

1. Inspection by the Township Engineer will, at a minimum, be made of the subgrade prior to placement of the base course, and of the base course prior to placement of the binder surface and of the binder prior to placement of scratch coats or the wearing surface.

1.03 SUBMITTALS

A. Provide soil analysis and test results to the Township Engineer upon request.

B. Provide documentation of materials placed to the inspector onsite or as otherwise directed by the Township Engineer.

1.04 JOB CONDITIONS - Section Not Used

PART 2 - PRODUCTS

2.01 ACCEPTABLE MATERIALS

For purposes of construction control, the following materials may be deemed acceptable for use in placement of fills:

- A. Soil. Soil shall include all inorganic material having a maximum size that can be readily placed and compacted in loose 8 inch layers and of which more than 35 percent shall pass the No. 200 sieve. Soil shall have a minimum dry weight density of 95 pounds per cubic foot as determined in accordance with PTM No. 106, Method B and a maximum liquid limit of 65 as determined in accordance with AASHTO Designation T89. The plasticity index, as determined by AASHTO Designation T90 for soils having liquid limits of 41 to 65 inclusive, shall be not less than that determined by the formula: Plasticity Index = Liquid Limit - 30.
- B. Granular Material. Granular material shall include all natural or synthetic mineral aggregates having a maximum size that can be readily placed and compacted in loose 8 inch layers and of which 35 percent or less shall pass the No. 200 sieve.
- C. Shale. Shale shall include all rock-like materials formed by the natural consolidation of mud, clay, silt and fine sand and usually thinly laminated, comparatively soft and easily split, having a maximum size that can be readily placed and compacted in loose 8 inch layers.
- D. Rock. Rock shall include all igneous, metamorphic and sedimentary rock having a maximum size that can be readily placed and compacted in loose 8 inch layers and which generally has sufficient fines to normally fill all the voids in each layer.

- E. Random Materials. Random material shall include any combination of the above classifications and may include old concrete, brick, etc., from demolition having a maximum size that can be readily placed and compacted in loose 8 inch layers, and which have been approved by the Township Engineer.

### PART 3 - EXECUTION

#### 3.01 SUBGRADE

- A. Perform soil erosion control work in accordance with requirements of the approved Soil Erosion and Sedimentation Control plan.
- B. Roadway Excavation. Excavate or otherwise remove and satisfactorily dispose of materials located within the limits indicated on the Drawings for roadways.
  - 1. Excavate to roadway subgrade depths required, and cut drainage channels and waterways as detailed on the Drawings.
  - 2. Remove rock encountered in roadway excavation to a depth six inches below finished subgrade elevation.
  - 3. Excavate unsuitable subgrade material. Refill such areas to required elevation with acceptable materials.
- C. Roadway Grading. Shape subgrade of roadways, intersections, approaches, entrances and adjoining pedestrian walkways to no more than 0.10 foot above or below the design elevations.
- D. Roadway Fill. Construction requirements for roadway fill shall be as follows:
  - 1. Form the roadway fill with acceptable materials.
  - 2. Compact material to a minimum final density of not less than 95% of the maximum dry weight density at its optimum moisture content plus or minus 2%.
- E. Roadway Embankment. Construction requirements for roadway embankment shall be as follows:
  - 1. Break up shale and other rock-like materials formed by natural consolidation of mud, clay, silt and fine sand into a maximum size that can be readily placed and compacted in loose eight inch layers.
  - 2. Place rock to form the base of roadway embankments. Place in uniform loose layers not exceeding in depth the approximate average size of the larger rock, but not exceeding 8 inches deep.
  - 3. Smooth and level each layer adding soil or granular material conforming to Section 02230, Paragraph 2.01A or 2.01B in sufficient quantity to supplement the smaller rock pieces, filling the voids and pockets.
  - 4. Form the top 18 inches of roadway embankments with soil or granular material conforming to Section 02230, Paragraph 2.01A or 2.01B.

5. Compact embankment material to a minimum final density of not less than 95% of the maximum dry weight density at its optimum moisture content plus or minus 2%.
6. During foreign borrow excavation operations, keep the borrow area graded to ensure free water drainage. Following completion of work in the borrow area, grade the area to present a uniformly trim appearance merging into the surrounding terrain and to prevent erosion.

### 3.02 BASE COURSES

#### A. Subbase Course

1. Compact subgrade material to a minimum final density of not less than 95% of the maximum dry weight density at its optimum moisture content plus or minus 2%. Perform finish rolling on roadway subgrade just prior to installation of aggregate subbase or base course.
2. When indicated on the Drawings and/or shown in the "Backfill and Surface Restoration Requirements" Table in Section 02575, construct subbase in accordance with Publication 408 Specifications, Section 350.

#### B. Crushed Aggregate Base Course - Type A

1. Compaction shall be achieved by means of approved static or vibratory equipment as specified in Publication 408, Section 108.05(c)3. If static roller is used, a base course of more than 8 inches shall be constructed in two lifts. If approved vibratory roller is used, a base course up to 10 inches in compacted thickness may be constructed in one course.
2. On prepared subgrade (or subbase if required), spread limestone screenings (AASHTO No. 10) to a depth of one inch and compact.
3. Construct stone subbase of AASHTO No. 1 aggregate to the compacted depth specified in the "Backfill and Surface Restoration Requirements" Table in Section 02575.
4. Spreading Coarse Material. The coarse material shall be spread uniformly on the initial layer of fine material by approved mechanical stone spreaders to the full width of the base unless otherwise specified for part-width construction. Spreaders shall be adjusted to spread the loose material to obtain a layer of the required depth after compaction. In areas inaccessible to spreading equipment, the material may be spread directly from trucks provided the distribution is equivalent to that achieved by the spreader. All segregated material shall be removed and replaced with well graded material. The coarse material shall not be spread for a distance of more than an average day's work ahead of choking and compacting.
5. Compacting Coarse Material. Immediately after surface corrections have been made to the spread coarse material, it shall be thoroughly compacted. The rolling shall begin at the sides and progress to the center, except on superelevated curves where the rolling shall begin on the low side and progress to the high side. The rolling shall be parallel with the centerline of

the roadway, uniformly lapping each preceding track, covering the entire surface with the rear wheels ahead of the roller wheels. After each layer of material has been spread and compacted, it shall be checked with approved templates and straightedges, and all irregularities shall be satisfactorily corrected. Red flags shall be placed at the limits of satisfactorily compacted coarse material. The flags shall be moved ahead as additional material is compacted, and no filler shall be applied to the coarse material in advance of the flag-marked sections.

6. Application of Fine Material. After the coarse material has been set and keyed by compaction, dry limestone screenings (AASHTO No. 10.), in an amount equal to approximately 50% of that required to fill the voids in the coarse material, shall be spread uniformly over the surface. The vibratory compaction equipment shall then be operated over the surface to cause the screenings to settle into the voids. The remaining screenings shall be spread and vibrated in one or more applications to satisfactorily fill the voids; however, the quantity of screenings used and the operation of filling shall not cause floatation of the coarse aggregate. Areas not completely filled, in the foregoing operations, shall be filled by manual methods and need not be further vibrated.
7. Compacting and Bonding. After completing the vibration of the fine material, the surface of single-layer construction, or the surface of each layer of multi-layer construction, shall be sprinkled with water and rolled. All excess screenings forming in piles or cakes upon the surface shall be loosened and scattered by sweeping, exercising care that the fine material is not removed below the top of the coarse aggregate. On the surface of single-layer construction or the top layer of multi-layer construction, the sprinkling and rolling shall be continued and additional screenings applied where necessary until all voids are filled and until a slight wave of grout forms in front of the roller wheels. Brooms attached to the roller, and hand brooms, shall be used to distribute the grout uniformly into the unfilled voids. After the wave of grout has been produced over the entire section of the base course, this portion shall be left to dry. The surface shall be sprinkled and re-rolled as required to bond it thoroughly and to secure a satisfactory surface. The quantity of screenings and water used shall be sufficient to produce a smooth, hard monolithic surface.
8. Maintenance and Traffic. The Contractor shall maintain the completed stone base course until the placement of the surface course. No traffic shall be allowed on the stone base course other than necessary local traffic and that developing from the operation of essential construction equipment. Any defects which may develop in the construction of the stone base course or any damage caused by the operation of local or job traffic shall be immediately repaired or replaced.

C. Crushed Aggregate Base Course - Type B

1. Compaction shall be achieved by means of approved static or vibratory equipment. If static roller is used, base course of more than 8 inches shall be constructed in two lifts. If approved vibratory roller is used, base course up to 10 inches compacted thickness may be constructed in one course.

2. On prepared subgrade (or subbase if required), construct stone subbase of PennDOT 2A coarse aggregate to the compacted depth specified in the "Backfill and Surface Restoration Requirement" Table in Section 02575.
3. Spreading Coarse Material. The aggregate material shall be spread uniformly by approved mechanical stone spreaders to the full width of the base unless otherwise specified for part-width construction. Spreaders shall be adjusted to spread the loose material to obtain a layer of the required depth after compaction. In areas inaccessible to spreading equipment, the material may be spread directly from trucks provided the distribution is equivalent to that achieved by the spreader. All segregated material shall be removed and replaced with well graded material. The aggregate material shall not be spread for a distance of more than an average day's work ahead of compacting.
4. Compacting Coarse Material. Immediately after surface corrections have been made to the spread material, it shall be compacted. The rolling shall begin at the sides and progress to the center, except on superelevated curves where the rolling shall begin on the low side and progress to the high side. The rolling shall be parallel with the centerline of the roadway, uniformly lapping each preceding track, covering the entire surface with the rear wheels and continuing until the material does not creep or wave ahead of the roller wheels. After each layer of material has been spread and compacted, it shall be checked with approved templates and straightedges, and all irregularities shall be satisfactorily corrected. Red flags shall be placed at the limits of satisfactorily compacted material. The flags shall be moved ahead as additional material is compacted.
5. Maintenance and Traffic. The Contractor shall maintain the completed base course until the placement of the surface course. No traffic shall be allowed on the base course other than necessary local traffic and that developing from the operation of essential construction equipment. Any defects which may develop in the construction of the base course or any damage caused by the operation of local or job traffic is the responsibility of the Contractor and shall be immediately repaired or replaced at no expense to the Township.

D. Crushed Aggregate Shoulders

1. As specified in Section 02230, Paragraph 3.02.C.

3.03 FIELD QUALITY CONTROL

A. Surface Tolerance.

After the base course has been completed as specified, the surface smoothness shall be checked with approved templates, string lines, or straightedges.

1. Templates. The Contractor shall furnish and use approved templates of required length and cut to the required crown of the finished surface of the base course, for checking the crown and contour thereof. The templates shall be equipped with metal or other approved vertical extensions attached to each end, so that the bottom of the template will at the elevation of the

top of the aggregate. At least 3 such templates shall be furnished, and used at intervals of not more than 25 feet.

2. String Lines. String lines, for controlling the finished elevation of the proposed base course, shall be furnished with ample supports and offset along each side of the base course, and shall be maintained until all irregularities have been satisfactorily corrected.
3. Straightedges. Approved straightedges 10 feet in length shall also be furnished and used for testing longitudinal irregularities in the surface of the base course.

Any surface irregularities that exceed 1/2 inch shall be remedied by loosening the surface and removing or adding material as required, after which the entire area, including the surrounding surface, shall be rolled until satisfactorily compacted.

B. Tests for Depth of Finished Stone Base Course. During the progress of the work, the depth of the base course may be measured by the Township Engineer and unsatisfactory work shall be repaired, corrected, or replaced. The initial layer of fine material placed as a bed and filler will be measured and considered as part of the base course in determining the compacted depth of the finished base course.

1. The depth will be determined by cutting or digging holes to the full depth of the completed base course. One depth measurement shall be made for each 3000 square yards, or less, of completed stone base course and at other locations the inspector suspects are deficient (reference PennDOT Pub 408 Sections 305.3M BCBC and 401.3M ID-2). Any section in which the depth is 1/2 inch or more deficient in specified depth, shall be satisfactorily corrected.
2. All test holes shall be backfilled with similar material and satisfactorily compacted.
3. Testing operations shall be performed under the observation of the Township Engineer who will check the depth for record purposes.

END OF SECTION

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## SECTION 02312

### CLOSED CIRCUIT TELEVISION INSPECTION OF NEW SANITARY SEWER MAINS AND CONNECTIONS TO EXISTING MAINS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Section Includes: Requirements to execute internal closed circuit television (CCTV) survey to inspect new sanitary sewer mains after installation.

##### 1.02 SUBMITTALS

- A. Submit the following :
  - 1. Sample of television survey log, DVD/CD-ROMs, and equipment list for approval before commencement of work.
  - 2. Submit completed DVD/CD-ROM.

##### 1.03 JOB CONDITIONS

- A. Video must provide coverage of 100% of pipe including pipe connections to manholes, all stub connections, and connections to existing pipes.
- B. Cross reference to Section 02221b Part 1.04.C.5. & 6.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

- A. General:
  - 1. Provide equipment to perform inspections of sanitary sewer mains located in streets, street rights-of-way, and off road easements.
    - a. Including but not limited to portable CCTV equipment, vehicles capable of transporting TV equipment and accessing remote easements, and adequate cleaning equipment.
  - 2. Certify that backup equipment is available and can be delivered to site within 48 hours.
- B. CCTV:
  - 1. Color Video Camera:
    - a. Specifically designed and constructed for this application.
    - b. Camera, Television Monitor, and Other Components: Capable of producing a minimum 700-line resolution color video picture.

- c. Pan and tilt type, capable of turning at right angles to pipe=s axis over an entire vertical circle (minimum pan of 270 degrees and rotation of 360 degrees).
- d. Lighting: Suitable to allow clear picture of entire inner pipe wall extending at least 10 feet in front, including black High Density Polyethylene (HDPE) pipe.
- e. Operative in 100 percent humidity conditions.
- f. Image: Capable of self righting itself.
- g. Include data view display feature capable of showing on tape following information.
  - 1) Lateral addresses.
  - 2) City and state.
  - 3) Date and time.
  - 4) Project name.
  - 5) Developer's name.
  - 6) Inside pipe diameter and type.
  - 7) Manhole identification (upstream manhole to downstream manhole).
  - 8) On-going footage counter accurate within 0.2 foot.
  - 9) Include operator narration, in format approved by Township, using Township approved terminology.
  - 10) Recording of single section of sewer onto 2 DVD/CD-ROMs will not be acceptable.
  - 11) Clearly label each DVD/CD-ROM as approved by the Township.
- h. Mounting:
  - 1) Mounted on tread tractor that moves through sewers.

C. Recording Media:

- 1. CD-ROM.
- 2. Camera, Television Monitor, and Other Components: Capable of producing a minimum 700-line resolution color video picture.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Prior to post-installation survey the new sanitary sewer main must be flushed and cleaned.
- B. Approval must be obtained form the Township before post-installation survey can begin.

### 3.02 POST-INSTALLATION SURVEY

- A. Procedure:
  - 1. CCTV:

- a. Mainline:
  - 1) Before TV inspection work, inspect sanitary sewer line from manhole to manhole, preferably upstream to downstream, one section at a time.
  - 2) Maintain sanitary sewer main isolation by plugging or bypass pumping while camera is moving and recording if depth of flow in sewer requires isolation.
    - a) Plugs: Secured so as to remain in place during inspection.
    - b) Conduct operations to prevent building backups and sewer overflows.
    - c) Be responsible for cleanup, repair, fines, property damage costs and claims for any sewage backup, bypass spillage or sanitary sewer overflow.
2. Placement of camera:
  - a. Manhole:
    - 1) Place at center of manhole and commence video before entering pipe.
    - 2) Start footage counter at center of manhole.
  - b. Mainline: Mount on a transport platform that will keep it centered along longitudinal axis of sewer mainline and above water.
3. Operation of Camera:
  - a. Show inside of manhole walls, manhole channel, and pipe connection to wall at both upstream and downstream manhole and lateral connections.
  - b. Move through line at speed no greater than 30 feet per minute stopping for minimum 10 seconds to record lateral connections, mainline connections, defects, and features and points of interest.
  - c. Maintain technical quality, sharp focus, and distortion free picture.
  - d. Videotape a section of sewer in its entirety with no breaks or interruptions.
  - e. Pan, tilt, and rotate as necessary to best view and evaluate lateral connections, defects, features, and points of interest.
  - f. Use power winches, powered rewinds, tractors, or other devices that do not obstruct camera view or interfere with proper documentation of sewer conditions to move camera through sewer.
    - 1) Whenever non-remote powered and controlled winches are used set up telephones or other suitable means of communication between manholes to insure good communications.
  - g. Use hydraulic jet nozzle if necessary to remove standing water from line.
  - h. Eliminate steam in line for duration of inspection:
    - 1) Utilize blower as needed to defog sewer line.
  - i. Measurement for location of defects and service laterals:
    - 1) At ground level by means of Township's Engineer-approved footage counter or metering device.

- 2) Measurement meters: Accurate to 0.2 foot over length of section being televised.
- 3) Use measuring target in front of television as exact measurement reference point.
- j. Movement of Television Camera:
  - 1) Mainline:
    - a) Stop camera at service connections and inspect lateral with pan and tilt camera.
    - b) At active service connections where flow is discharging.
      - (1) Identify building address and confirm that laterals are active by obtaining flush, with or without dye, of property owner's commode or by using outside cleanout, if available.
      - (2) If no flows are being discharged from building, consider observed flow as infiltration/inflow.
- k. Identification of Defects:
  - 1) If roots, sludge, or sediment material impedes inspection withdraw CCTV equipment and perform inspection from opposite end.
    - a) Extract camera stuck in sewer line.
    - b) When additional obstructions are encountered after re-deployment of equipment, and no means are available for passing obstructions, remand to Township for resolution.

B. Field Documentation:

1. Mainline:
  - a. Submit original records, logs, DVDs, CD-ROMs, and electronic data for sanitary sewer line inspection to Township within 5 working days.
  - b. Include, but not be limited to following information.
    - 1) Project Number.
    - 2) Basin Name.
    - 3) Owner.
    - 4) Date, time (begin to end inspections).
    - 5) Weather condition.
    - 6) Operator name.
    - 7) QA reviewer name.
    - 8) DVD/CD number and index.
    - 9) Address of upper most lateral.
    - 10) Manhole number to manhole number.
    - 11) Manhole depths.
    - 12) Length of pipe segment.
    - 13) Direction of CCTV (Upstream or Downstream).
    - 14) Pipe size.
    - 15) Pipe material.
    - 16) General physical conditions.
    - 17) Footage locations, clock position, descriptions, and estimated leakage rates for visible point sources of infiltration/inflow.
    - 18) Footage locations, clock position, and descriptions for lateral connections and estimated flow from laterals.

- 19) Footage locations, clock position, and descriptions of defects such as obstructions, root intrusion, blockages in pipe, deteriorated joints, offset joints, holes, breaks, cracks, collapses, bends or sags in alignment, or protruding lateral connections.
  - 20) Footage locations, clock position, and descriptions of other defects, features and points of interest found.
  - 21) Whether CCTV was complete or incomplete.
- c. DVD/CD-ROM Recording/Playback:
- 1) At same speed that it was recorded.
  - 2) Supply slow motion or stop motion playback features.
  - 3) Once recorded, DVD/CD-ROM becomes property of the Township.
  - 4) Have DVD/CD-ROM and necessary playback equipment readily accessible for review by Township's Engineer during Project.
- d. Observation terminology utilized during audio narration: Follow the Township approved terminology.
- e. DVD/CD-ROMs displaying poor video quality refers to, but is not limited to grease or debris on lens, camera under water, image too dark, washed-out, distorted, or out of focus, lines improperly cleaned, and poor/no audio.
- 1) Re- televise line if necessary and resubmit DVD/ CD-ROM.

END OF SECTION

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## SECTION 02444

### CHAIN-LINK FENCES AND GATES

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Work of This Section Includes, but is not limited to:
  - 1. Chain-Link Fencing; 6-foot high
  - 2. Zinc-coated (Galvanized) steel fabric
    - a. Top rail, bottom tension wire
    - b. Gates: Size and swing as indicated on the Drawings

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards:
  - 1. American Society for Testing and Materials (ASTM):
    - a. A120 Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless
    - b. A121 Zinc-Coated (Galvanized) Steel Barbed Wire
    - c. A123 Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
    - d. A392 Zinc-Coated Steel Chain-Link Fence Fabric

##### 1.03 SUBMITTALS

- A. Manufacturer's Product Data: Submit manufacturer's latest publications of descriptive literature and product data.
- B. Shop Drawings: Submit shop drawings of fence layout including details of gates, fittings, hardware, and anchoring.
- C. Samples:
  - 1. Fence Fabric: one 12" square
  - 2. Posts and Rails: one 12" length each size
  - 3. Caps, Ties, Hardware: one representative sample each
  - 4. Barbed Wire: one 18" length
- D. Compliance Statement: Submit a Statement of Compliance from the materials supplier(s), together with supporting data, attesting that the products provided meet or exceed specification requirements.

PART 2 - PRODUCTS

2.01 CHAIN-LINK FABRIC

- A. Zinc-Coated (Galvanized) Steel; ASTM A392, Class 1. Hot-dip galvanized after weaving. One-piece full height of fabric.
- B. 2" Diamond Mesh; 9 gage (0.148") wire, 1290 lbf minimum breaking strength
  - 1. Selvages barbed and barbed

2.02 FRAMEWORK

- A. Galvanized Steel Pipe; ASTM A120, Schedule 40. Hot-dip galvanized inside and outside. Provide post caps.
- B. Fence Posts:
  - 1. Corner, Terminal and Pull Posts: 2.875" O.D.
  - 2. Line Posts: 2.375" O.D.
  - 3. Top Rail, Brace Rails: 1.660" O.D.
  - 4. Truss Rods: 0.313" Rod, w/Turnbuckles

C. Gate Posts:

<u>Single Gate</u>	<u>Double Gate</u>	<u>Post Size</u>
Up to 6'	Up to 12'	2.875" O.D.
7' to 12'	13' to 25'	4.000" O.D.
13' to 17'	26' to 35'	6.625" O.D.

2.03 GATES

- A. Framework:
  - 1. 1.660" O.D. galvanized steel pipe, with diagonal truss rods. Provide horizontal center rail on gates over 6' high; vertical center upright on gate leaves over 8' wide.
- B. Hinges: Non-lift-off, 180° swing offset type, of size to accommodate gate frame and post.

2.04 FITTINGS

- A. Rail ends, rail sleeves, tension bars, brace ends, post tops and caps, latch forks, lock keepers, and other appurtenances, including gate hinges and barbed wire support arms:
  - 1. Malleable, pressed or cast steel. Hot-dip galvanized after fabrication, ASTM A123.

## 2.05 TENSION WIRE

- A. #6 gage Galvanized Coil Spring Tension Wire; #9 gage Hog Rings and Tie Wire.

## PART 3 - EXECUTION

### 3.01 INSPECTION

- A. Verify that final grading in fence location is completed without irregularities which would interfere with fence installation. Do not commence work until unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Measure and layout complete fence line; measure parallel to surface of ground.
- B. Locate and mark position of posts. Locate corner posts at each horizontal angle point; locate line posts at equal distant spacing on not more than 10' nor less than 8' centers, unless otherwise indicated on the Drawings.

### 3.03 POST INSTALLATION

- A. Encase posts in concrete to minimum 3' depth. Extend concrete at least 6" below bottom of posts.
  - 1. 10" diameter encasement for line posts,
  - 2. 12" diameter encasement for end, corner, pull and gate posts.

Extend concrete 2" above finished grade, crowned to drain water away from the posts.

- B. Provide corner, end, and pull posts with a horizontal brace and tie rod on each side of the posts, extending and connecting to adjacent line posts.
- C. On fences under 6' high, attach post caps with setscrews.

### 3.04 FABRIC INSTALLATION

- A. Remove slack from fabric by means of mechanical fence stretchers before making attachment to posts.
- B. Cut fabric to form one continuous piece between terminal posts.
- C. Hold bottom of fabric 1" to 2" above finished grade.

- D. Attach fabric to terminal posts with vertical tension bars threaded through fabric and held by tension bands spaced maximum 12" o.c.
- E. Fasten fabric to line posts with #9 gage ties, or by integral fabric lock loops as applicable, at maximum 12" intervals.
- F. Fasten fabric to top rail and intermediate rail with #9 gage ties at maximum 18" intervals.
- G. Fasten fabric to tension wire with hog rings and ties at maximum 18" intervals.

### 3.05 GATES

- A. Install gates of the size and swing as indicated on the Drawings.
- B. Fill gate frame with same fabric as fence.
- C. Attach fabric to gate frame vertical end members with tension bars threaded through fabric and held by tension bands spaced maximum 12" intervals; attach to horizontal rails, center upright, and brace rails with #9 gage ties at maximum 12" intervals.
- D. Provide latch forks, lock keepers, catches, plungerbars and stop holders. Latches and plungerbars operable from either side of gate. Padlock hasp integral part of latch.
- E. Locate gate stops, set in concrete, so that plungerbar fully engages. Adjust hardware to provide smooth operation.

### 3.06 FIELD QUALITY CONTROL

- A. Remove and replace fencing which is improperly located or is not true to line and grade, and posts which are not plumb.
- B. Adjust brace rails and tension rods for rigid installation.
- C. Tighten hardware, fasteners, and accessories.
- D. Remove excess and waste materials from the project site.

END OF SECTION

SECTION 02485

FINISH GRADING, SEEDING, AND SODDING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work of this section includes, but is not limited to:

1. Placing topsoil
2. Soil conditioning
3. Finish grading
4. Seeding
5. Sodding
6. Maintenance

B. Related work specified elsewhere:

1. Clearing and grubbing: Section 02100
2. Trenching, backfilling, & compacting: Sections 02221a&b

C. Definitions: NONE

D. Applicable Standard Details: NONE

1.02 QUALITY ASSURANCE

A. Soil and soil supplement testing shall be performed by a Soils Testing Laboratory engaged and paid for by the Developer and approved by the Township's Engineer.

B. Collect soil samples under the direction of the Township's Engineer.

C. Reference Standards:

1. Pennsylvania Department of Transportation Publication 408 Specifications
2. Pennsylvania Seed Act of 1965, Act 187, as amended
3. Agricultural Liming Materials Act of 1978, P.L.15, No. 9 (3P.S.132-1), as amended
4. Pennsylvania Soil Conditioner and Plant Growth Substance Law, Act of December 1, 1977, P.L. 258, No. 86 (3P.S.68.2), as amended
5. Rules for Testing Seeds of the Association of Official Seed Analysts
6. American Association of State Highway and Transportation Officials: AASHTO Designation T194, Determination of Organic Matter in Soils by Wet Combustion

- D. All materials used in the PennDOT road right-of-way must be from a certified PennDOT supplier.
- 1.03 SUBMITTALS
- A. Soil and seed analysis and/or test reports to the township upon request.
  - B. Documentation of materials or products placed if requested.
  - C. Certificates
    - 1. Prior to use or placement of material, submit a Statement of Compliance from the materials suppliers, together with supporting data, attesting that the composition of the following products meets specification requirements.
      - a. Fertilizer - Analysis content and percent of each.
      - b. Lime - Analysis content and percent of each.
      - c. Seed mixture(s) - State percentage of mixtures, purity, germination and maximum weed seed content of each grass mixture.
    - 2. Submit certified soil sample analyses, including laboratory's recommended soil supplement formulation, topsoil analysis - State pH, texture, organic content, and macro nutrients.

## PART 2 - PRODUCTS

### 2.01 TOPSOIL

- A. Having a pH of between 6.0 and 7.0; containing not less than 2% or more than 10% organic matter as determined by AASHTO T194.
- B. Fertile friable loam, sand loam, or clay loam which will hold a ball when squeezed with the hand, but which will crumble shortly after being released.
- C. Free of clods, grass, roots, or other debris harmful to plant growth.
- D. Free of pests, pest larvae, and matter toxic to plants.

### 2.02 FERTILIZER

- A. Basic Dry Formulation Fertilizer:
  - 1. Analysis 0-20-20 and as defined by the Pennsylvania Soil Conditioner and Plant Growth Substance Law.
- B. Starter Fertilizer:
  - 1. Analysis 10-5-5 or 12-6-6, 12-18-10 or 18-24-10 as defined by the Pennsylvania Soil Conditioner and Plant Growth Substance Law.
- C. Liquid formulations may be used in lieu of dry formulations, provided the rate of

application is adjusted to apply the same quantities of nitrogen, phosphorus, and potassium per unit area as specified for dry formulations.

2.03 LIME

- A. Raw ground limestone conforming to Publication 408 Specifications, Section 804.2(a).

2.04 SEED

- A. Fresh, clean, dated material from the last available crop and within the date period specified, with a date of test not more than 9 months prior to the date of sowing. Percentage of pure seed present shall represent freedom from inert matter and from other seeds distinguishable by their appearance. All seeds will be subject to analysis and testing.
- B. Deliver seed fully tagged and in separate packages according to species or seed mix. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

2.05 EROSION CONTROL FABRIC

- A. Shall be a knitted construction of yarn with uniform openings interwoven with strips of biodegradable paper, furnished in rolls with 4-mil opaque polyethylene base as protection for outdoor storage.
- B. Fabric 0.2 pound per square yard.

2.06 JUTE MATTING

- A. Shall be heavy weight, minimum 0-9 pound per square yard, jute mesh with 1" opening.

2.07 FABRIC/MATTING ANCHORS

- A. Staples for fastening fabric to ground shall be minimum 11 gauge wire, "U" shaped, with a 1" crown and 6" legs.

TABLE 1 - GRASS AND AGRICULTURAL SEEDS

<u>Species</u>	<u>Minimum Guaranteed Purity (Percent)</u>	<u>Maximum Weed Seed (Percent)</u>	<u>Minimum Guaranteed Germination (Percent)</u>
Kentucky Bluegrass ( <i>Poa pratensis</i> ) Domestic origin; min. twenty-one pounds per bushel	90	0.20	80
Perennial Ryegrass ( <i>Lolium perenne</i> , var. Pennfine)	95	0.15	90
Kentucky 31 Fescue ( <i>Festuca elatior arundinacea</i> )	98	0.25	85
Pennlawn Red Fescue ( <i>Festuca rubra</i> , var. Pennlawn)	98	0.25	90
Annual Rye Grass ( <i>Lolium multiflorum</i> )	95	0.15	90
Timothy ( <i>Phleum pratense</i> )	98	0.25	95

2.05 SEED MIXTURES

- A. See "Seeding Restoration Table" at end of this Section.

2.06 INOCULANT

- A. Inoculate leguminous seed before seeding with nitrogen fixing bacteria culture prepared specifically for the species.
- B. Do not use inoculant later than the date indicated by the manufacturer.
- C. Protect inoculated seed from prolonged exposure to sunlight prior to sowing.
- D. Reinoculate seed not sown within 24 hours following initial inoculation.

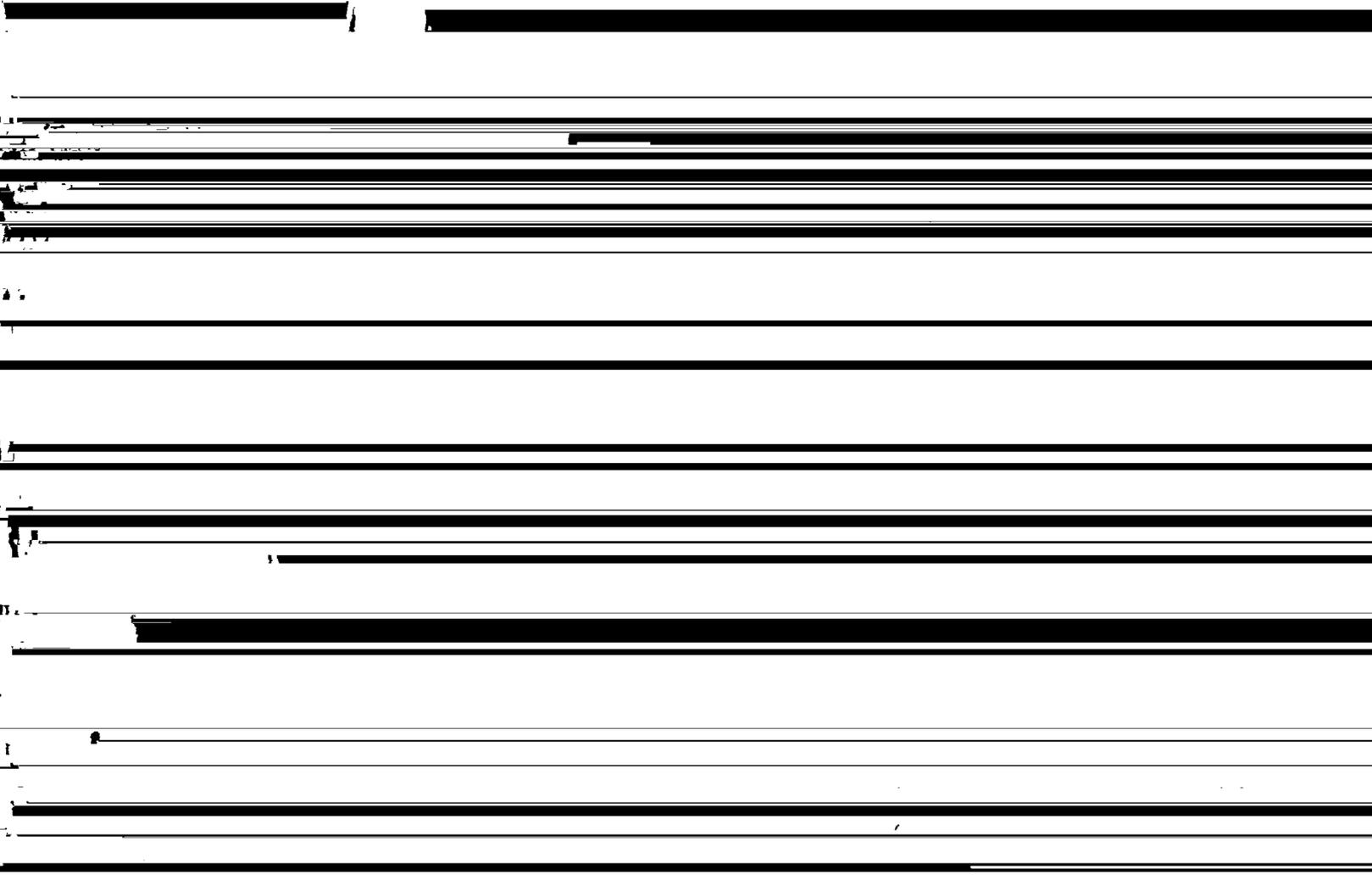
2.07 MULCHING MATERIALS

- A. Mulches for seeded areas shall be one, or a combination of, the following:
  - 1. Hay:
    - a. Cured to less than 20% moisture content by weight.
    - b. Contain no stems of tobacco, soybeans, or other coarse or woody material.
    - c. Timothy hay or mixed clover and timothy hay.
  - 2. Straw:
    - a. Cured to less than 20% moisture content by weight.
    - b. Contain no stems of tobacco, soybeans, or other coarse or woody material.



- E. Deliver sod to the project site within 24 hours after being cut and place sod within 36 hours after being cut. Do not deliver small, irregular, or broken pieces of sod.
- F. During wet weather, allow sod to dry sufficiently to prevent tearing during handling and placing. During dry weather, moisten sod to ensure its vitality and to prevent dropping of the soil during handling. Sod which dries out will be rejected.

PART 3 - EXECUTION



toxic to plant growth.

- b. Organic Matter: 20% minimum
- c. Water-Holding Capacity: 120% minimum
- d. pH: 6.0

B. Mulch Binders:

1. Emulsified Asphalt AASHTO M140, Grade SS-1
2. Cut Back Asphalt AASHTO M81, RC 250
3. Nonasphaltic Emulsion - Natural Vegetable Gum Blended with Gelling and

3. Do not place topsoil when the subgrade is frozen, excessively wet, or extremely dry.
4. Do not handle topsoil when frozen or muddy.

C. Tillage:

1. After seed bed areas have been brought to proper compacted elevation, thoroughly loosen to a minimum depth of 4" by discing, harrowing, or other approved methods. Do not work topsoiled areas when frozen or excessively wet.
2. Liming:
  - a. Distribute lime uniformly at the specified rates.
  - b. Thoroughly incorporate into the topsoil to a depth of 4".
  - c. Incorporate as a part of the tillage operation.
3. Basic Fertilizer:
  - a. Distribute basic fertilizer uniformly at the specified rate.
  - b. Thoroughly incorporate into the topsoil to a depth of 4".
  - c. Incorporate as a part of tillage operation.

D. Finish Grading:

1. Remove unsuitable material larger than ½" in any dimension.
2. Uniformly grade surface to the required contours without the formation of water pockets.
3. Rework areas which puddle by the addition of topsoil and fertilizer and rake.

3.03 SEEDING

- A. Distribute starter fertilizer at the specified rates.
- B. Incorporate starter fertilizer into the upper 1" of soil.
- C. Uniformly sow specified seed mix by use of approved hydraulic seeder, power-drawn drill, power-operated seeder, or hand-operated seeder. Do not seed when winds are over 15 mph.
- D. Upon completion of sowing, cover seed to an average depth of 1/4" by hand raking or approved mechanical methods.
- E. Mulch immediately after seeding, using one of the following methods:

1. Place hay and straw mulch in a continuous blanket at a minimum rate of 1,200 pounds per 1,000 square yards.
  - a. Anchor hay or straw mulch by use of twine, stakes, wire staples, paper, or plastic nets.
  - b. Emulsified asphalt may be used for anchorage provided it is applied uniformly at a rate not less than 31 gallons per 1,000 square yards.
  - c. Chemical mulch binders may be used for anchorage if they are applied uniformly at the manufacturer's recommended rate.
  - d. Chemical mulch binders or a light covering of topsoil may be used for anchorage when the size of the area precludes the use of mechanical equipment.
    1. Apply wood cellulose fiber hydraulically at a rate of 320 pounds per 1,000 square yards. Incorporate as an integral part of the slurry after seed and soil supplements have been thoroughly mixed.
    2. Spread mushroom manure uniformly to a minimum depth of 1/2" or to the depth indicated on the Drawings.
- F. When mulch is applied to grass areas by blowing equipment, the use of cutters in the equipment will be permitted to the extent that a minimum of 95% the mulch is 6" or more in length. For cut mulches applied by the blowing method, achieve a loose depth in place of not less than 2".
- G. When mulching by the asphalt mix method, apply the mulch by blowing. Spray the asphalt binder material into the mulch as it leaves the blower. Apply the binder to the mulch in the proportion of 1.5 to 2.0 gallons per 45 pounds of mulch.
  1. Protect structures, pavements, curbs, and walls to prevent asphalt staining.
  2. Erect warning signs and barricades at intervals of 50 feet or less along the perimeter of the mulched area.
  3. Do not spray asphalt and chemical mulch binders onto any area within 100 feet of a stream or other body of water.
- H. Protect structures, pavements, curbs, and walls to prevent asphalt staining.
- I. Do not spray asphalt and chemical mulch binders onto any area within 100 feet of a stream or other body of water.

### 3.04 SODDING

- A. Prior to sod placement, complete finish grading.
- B. Do not place sod when the temperature is lower than 32°F.

- C. Place sod by hand with tight joints and no overlap. Transverse joints shall be broken or staggered.
- D. Place sod so that the top of the sod is flush with the surrounding grade.
- E. Use of tools which damage the sod or dumping of sod from vehicles will not be permitted.
- F. Water sod to the saturation point immediately after placement.
- G. After watering, tamp with an approved tamper to close all joints and insure close contact between sod and sod bed. After tamping, the sod shall present a smooth, even surface free from bumps and depressions. If so directed, use a light roller, weighing not more than 65 pounds per foot of roller width to complete firming and smoothing the sod.
- H. When placing sod in ditches, place the strip with the long dimension at right angles to the flow of water. At any point where water will start flowing over a sodded area, the upper edge of the sod strips shall be turned into the soil below the adjacent area and a layer of compacted earth placed over this juncture to conduct the water over the edge of the sod.
- I. In ditches and on slope areas, stake each strip of sod securely with at least 1 wood stake for each 2 square feet of sod. Stakes shall be 1/2" by 1" with a length of 8" to 12". Drive stakes flush with the top of the sod, with the long face parallel to the slope contour.

### 3.05 MAINTENANCE

- A. Developer shall be responsible for maintenance of seeded work.
- B. Maintenance includes watering, weeding, two initial mowings, cleanup, edging, and repair of washouts or gullies. The Developer shall be responsible for maintenance until the time of initial mowing. The Developer shall be responsible for the initial mowing.
- C. Keep seeded areas moist to a depth of 3" for a period of 14 days following seeding.
- D. Those areas which do not show a prompt catch of grass within 24 days of seeding shall be reseeded until complete grass catch occurs.
- E. When the grass reaches an average height of 3", cut to a height of 2"; irregularities or depressions which show up at this time shall be leveled and reseeded.
- F. Developer's maintenance shall continue until all areas are grassed and free from bare spots or off-color areas, and turf areas are accepted.

SEE ATTACHED SEEDING RESTORATION TABLE

SEEDING RESTORATION TABLE					
<u>RESTORATION CONDITION</u>	<u>TOPSOIL</u>	<u>LIME</u>	<u>BASIC FERTILIZER</u>	<u>STARTER FERTILIZER</u>	<u>SEED &amp; MIX SOWING RATE (% BY WEIGHT)</u>
Temporary Cover	N/A	N/A	N/A	N/A	100% Annual Ryegrass Sow 9# per 1,000 Sq. Yds. Mar. thru May/Aug. thru Sept.
Roadside; Non-Mowed	Yes	100# per 1,000 Sq. Ft.	No	10-5-5 @ 50# per 1,000 Sq. Td. <u>or</u> 12-6-6 @ 33# per 1,000 Sq. Yd.	80% Kentucky 31, Fescue 20% Pennlawn Red Fescue Sow 21# per 1,000 Sq. Yds. Mar. thru May/Aug thru Sept.
Roadside; Mowed	Yes	100# per 1,000 Sq. Ft.	No	10-5-5 @ 50# per 1,000 Sq. Td. <u>or</u> 12-6-6 @ 33# per 1,000 Sq. Yd.	50% Kentucky Bluegrass 30% Pennlawn Red Fescue 20% Perennial Ryegrass Sow 21# per 1,000 Sq. Yds. Mar. thru May/Aug. thru Sept.
Bank Areas	Yes	100# per 1,000 Sq. Ft.	No	10-5-5 @ 50# per 1,000 Sq. Td. <u>or</u> 12-6-6 @ 33# per 1,000 Sq. Yd.	45% Kentucky 31, Fescue 55% Annual Ryegrass Sow 9# per 1,000 Sq. Yds. Anytime except Sept. & Oct.
Lawns	Yes	100# per 1,000 Sq. Ft.	0-20-20 @ 50# per 1,000 Sq. Yd.	10-5-5 @ 50# per 1,000 Sq. Td. <u>or</u> 12-6-6 @ 33# per 1,000 Sq. Yd.	50% Kentucky Bluegrass 30% Pennlawn Red Fescue 20% Perennial Ryegrass Sow 21# per 1,000 Sq. Yds. Mar. thru May/Aug. thru Sept.
Open Fields; Non-Cultivated, Pasture	No	No	No	10-5-5 @ 50# per 1,000 Sq. Td. <u>or</u> 12-6-6 @ 33# per 1,000 Sq. Yd.	100% Timothy Sow 9# per 1,000 Sq. Yds. Mar. thru May/Aug. thru Sept.
Open Fields; Cultivated	No	No	No	10-5-5 @ 50# per 1,000 Sq. Td. <u>or</u> 12-6-6 @ 33# per 1,000 Sq. Yd.	100% Annual Ryegrass Sow 9# per 1,000 Sq. Yds. Mar. thru May/Aug. thru Sept.
Woods; Sparse	No	No	No	10-5-5 @ 50# per 1,000 Sq. Td. <u>or</u> 12-6-6 @ 33# per 1,000 Sq. Yd.	100% Red Fescue Sow 36# per 1,000 Sq. Yds. Mar. thru May/Aug. thru Sept.
Sodding	Yes	100# per 1,000 Sq. Ft.	0-20-20 @ 50# per 1,000 Sq. Yd.	N/A	N/A

END OF SECTION

SECTION 02500

BITUMINOUS PAVING AND SURFACING

PART I - GENERAL

1.01 DESCRIPTION

A. The work of this section includes, but is not limited to:

1. Bituminous concrete base course construction.
2. Placement and compaction of bituminous binder and wearing surface.
3. Placement of bituminous seal coat and surface treatment.

B. Related work specified elsewhere:

1. Clearing and grubbing: Section 02100
2. Roadway excavation, fill, and compaction: Section 02230

C. Definitions:

Superpave- Superior performing asphalt pavement from a plant-mixed Hot Mix Asphalt (HMA) using a volumetric mixture design developed with the Superpave Gyratory Compactor (SGC).

Marshall Mix- ID-2 mix design used only as approved by the Township Engineer.

D. Applicable Standard Details:

02500-1 Superpave Street Construction Details

02500-2 Marshall Mix Street Construction Details

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. Pennsylvania Department of Transportation:
  - a. Publication 408 Specifications
  - b. Regulations Governing Occupation of Highways by Utilities (67 PA Code, Chapter 459)
  - c. Publication 203, Work Zone Traffic Control
  - d. Publication 27, Specification for Bituminous Mixtures (Bulletin 27)
  - e. Publication 37, Specification for Bituminous Materials (Bulletin 25)

2. American Society for Testing and Materials:
  - a. ASTM D2950, Density of Bituminous Concrete in Place by Nuclear Method.

B. Inspections:

1. Inspection by the Township Engineer will, at a minimum, be made of the subgrade prior to placement of the base course and of the base course prior to placement of the binder surface.

1.03 SUBMITTALS

- A. Provide material analysis for test reports to Township Engineer upon request.
- B. Provide documentation of materials placed to the Inspector on site or as otherwise directed by the Township Engineer.

1.04 JOB CONDITIONS

A. Control of Traffic:

1. Take measures to control traffic during paving operations. Do not allow traffic on newly paved areas until adequate stability and adhesion have been attained and the material has cooled to 140° F or less.
2. Employ traffic control measures in accordance with Publication 203 "Work Zone Traffic Control".
3. Notify Township Police Department at least 72 hours in advance of any operations requiring lane closure or changes to existing traffic patterns.

B. Protection of Adjacent Areas:

1. Restore existing surface outside the limits of the work that has been damaged by the Contractor's operations to its original condition.

PART 2 - PRODUCTS

2.01 BITUMINOUS MATERIALS AND AGGREGATES

- A. Refer to Publication 408 Specifications. All bituminous materials and aggregates used in base course construction, paving, and resurfacing are designated in these specifications by, and shall conform to, the applicable portions of the Publication 408 Specifications for Superpave in Section 409.
- B. If approved by the Township Engineer, Marshall mixes may be used as an alternative measure in accordance with Publication 408 Specifications and as follows.

PART 3 - EXECUTION

3.01 BITUMINOUS CONCRETE BASE COURSES

- A. Where indicated on the Drawings and/or shown in the "Backfill and Surface Restoration Requirements" Table, construct bituminous concrete base course to compacted depth in accordance with Publication 408 Specifications, Section 309 (PG 64-22).
- B. When using the alternative Marshall mixes, use Publication 408 Specifications, Section 350.

3.02 PREPARATION OF EXISTING PAVEMENT SURFACE

- A. Clean street surface of all dust, debris, loose stone, earth, or other deleterious material by means of hand brooms or approved power brooms.
- B. Scarify areas shown on Drawings. Where the existing base is judged inadequate by the Township Engineer, construct new base of the required type as specified in the "Backfill and Surface Restoration Requirements" Table in Section 02575.
- C. Place Superpave in accordance with Publication 408 Specifications, Section 409.3.
  - 1. Patch holes and depressions greater than one inch and less than four inches with 9mm materials, compacted in layers not exceeding two inches after compaction.
  - 2. Holes greater than four inches in depth shall be sawed back to sound pavement, and patched with a minimum of six inches of crushed aggregate base course, five inches of 25mm binder material, and one inch of 9mm.
- D. If using approved Marshall mixes, follow procedure below.
  - 1. Patch holes and depressions greater than one inch and less than four inches with ID-2 material, compacted in layers not exceeding two inches after compaction.
  - 2. Holes greater than four inches in depth shall be sawed back to sound pavement, and patched with a minimum of six inches of crushed aggregate base course and two inches of ID-2 material.
- E. When required by the Township Engineer, apply EM 50 tack coat in accordance with Publication 408 Specifications, Section 460.

3.03 SURFACE COURSES

- A. Construct Superpave course in accordance with Publication 408 Specifications. Use PG 64-22.
- B. Bituminous Surface Course ID-2 (Alternative Marshall Mix)
  - 1. Construct binder course meeting the requirements of Publication 408

Specifications, Section 421 to compacted depth specified in the "Backfill and Surface Restoration Requirements" Table.

2. Construct wearing surface meeting the requirements of Publication 408 Specifications, Section 420 to the compacted depth specified in the "Backfill and Surface Restoration Requirements" Table.

C. Bituminous Seal Coat (single application)

1. Construct bituminous seal coat in accordance with Publication 408 Specifications, Section 470.

D. Bituminous Surface Treatment (double application)

1. Construct bituminous surface treatment in accordance with Publication 408 Specifications, Section 480.

3.04 JOINTS

- A. For Superpave joints, place in accordance with Publication 408 Specifications, Section 409.3(k).

B. Notch

If using the Marshall mixes approved as an alternative by the Township Engineer, the edge of the overlay shall be saw cut to a depth of 1-1/2" for the entire length of the joint and the detached material removed to a minimum notch width of six". A cold planer may be used. The vertical face must be painted with E-6, E-8 or the same asphalt material used in mix design (Publication 408, Section 401.2(J)).

C. Sealing

If using the Marshall mixes approved as an alternative by the Township Engineer, all joints to be sealed with hot bituminous material using AC-20. When wearing course is placed adjacent to curb to form bituminous gutter, seal with hot bituminous material of the class and type designated for wearing course and extend to 12 inches from the curb, applied evenly. The use of Class E-6 or E-8 may be permitted in place of hot bituminous material (Publication 408, Section 401.3(G),(J)).

3.05 FIELD QUALITY CONTROL

- A. Quality control shall in accordance with Publication 408 Specifications, Section 409.

B. Surface Tolerance of Base Course – Alternative Marshall mixes.

After the base course has been completed as specified, the surface contour shall be checked with approved templates, string lines, or straightedges.

1. Templates. The Contractor shall furnish and use approved templates of required length and cut to the required crown of the finished surface of the base course, for checking the crown and contour thereof. The templates

shall be equipped with metal or other approved vertical extensions attached to each end, so that the bottom of the template will be at the elevation of the top of the aggregate. At least 3 such templates shall be furnished, and used at intervals of not more than 25 feet.

2. String Lines. String lines, for controlling the finished elevation of the base course, shall be furnished with ample supports and offset along each side of the base course, and shall be maintained until all irregularities have been satisfactorily corrected.
3. Straightedges. Approved straightedges 10 feet in length shall also be furnished and used for testing longitudinal irregularities in the surface of the base course.
4. Any surface irregularities that exceed 1 inch shall be remedied by removing or adding bituminous material as required, after which the entire area, including the surrounding surface, shall be rolled until satisfactorily compacted.

C. Tests for Depth of Finished Base Course for Superpave shall be in accordance with Publication 408 Specifications, Section 309.

D. Tests for Depth of Finished Base Course for alternative Marshall mixes.

During the progress of the work, the depth of the base course may be measured by the Township Engineer and unsatisfactory work shall be repaired, corrected, or replaced.

1. The depth will be determined by cutting or digging holes to the full depth of the completed base course. One depth measurement shall be made for each 3000 square yards, or less, of completed base course and at other locations the inspector suspects are deficient. Any section in which the depth is 1/2 inch or more deficient in specified depth, shall be satisfactorily corrected.
2. All test holes shall be backfilled with similar material, satisfactorily compacted, and sealed.
3. This operation shall be performed under the observation of the Township Engineer who will check the depth for record purposes.

E. Surface Tolerance of Wearing Course for Superpave shall be in accordance with Publication 408 Specifications, Section 409.3 (I).

F. Tests for Surface Tolerance of Wearing for alternative Marshall mixes.

After the wearing course has been completed as specified, the surface contour shall be checked with straightedges.

1. Straightedges. Approved straightedges 10 feet in length shall be furnished and used for testing longitudinal irregularities in the surface of the wearing course.
2. Any surface irregularities that exceed 3/16 inch shall be remedied by

removing or adding wearing material as required, after which the entire area, including the surrounding surface, shall be rolled until satisfactorily compacted.

- G. Tests for Depth of Finished Wearing Course for Superpave shall be in accordance with Publication 408 Specifications, Section 409.3(m).
- H. Tests for Depth of Finished Wearing Course for alternative Marshall mixes.

During the progress of the work, the depth of the wearing course will be measured by the Township Engineer and unsatisfactory work shall be repaired, corrected, or replaced.

1. The depth will be determined by cutting or digging holes to the full depth of the completed wearing course. Test holes to be excavated by the Contractor. One depth measurement shall be made for each 3000 square yards of completed wearing course and at other locations which the inspector suspects are deficient. Any section in which the depth is 1/4 inch or more deficient in specified depth, shall be satisfactorily corrected.
  2. All test holes shall be backfilled with similar material, satisfactorily compacted, and sealed.
  3. This operation shall be performed under the observation of the Township Engineer who will check the depth for record purposes.
- I. Cross reference PENNDOT 408 Sections: 401.3M ID2; 305.3.M BCBC

END OF SECTION

SECTION 02525

CEMENT CONCRETE CURB & SIDEWALK

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work of this section includes, but is not limited to:

1. Subgrade preparation
2. Construction of cement concrete curb and sidewalk

B. Related work specified elsewhere:

- |  |                   |
|--|-------------------|
| 1. Trenching, backfilling, and compaction:   | Sections 02221a&b |
| 2. Finish grading, seeding, and sodding:     | Section 02485     |
| 3. Bituminous paving and surfacing:          | Section 02500     |
| 4. Trench paving and restoration:            | Section 02575     |
| 5. Plain and reinforced cement concrete:     | Section 03000     |
| 6. Cement concrete for utility construction: | Section 03300     |

B. Definitions: NONE

C. Applicable Standard Details:

- 02525-1 Concrete Sidewalk Detail
- 02525-2 Standard Concrete Curb Detail

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. Pennsylvania Department of Transportation (for work in state highways)
  - a. Publication 408 Specifications
  - b. Publication 203, Work Zone Traffic Control
  - c. Publication 72M, RC-64M, Curbs and Gutters, Sheet 1 of 1
  - d. Publication 72M, RC-67M, Curbs, Ramps, and Sidewalks, Sheets 1 thru 13 of 13
2. American Society for Testing and Materials (ASTM) [See Section 03000 for all applicable ASTM Standards]

3. American Concrete Institute (ACI) See Section 03000 for all applicable ACI Standards]

B. Inspections:

1. Inspection by the Township Engineer will at a minimum be made of the subgrade, formwork, and any steel prior to placement of the concrete.

C. Testing:

1. As specified in Section 03000, Part 3.11.

1.03 SUBMITTALS

- A. Provide material analysis for test reports and/or material tickets to Township Engineer upon request.

- B. Provide documentation of materials placed to the Inspector on site or as otherwise directed by the Township Engineer.

1.04 JOB CONDITIONS

A. Control of traffic:

1. Take measures to control traffic during concreting operations. Do not allow traffic on newly placed concrete until adequate strength has been attained.
2. Employ traffic control measures in accordance with Publication 203, Work Zone Traffic Control.
3. Notify Township Police Department at least 72 hours in advance of any operations requiring changes to existing traffic patterns.

B. Protection of adjacent areas:

1. Restore existing surfaces outside the limits of the work that have been damaged by the Contractor's operations to their original or better condition.

C. Coordination with utilities:

1. Coordinate all necessary adjustments of existing utilities to accommodate this work.
2. Provide access to the site for utility work.

PART 2 - PRODUCTS

2.01 CONCRETE

- A. As specified in Section 03000, Parts 2.01 and 3.01.

- B. For slip formed curb, same as 2.01.A except with a maximum slump of 1-1/2".

- C. For replacement of curb and sidewalk at existing active driveways, use air-entrained, PA DOT Class HES (High Early Strength).

## 2.02 FORMS

### A. General requirements:

1. Cross reference as specified in Section 03000, Part 3.02.
2. Forms shall be dimensioned equal to or greater than the finished product dimensions (2x4 nominal lumber is not acceptable for 4" thick sidewalks).
3. Forms shall be coated with a form release agent just prior to placement of concrete.

### B. Straight curbing (or radius greater than 40 feet):

1. Approved metal forms.
2. Wood forms, not less than 2 inch nominal thickness, planed on finish side.

### C. Radius curbing:

1. Approved metal forms.
2. Fabricated plywood, hardboard forms, or polyforms.

### D. Machine-placed curbing:

1. Straight or radius curbing may be placed with a self-propelled machine approved by the Township Engineer.
2. Excess material shall be immediately removed to leave the curbing at full dimensions per specifications.
3. Voids, gouges, and honeycombs will be promptly filled while curbing is still fresh and workable.
4. The specified finish will extend 4" beyond the ultimate exposure limits.

## 2.03 REINFORCEMENT

- A. As specified in Section 03000, Part 2.02.

## 2.04 JOINT MATERIAL

- A. Joint Filler - Premolded expansion joint material shall be fiber joint filler conforming to ASTM D994 for curbing.
- B. Joint Filler - Premolded expansion joint material shall conform to ASTM D994 or D4819 for sidewalks.

2.05 FORM COATING MATERIALS

- A. As specified in Section 03000, Part 2.04.

2.06 CONCRETE CURING COMPOUNDS

- A. As specified in Section 03000, Part 2.05.

PART 3 - EXECUTION

3.01 CURB CONSTRUCTION (As set forth in PennDOT RC-64M)

- A. Excavate to required depth, remove and dispose of material, and compact the subgrade material to a firm, even surface.
- B. Exposed edges of existing work shall be smooth and square.
- C. Forms shall be placed as appropriate to the type of curbing on 2 sides (front and back).
- D. Forms shall be securely braced to limit deflection during placement of concrete.
- E. Provide openings through curb for drainage pipes. Install one, 2'-0" long, #4 reinforcing bar in the middle of curb centered above the pipe with a minimum of one inch of concrete cover.
- F. Concrete shall be placed in accordance with Section 03000, Part 3.06.C.
- G. Variation of more than 1/8" from the established line and grade shall be cause for rejection of that portion of the work.
- H. Form or saw contraction joints 3/16" wide and 2" deep at 10-foot maximum intervals on 2 sides (front and top). Saw as soon as possible after the concrete has set sufficiently to preclude raveling during the sawing and before any shrinkage cracking occurs in the concrete, but in no case later than 24 hours following placement of the material.
- I. Provide 1/2" full size expansion joints at 60-foot intervals, at the end of each pour, and at the beginning and end of all radii. 1/2" full size expansion joint material shall also separate curb from adjacent sidewalks, poles, hydrants, walls and other permanent structures.
- J. Unless otherwise approved by the Township Engineer, the last three feet of curb shall be tapered to a 1-1/2" reveal with expansion joint at the beginning of taper.
- K. Finish top surface with magnesium or wood floats. Provide depressions for drainage, driveways, and accessible ramps as directed by the Township Engineer.
- L. Tool all exposed edges to the specified radius.
- M. Do not remove forms until concrete has set.

- N. Begin proper curing in accordance with Section 03000, Part 3.10, immediately after form removal.
  - O. Correct minor irregularities with a carborundum stone or mortar comprised of two parts fine aggregate to one part cement.
  - P. For slip formed curb, uniformly feed the concrete to the machine so the concrete maintains the shape of the section, without slumping after extrusion. Voids or honeycomb on any surface of the finished curb will not be allowed. Immediately after extrusion, perform any additional surface finishing required.
- 3.02 SIDEWALK CONSTRUCTION (As set forth in PennDOT RC-67M)
- A. Cross reference Section 03000-5, Part 3.02 Formwork for acceptable form materials and methods of use.
  - B. Excavate to required depth, remove and dispose of material, and compact the subgrade material to a firm, even surface.
  - C. Exposed edges of existing work shall be smooth and square.
  - D. Construct accessible ramps where directed by the Township Engineer.
    - 1. Ramp runs must be held to a maximum 1:12 (1" in 12") slope in the direction of travel with a maximum cross slope of 2% (1/4" per foot) and terminate at a level landing.
    - 2. Pedestrian areas requiring a change in direction of travel must be level and of an appropriate size to comply with ADA and PENNDOT standards.
  - E. Spread aggregate and compact to the thickness shown on the Standard Details.
  - F. Concrete shall be placed in accordance with Section 03000, Part 3.06.C.
  - G. Score contraction joints at 5-foot intervals to sufficient depth to insure cracking at the joint.
  - H. Provide 1/4" expansion joint at 20-foot intervals and at the end of each pour. Provide 1/2" expansion joint material to separate adjacent curb, poles, hydrants, walls, and other permanent structures.
    - 1. Tool a light radius at expansion materials to prevent flaking. Feathering over expansion joint is not acceptable.
    - 2. Expansion material must extend the full thickness and plan dimension of the concrete placement.
  - I. Apply light broom finish as specified in Section 03000, Part 3.09.G.4.
  - J. Provide depressions for driveways, downspouts, and drainage as directed by the Township Engineer.

- K. Begin proper curing in accordance with Section 03000, Part 3.10, immediately following form removal.

3.03 BACKFILLING AND RESTORATION

- A. Temporary backfill at curbs shall consist of select granular material per Section 02221a, Part 2.01.A, front and back, to within 8" of top of curb.
- B. Restore adjacent areas as indicated in the Backfill and Surface Restoration Requirements Table.

END OF SECTION

SECTION 02575

TRENCH PAVING AND RESTORATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work of this section includes, but is not limited to:

1. Temporary trench paving
2. Permanent trench paving
3. Shoulder restoration
4. Driveway restoration

B. Related work specified elsewhere:

- |  |                   |
|--|-------------------|
| 1. Trenching, backfilling, and compacting: | Sections 02221a&b |
| 2. Bituminous paving and surfacing:        | Section 02500     |
| 3. Plain and reinforced cement concrete:   | Section 03000     |
| 4. Concrete for utility construction       | Section 03300     |

C. Definitions: NONE

D. Applicable Standard Details:

02575-1 Trench Repaving Details  
Backfill and Surface Restoration Requirements Table

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. Pennsylvania Department of Transportation:
  - a. Publication 408 Specifications
  - b. Regulations Governing Occupation of Highways by Utilities (67 PA Code, Chapter 459)
  - c. Publication 203, Work Zone Traffic Control
  - d. Publication 27, Specification for Bituminous Mixtures (Bulletin 27)
  - e. Publication 37, Specification for Bituminous Materials (Bulletin 25)

- f. Publication 41, List of Commercial Producers of Bituminous Mixtures (Bulletin 41)
    - g. Publication 213, Work Zone Traffic Control
  - 2. American Society for Testing and Materials:
    - a. ASTM D1950, Density of Bituminous Concrete in Place by Nuclear Method.
- B. Inspections:
  - 1. Inspection by the Township Engineer will, at a minimum, be made of the subgrade prior to placement of the base course, and of the base course prior to placement of the binder surface.
- C. Use only materials which are furnished by a bulk bituminous concrete producer regularly engaged in production of hot-mix, hot-laid bituminous concrete and as listed in PennDOT Bulletin 41, List of Commercial Producers of Bituminous Mixtures.
- D. All materials used in the PennDOT Road right-of-way must be from a certified PennDOT supplier.

#### 1.03 SUBMITTALS

- A. Provide material analysis for test reports to Township Engineer upon request.
- B. Provide documentation of materials placed to the Inspector on site or as otherwise directed by the Township Engineer.
- C. Submit a Statement of Compliance, together with supporting data, from bituminous and aggregate suppliers attesting that the materials provided conform to the State and Township specifications.
- D. Submit batch tickets for each load of bituminous concrete delivered to the project site.

#### 1.04 JOB CONDITIONS

- A. Control of Traffic:
  - 1. Take measures to control traffic during paving operations. Do not allow traffic on newly paved areas until adequate stability and adhesion have been attained and the material has cooled to 140° F or less.
  - 2. Employ traffic control measures in accordance with Publication 203 "Work Zone Traffic Control".
  - 3. Notify Township Police Department at least 72 hours in advance of any operations requiring changes to existing traffic patterns.

B. Protection of Adjacent Areas:

1. Restore existing surface outside the limits of the work that has been damaged by the Contractor's operations, to its original or better condition.

C. Weather Limitations:

1. Construct bituminous base courses only when the air and surface temperature is above 35 degrees F and when base is dry.
2. Construct binder and wearing courses only when the air and surface temperature is above 40 degrees F and when base is dry.
3. Aggregate base courses may be placed when the air temperature is above 35 degrees F and rising. Do not place aggregate base course material on soft, muddy or frozen areas.

D. Do not allow traffic on repaved areas until authorized by the Township.

1.05 TESTING

A. Thickness Testing:

1. Obtain a minimum of one 6" diameter core sample for each 200 linear feet of permanent paving, or fraction thereof, for test of depth of bituminous material courses.
2. Take core samples at locations as directed by the Township after final compaction rolling.
3. Bituminous concrete courses deficient more than 1/4" from the specified depth in any one sample, or uniformly more than 1/8" in three or more samples, shall be removed and replaced to the correct depth.
4. Refill and compact test holes with material acceptable to, and under the direction of, the Township.

B. Surface Smoothness:

1. Test finished surface of each bituminous concrete course for smoothness using 10' straightedge applied parallel with, and at right angles to, centerline of paved area.
2. Surfaces will not be acceptable if exceeding 1/4" tolerance for smoothness.
3. Check surfaces areas at intervals as directed by the Township.
4. Ponding to a depth of 1/4" over a 20 square foot area shall be corrected as directed by the Township.

C. Density Testing:

1. Acceptance will be based on the results of nuclear density tests performed

by a licensed nuclear gage operator, employed by an independent testing laboratory paid by the Contractor, and witnessed by the Township.

- a. Use one of the following nuclear gages or equal:
    - 1) Troxler electronics, Model 3411B
    - 2) Campbell Pacific Nuclear, Model MC-2
    - 3) Seaman Nuclear, Model MC-2
  - b. Use nuclear gage calibrated in accordance with AASHTO test method T-238-86. Submit certification of annual calibration of gages and documentation of licensed operator=s training to the Township. Recalibrate any gage which is damaged and/or repaired.
2. A minimum of three (3) tests per each 1,000 square yards or portion thereof meeting the requirement below will be required for each course.
- a. Binder and Wearing Courses >=92 percent of Theoretical Density
  - b. Bituminous Base Course >=88 percent of Theoretical Density

## PART 2 - PRODUCTS

### 2.01 CONCRETE

- A. As specified in Section 03000, Parts 2.01 and 3.01. and Section 03310.
- B. For active driveway restoration, use air-entrained, PennDOT Class HES (High Early Strength).

### 2.02 BITUMINOUS MATERIALS AND AGGREGATES

- A. Refer to Publication 408 Specifications. All bituminous materials and aggregates used in base course construction, paving, and resurfacing are designated in these specifications by, and shall conform to, the applicable portions of the Publication 408 Specifications for Superpave in Section 409.

### 2.03 EXCAVATABLE FLOWABLE FILL

- A. Consisting of the following on a per cubic yard basis: W/C ratio 2.380, 94 lbs cement, 2,314 lbs fine aggregate, and 26.9 gals water.
- B. Mix design meets PennDOT Publication 408 specifications (latest edition) for flowable fill.

## PART 3 - EXECUTION

### 3.01 TEMPORARY TRENCH PAVING

- A. Place temporary paving immediately upon completion of trench backfilling. Unpaved trenches shall not remain unpaved longer than two (2) working days

after backfilling, nor over weekends and holidays.

- B. Shape and compact subgrade material, then place and compact base course to the required thickness.
- C. Place temporary paving material. Compact to required minimum thickness with trench roller having a minimum 300 pounds pressure per inch-width of compaction.
- D. Continuously maintain temporary paving.
- E. Temporary paving on roads must remain in place for a minimum of 90 days.
- F. Continuously maintain temporary paving to the satisfaction of the township Engineer as required by permit requirements, and the state and township road departments.

### 3.02 PERMANENT TRENCH PAVING

- A. Commence final repaving work only upon written instructions from the Township.
- B. For Bituminous Surface Course (Trench) Types 1, 2a, and 2b, saw existing paving in accordance with 67 PA Code, Chapter 459. Remove temporary paving material.
- C. For Bituminous Surface Course (Trench) Type 3, trim existing paving to remove damaged areas. Cut straight joint lines and right angle offsets.
- D. Construct permanent base and surface courses to the required compacted thicknesses shown in the "Backfill and Surface Restoration Requirements" Table, Detail 02575-1 and in accordance with Publication 408 Specifications for Superpave, Sections 309 and 409.
- E. Apply AC-20 joint sealer to cut edges of bituminous paving
- F. Maintain permanent paving throughout the maintenance period to the satisfaction of the township and state road departments.

### 3.03 BITUMINOUS OVERLAY

- A. See Section 02500

### 3.04 SHOULDER RESTORATION

- A. Restore shoulders in accordance with the "Backfill and Surface Restoration Requirements" Table.

### 3.05 DRIVEWAYS

- A. Trim concrete and bituminous driveway surfaces to remove damaged areas. Saw or cut straight joint lines parallel to the centerline of the trench. Cut offsets at right angles to the trench centerline.

- B. Restore existing concrete driveways with a 6" layer of concrete reinforced with WWF 6 x 6 - W2.9 x W2.9 (6 ga.) wire mesh, placed 2" from top surface. See Section 03000.
- C. Restore existing bituminous driveways in kind; minimum 1½" layer wearing course over 6" layer of select granular material (2RC).
- D. Restore earth driveways with a 6" layer of select granular material (2RC).
- E. Restore stone or gravel driveways in kind; minimum 6" layer of select granular material (2RC).
- F. Restore brick driveways with like bricks placed on a 4" thick wet sand bed. Place bricks in like pattern and spacing.

**BACKFILL AND SURFACE RESTORATION REQUIREMENTS TABLE**

Surface Class	Type Backfill	% (1) Compaction	Temp. Base	Temp. Surface	Final Base	Final Surface	Standard Details
Vegetative	S.2230 (2.01)	95%	--	(2)	--	(2)	---
Stone	S.2230 (2.01)	95%	6" Thick Type B S.2230(c)	--	--	--	---
Standard Superpave (overlay)	--	--	--	--	--	1 ½" Thick 9.5mm Wearing	
Standard Superpave (new)	PA DOT #2RC 8" Thick	95%	--	--	3" Thick 25 mm Base	1 ½" Thick 9.5mm Wearing 2" Thick 19mm Binder	2500-1
Alternate 2 Bituminous Surface Course ID-2 (Overlay)	--	--	--	--		1 ½" thick ID-2 S.2500 (3.03A2)	---
Alternate 1 Ballast Base Bituminous Surface Course ID-2 (New)	S.2230 (2.01)	95%	--	--	8" Thick Type A S.2230 (3.02B)	3" Thick Binder Course, 1 ½ " Thick Wearing Surface S.2500 (3.03A)	2500-2
Alternate 2 RC Base Bituminous Surface Course ID-2 (New)	S.2230(2.01)	95%	--	--	4" Thick PA DOT #2RC S.2230 (3.02A) 5" Thick BCBC S.2500 (3.01)	1 ½ " Thick Wearing Surface S.2500 (3.03A)	2500-2
Superpave Trench Repair	Flowable Fill S.2575(2.03)		--	--	5" Thick 25mm Base	1 ½ " Thick 9.5mm Wearing Surface S.2500 (3.03A.2)	2575-1

END OF SECTION

SECTION 02601a

MANHOLES

(For Sanitary Sewer Manholes, see Section 02601b)

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work of this section includes, but is not limited to:

1. Precast concrete manholes
2. Cast-in-place manhole bases
3. Manhole Steps
4. Manhole Covers and Frames

B. Related Work Specified Elsewhere

- |  |                   |
|--|-------------------|
| 1. Trenching, backfilling, and compacting: | Sections 02221a&b |
| 2. Sanitary sewer pipe:                    | Section 02610     |
| 3. Sewer and manhole testing:              | Section 02651     |
| 4. Plain and reinforced cement concrete:   | Section 03000     |
| 5. Concrete for utility construction:      | Section 03300     |

C. Definitions: NONE

D. Applicable Standard Details:

- |          |   |
|----------|---|
| 02601-1  | Cast-in Place Manhole Base                            |
| 02601-2  | Plans of Manhole Bases                                |
| 02601-3  | Terminal Manhole Type I Base                          |
| 02601-4  | Standard Shallow Manhole                              |
| 02601-5  | Standard Deep Manhole                                 |
| 02601-6  | Precast Manholes Typical all Joints                   |
| 02601-7  | Aluminum Manhole Step                                 |
| 02601-8  | Groundwater Height Indicator                          |
| 02601-9  | Heavy Traffic Sanitary Sewer<br>Manhole Frame & Cover |
| 02601-10 | PVC Pipe Type A Drop Manhole                          |
| 02601-11 | PVC Pipe Type B Drop Manhole                          |
| 02601-12 | Watertight Manhole Frame and Cover                    |

1.02 INSPECTIONS

A. Contractors/owners shall be responsible to notify the Township Engineer or designated representative 48 hours (two business days) in advance of all required inspections.

- B. Inspections of the manholes by the Township Engineer will, at a minimum, be made of materials upon delivery to the job site; of the subgrade, prior to manhole base construction or placement; and of the completed manhole, prior to backfill.
- C. Inspections of the frame and covers by the Township Engineer will be made upon delivery to the job site; and of the completed installation, prior to backfill.
- D. A final inspection of the manhole channels, steps, frames and covers, and all joints will be performed upon completion of all testing, roadway restoration, and/or seeding.
- E. Manholes shall be subject to rejection for failure to conform with these specifications or if any one of the following conditions is noted:
  - 1. Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
  - 2. Defects that indicate incorrect proportioning, mixing, and molding.
  - 3. Surface defects larger than 1/2" diameter indicating honey-combed or open texture.
  - 4. Damaged or cracked ends, where such damage would prevent making a satisfactory joint.
  - 5. Divots or spalling more than 1/4" deep or greater than 3" in any surface dimension that indicates improper handling or storage.

1.03 PRODUCTS DELIVERY, STORAGE AND HANDLING

- A. Precast Concrete Units:
  - 1. After fabrication and curing, transport the manhole and components to the job site. Protect until required for installation.
  - 2. Handle to avoid damage to surfaces, edges and corners and to avoid creation of stresses within the units.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Crushed Stone Subbase:
  - 1. Size 2B, Type C, Section 703.3, Publication 408 Specifications
- B. Masonry Mortar: ASTM C270, Type S
- C. Cement Concrete: Section 03300, Part 2.01

## 2.02 MANHOLES

### A. Precast Concrete Manhole Sections:

1. Conforming to ASTM C478, with 5.5%  $\pm$  1% air-entrained cement concrete.
2. Eccentric cone or flat slab top sections as indicated on the Drawings; minimum 24" access opening.
3. Precast riser sections of length to suit.
4. Poured concrete bases only.

### B. Manhole Steps:

1. Aluminum: Alloy 6061-T6
2. Sanitary Sewer requires 1/2" steel reinforced copolymer polypropylene meeting ASTM C478 (and others)

### C. Manhole Frames and Covers:

1. Cast iron castings: ASTM A48, Class 30 or better; free of bubbles, sand and air holes, and other imperfections.
2. Contact surfaces machined and matched. Lateral clearance between frame and cover shall not exceed a total of 1/4". Rocking of the cover is unacceptable.
3. Cast cover inscription with pipeline service and Township name.
4. All frames and covers shall be capable of withstanding an AASHTO HS-25 loading and shall have a minimum 22" clear opening.

### D. Joint Sealant Compound: FS SS-S-00210, performed, flexible, self-adhering, cold-applied meeting ASTM C990.

### E. Resilient Pipe-to-Manhole Connection: ASTM C923.

### F. Concrete Adjusting Rings: Precast cement concrete grade adjustment rings shall be cast from 5000 psi concrete (28-day compressive strength), shall be a maximum of 2" thick, and shall be reinforced with a minimum of two 1/4" diameter wires or steel bars.

### G. Manhole Inserts (where required):

1. Inserts shall be stainless SS tetherlock model Rainstopper, or
2. High density polyethylene copolymer meeting ASTM D1248, CL A, CAT 5, Type III.

## PART 3 - EXECUTION

### 3.01 EXCAVATION

- A. Perform excavation to the line and grade indicated on the Drawings and as specified in Section 02221a.
- B. Location and depth of manholes as indicated on the Drawings.

### 3.02 CONSTRUCTION

- A. Construct watertight manholes of precast concrete sections of the type indicated on the Drawings. Construct 4' diameter manholes unless otherwise indicated.
- B. Construct drop connections of the required type as indicated on Standard Detail 02601-10 or 02601-11.
  - 1. Encase drop connection in concrete.
  - 2. Upper pipe must be flush with inside wall of manhole.
- C. Install a minimum of 4" of crushed stone subbase.
- D. Provide cast-in-place concrete bases.
  - 1. Construct cast-in-place bases as indicated on Standard Details 02601-1 or 02601-3.
    - a. Provide concrete to support the full length of the pipe section cast into the base.
    - b. Cast-in-place bases may be constructed with a special form for a joint to match the manhole cylinder sections.
- E. Form flow channels in manhole bases as indicated on Standard Detail 02601-2. Slope channels uniformly from influent invert to effluent invert; minimum 1" drop. Construct bends of the largest possible radius. Form channel sides and invert smooth and uniform; free of cracks, holes or protrusions.
- F. Do not permit pipe to project more than 2" into the manhole.
- G. Seal joints between precast concrete manhole sections with joint sealant compound as indicated on Standard Detail 02601-6.
  - 1. Apply joint sealant compound in accordance with instructions of the manufacturer. Place compound on the interior and exterior sides of the joint to be squeezed out by the weight of the upper section.
  - 2. Trowel sealant compound smooth with manhole interior while still pliable.
  - 3. Face-off all interior joints with water plug.
- H. Install manhole sections with steps in proper vertical alignment with frame, lid, and each other.

- I. Use precast manhole rings to achieve elevation indicated for frame and cover.
  - 1. Do not adjust elevation more than 4 inches with 2- 2 inch precast rings. Seal joints between precast rings with joint sealant compound per 3.02 G 1-3 above.
  - 2. Cast-in-place MH riser adjustment rings may be permitted only with written approval by the Township Engineer of the design and method of forming details submitted.
  - 3. Frame flange and cone surface will be properly treated with a bonding or sealing agent approved by the Township Engineer.
  
- J. Install manhole frames and covers.
  - 1. Set top of frames at finished grade elevation or other elevation indicated on the Drawings.
  - 2. Seal joints between manhole frame and manhole with joint sealant compound per 3.02 G 1-3 above.
  - 3. Face-off interior and exterior frame joint with water plug.
  
- K. Where new manholes are to be constructed on existing pipelines, carefully excavate around existing pipeline for placement of the new manhole base. Take all measures necessary to control flow through the existing pipeline and to prevent leakage into the new base. After completion of the manhole, carefully remove the top portion of the existing pipeline to within two (2) inches of manhole walls and aligned with completed bench to create the flow channel.

3.03 BACKFILLING

- A. Backfill only after complete examination of the manhole by the Township Engineer or Township Engineer Inspector.
  
- B. Perform backfilling as specified in Section 02221. Place backfill in approximately equal lifts on opposite sides of manhole to equalize opposing horizontal pressures.

END OF SECTION

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## SECTION 02601b

### SANITARY SEWER MANHOLES (For All Other Manholes, See Section 02601a)

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Work of this section includes, but is not limited to:
  - 1. Precast Concrete Manholes
  - 2. Concrete Manhole Bases
  - 3. Manhole Steps
  - 4. Manhole Covers and Frames
  
- B. Related Work specified elsewhere:
  - 1. Sections 02221a&b - Trenching, Backfilling, & Compacting
  - 2. Section 02610 - Sanitary Sewer Pipe
  - 3. Section 02651 - Sewer and Manhole Testing
  - 4. Section 03300 - Concrete for Utility Construction
  
- C. Applicable Standard Details:
  - 1. 5100G Precast Manhole Base Detail
  - 2. 5106 Standard Shallow Precast Manhole
  - 3. 5107 Standard Deep Precast Manhole
  - 4. 5109A Manhole Cover with Anchor Bolt
  - 5. 5110C Manhole Step Details
  - 6. 5115 Heavy Duty Watertight Manhole Frame and Cover with Gasket in Frame
  - 7. 5119A Type A Drop Manhole Details, PVC Pipe
  - 8. 5120A Type B Drop Manhole Details, PVC Pipe
  - 9. 5122 Precast Concrete Doghouse Manhole
  - 10. 5123 Precast Concrete Doghouse Manhole – Invert Section View

##### 1.02 QUALITY ASSURANCE

- A. Pennsylvania Department of Transportation (PennDOT):
  - 1. Publication 408/2007 Specifications.
  
- B. American Society for Testing and Materials (ASTM):
  - 1. A496 Specifications for Steel Wire, Deformed, for Concrete Reinforcement
  - 2. C270 Specifications for Mortar for Unit Masonry
  - 3. C478 Specifications for Precast Reinforced Concrete Manhole Sections
  - 4. C497 Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile

5. D1248 Standard Specification for Polyethylene Plastics
  6. D448 Standard Sizes of Coarse Aggregate for Highway Construction
  7. D4101 Specification for Propylene Plastic Injection and Extrusion Materials
- C. American Association of State Highway Transportation Officials (AASHTO):
1. AASHTO M306-05 Standard Specification for Drainage, Utility, and Related Castings.
- D. Federal Country-of-Origin Marking Law:
1. United States Federal Law requires that imported castings (manhole frame and covers) are subject to specific country-of-origin markings in order to legally enter the United States.

### 1.03 SUBMITTALS

- A. Submit shop drawings and certification from material suppliers attesting that materials meet or exceed AASHTO M306-05 requirements.
- B. Shop Drawings:
1. Submit detailed shop drawings of manhole sections and precast bases.
  2. Submit detailed shop drawings of manhole frames and covers.
  3. Submit detailed shop drawings of manhole steps.
- C. Submit manufacturers' descriptive literature and installation instructions for the resilient pipe-to-manhole connection and for the joint sealant compound.
- D. Submit certification that material was manufactured in the United States of America.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Crushed Stone Subbase: ASTM D448, Size 57(PennDOT 2B) (AASHTO M-43) or Select Granular Material (PennDOT 2RC), Section 703.3 Publication 408/2007.
- B. Masonry Mortar: ASTM C270, Type S
- C. Cement Concrete: Section 03300

## 2.02 MANHOLES

- A. Precast Concrete Manhole Sections:
1. Conforming to ASTM C478, with 5.5%  $\pm$  1% air-entrained cement concrete.
  2. Provide flat slab top sections for manholes less than 4' deep or as indicated on Contract Drawings.
  3. Provide eccentric cone sections for manholes greater than 4' in depth, except as indicated on Contract Drawings.
  4. Provide 22" minimum access opening.
  5. Precast riser sections of length to suit.
  6. Precast bases of a design similar to the precast riser sections. Base to be integral with first riser section, minimum height of riser - 24".
- B. Exterior Coating:
1. Factory applied bitumastic coating to manhole exterior.
  2. Prepare surface for coating application in accordance with coating manufacturer's instructions.
  3. Apply coating to minimum 20-mil dry film thickness.
- C. Manhole Steps:
1. Steel reinforced copolymer polypropylene meeting the following specifications:
    - a. ASTM C478
    - b. ASTM C497, Method of test
    - c. ASTM D4101, PP0344B33534Z02 copolymer polypropylene
    - d. ASTM A496, D20, 1/2" reinforced rod
- D. Manhole Frames and Covers:
1. Frames and covers shall adhere to specifications for AASHTO Designation M306-05.
  2. Casting shall be free of bubbles, sand and air holes, and other imperfections.
  3. Castings shall be perfectly round and not deformed.
  4. Lateral clearance between frame and cover shall not exceed a total of 1/4 inch.
  5. Contact surfaces machined and matched. No "rocking" shall be acceptable.
  6. Cast cover inscription with "Sanitary Sewer" and "Springettsbury Township", if intended for a sewer system to be dedicated to the Township. This shall be as required by the Township.
  7. Cast cover inscription with "Sanitary Sewer" only if not intended for a sewer system to be dedicated to the Township. This shall be as required by the Township.
  8. 22" minimum clear access opening.

9. Frames shall be compatible in all ways with East Jordan Iron Works 1119Z frames, covers shall be compatible in all ways with East Jordan Iron Works 1120AGS. If necessary, these same frames and covers come in a watertight configuration.
10. Frames and covers not meeting these criteria will be immediately rejected.
11. Certification that frames and covers are made in the USA will be required.
12. East Jordan Iron Works as shown in Standard Detail 5115.
13. Watertight assembly required:
  - a. Bolt cover to frame with 4 1/2"-13 stainless steel hex bolts, with stainless steel washer and neoprene washer.

E. Manhole Inserts:

1. Manhole inserts shall be either stainless steel Tetherlock Model Rainstopper as manufactured by Southwestern Packing and Seals, Shreveport, LA, Telephone (318)687-4330, or equal.
2. High density polyethylene copolymer meeting ASTM designation D1248, Class A, Category 5, Type III. Inserts shall be a uniform 1/8 inch in thickness with a 1-inch wide polypropylene lifting handle attached with a wide head 3/16 inch SS rivet with a 3/4" stainless steel backup washer as supplied by Contractor Specialties and Supply Company, or equal.

F. Joint Sealant: ASTM C990.

G. Resilient Pipe-to-Manhole Connection: ASTM C923.

## PART 3 - EXECUTION

### 3.01 EXCAVATION

- A. Perform excavation to the line and grade indicated on the Contract Drawings and as specified in Section 02221b - Trenching, Backfilling, and Compacting.
- B. Location and depth of manholes as indicated on the Drawings.

### 3.02 CONSTRUCTION

- A. Construct watertight manholes of precast concrete sections of the type indicated on the Contract Drawings.
- B. Construct 4' diameter manholes unless otherwise indicated.
- C. Construct drop connections of the required type as indicated on Standard Details 5119A and 5120A. Encase drop connection in concrete. Inside drops are not acceptable.
- D. Provide precast concrete bases.

1. Install precast bases as shown on Standard Detail 5100G.
  - a. Set the precast base on 6" crushed stone subbase.
  - b. Provide a sealed, flexible resilient connection between pipe and precast base section. Normally this will be precast into manhole. If boring use link seal or Township approved equal.

E. Flow Channels:

1. Form flow channels in manhole bases as indicated on the Standard Details.
2. Slope channels uniformly from influent invert to effluent invert, minimum 1" drop.
3. Construct bends of the largest possible radius. Form channel sides and invert smooth and uniform; free of cracks, holes or protrusions.
4. Bench shall slope 1-inch per foot from the outer wall to the lip of the flow channel.
5. Bench and flow channels must have a smooth finish.
6. Flow channel must be the same diameter as the influent or effluent pipe, whichever is larger.
7. The flow channel must be opened to  $\frac{1}{2}$  of the pipe diameter.
8. Gap between pipe and precast manhole must be filled with grout over rubber sleeve.

- F. Do not permit pipe to project more than 2" into the manhole. Influent and effluent pipe inverts and sides must be smoothly grouted in the flow channel and manhole with no offsets or "shoulders".

G. Joint Sealant:

1. Seal joints between precast concrete manhole sections with two (2) rows of joint sealant compound.
2. Apply joint sealant compound in accordance with instructions of the manufacturer. Place compound on the interior and exterior sides of the joint to be squeezed out by the weight of the upper section.
3. Excess sealant must be cut flush with the face of the manhole and removed. Do not pull excess to remove.
4. Do not apply rigid mortar to the joints between manhole sections.

- H. Install manhole sections with steps in proper vertical alignment.

I. Precast Manhole Rings:

1. Use precast manhole rings to achieve elevation indicated for frame and cover. Steel grade adjustment rings are not acceptable for new construction.
2. Do not adjust elevation more than 1 ft. with precast rings.
3. Seal joints between precast rings with joint sealant compound.

- J. Install Manhole Frames and Covers:
  - 1. Set top of frames 1/8 inch below finished grade elevation or other elevation indicated on the Drawings.
  - 2. Manholes Located in Non-paved Areas:
    - a. Top of frame to be a minimum of 18 inches above finished grade elevation.
    - b. Manhole frame to be bolted to cone with four (4) stainless steel bolts as shown in Standard Detail 5109A.
  - 3. Seal joint between manhole frame and manhole with joint sealant compound.
  - 4. After firmly seating manhole frame and cover into the joint sealant and vacuum testing, neatly trowel a minimum of 3 inches of mortar over the flange unless under paved roadway.
  
- K. Where new manholes are to be constructed on existing pipelines, carefully excavate around existing pipeline for placement of the new manhole base; take all measures necessary to control flow through the existing pipeline and to prevent leakage into the new base; after completion of the manhole, carefully remove the top portion of the existing pipeline to its centerline. See Standard Details 5122 and 5123.

### 3.03 CONNECTIONS OF SEWER MAINS TO EXISTING MANHOLES

- A. Connections to existing manholes shall be made carefully and as shown in Standard Detail 5121; excavating down on the outside of the manhole without causing damage to the manhole. Core drill an opening into the manhole, insert a sealed, flexible resilient connection for the new pipe entering the manhole; once the connection is complete, perform a vacuum test as specified in Section 02651 on the existing manhole and provide by-pass pumping if required to do the testing. If the vacuum test fails, do necessary repairs and retest. Backfill around manhole in accordance with Section 02221b - Trenching, Backfilling, and Compaction.
  
- B. Flow channels must be designed to create sound hydraulics, and the flow channels must be approved by the Township.

### 3.04 BACKFILLING

- A. Test manhole as specified in Section 02651 prior to backfilling.
  
- B. Perform backfilling as specified in Section 02221b - Trenching, Backfilling and Compacting.
  
- C. Place backfill in approximately equal lifts on opposite sides of manhole to equalize opposing horizontal pressures.

END OF SECTION

## SECTION 02602

### GRINDER PUMPING STATIONS (SERVICING INDIVIDUAL PROPERTIES)

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Work of this section includes, but is not limited to, sewage grinder pumping stations with sump, piping, controls, and all appurtenances for a complete installation.
- B. Township does not allow individual lot grinder pumps. Special approval must be obtained from the Township for the installation of individual lot grinder pumps.
  - 1. When special approval is granted, the homeowner is responsible to own, maintain, and replace when required.
  - 2. When special approval is obtained for the use of an individual lot grinder pump for new construction, the grinder pump must be located in the basement of the new dwelling. The installation of the grinder pump must comply with Springettsbury Township Building and Plumbing Codes.
  - 3. An exterior grinder pump can be used when special approval is obtained for the use of an individual lot grinder pump for the retrofit of an existing dwelling and only if it is not feasible to locate the grinder pump in the basement as approved by the Township.
- C. Related Work specified elsewhere:
  - 1. Section 02220 - Earthwork
  - 2. Section 02221b - Trenching, Backfilling & Compacting
  - 3. Section 02601b - Sanitary Sewer Manholes
  - 4. Section 02610 - Sanitary Sewer Pipe
  - 5. Section 03300 - Concrete for Utility Construction
  - 6. Section 03400 - Precast Concrete Structures

##### 1.02 QUALITY ASSURANCE

- A. Design Criteria: The Developer shall provide the following to the Township for approval:
  - 1. Capacity: Head and rpm.
  - 2. Electrical characteristics.
  - 3. Pump discharge size.
  - 4. All electrical equipment installed in a wet well must be UL approved to meet the requirements for use in Class I, Group D, Division 1 locations as

defined in Article 500, "Hazardous Locations", of the National Electric Code (NEC) of the National Fire Protection Association (NFPA).

- B. The grinder pumping station shall have sufficient weight to counteract the buoyancy uplift from ground water that is at a level equal to the top of the structures with a factor of safety of 1.5. Provide calculations demonstrating this requirement is being met.

### 1.03 SUBMITTALS

- A. Shop Drawings and Product Data:
  - 1. Submit detailed installation shop drawings for basin assembly, pumps, piping, controls and accessories including wiring schematics.
  - 2. Submit manufacturer's latest published literature for all materials specified under this Section.
- B. Provide 6 copies of instruction manuals, including maintenance schedule, overhaul procedures and parts lists, for each pumping station.
- C. Maintenance Material (Spare Parts):
  - 1. Provide one complete set of manufacturer's recommended spare parts for each pump, including pump seals, bearings, bushings, gaskets, and cutter assembly.
  - 2. Provide 100% spare fuses, 100% spare pilot light and alarm light lamps, one spare motor starter coil, and one spare control transformer for each pumping station control panel.
  - 3. Package each part individually or in sets in moistureproof containers or wrappings, clearly labeled with part name and manufacturer's part/stock number.

## PART 2 - PRODUCTS

### 2.01 GENERAL DESCRIPTION:

- A. Each station consisting of one submersible sewage grinder pumps, mercury switch level controls, discharge piping, check valves with hydraulically sealed discharge flanges, gate valves, pump mounting plate with bottom rail supports, pump lifting chains, basin cover plate, basin, pump control panel, and other necessary appurtenances.

### 2.02 GRINDER PUMPS

- A. Cast iron casing.
- B. Bronze or cast iron semi-open type impeller.

- C. Grinder Assembly:
  - 1. Primary and secondary cutter rings of hardened stainless steel.
  - 2. Cutters capable of being reversed to provide sharp unused cutting edges when original edges become dull.
  - 3. Cutter assembly removable without dismantling pump.

## 2.03 PUMP MOTORS

- A. Sealed Submersible.
- B. Open windings operating in dielectric oil.
- C. Non-overloading throughout the entire range of the pump curve.
- D. Two carbon/ceramic mechanical shaft seals with oil chamber between seals.
- E. Mount an electrode between seals to detect water leaking into seal chamber and actuate a light on the control panel.
- F. Integral stainless steel motor and pump shaft.
- G. Upper and lower ball bearings to support rotor; lower bronze sleeve or ball bearing to take radial loads from impeller; minimum ball bearing B-10 life of 15,000 hours.
- H. Stainless steel fasteners.
- I. Protect motor with a heat sensor thermostat to stop motor if overloaded; thermostat to reset automatically when temperature drops to a safe level.
- J. Motor leads potted in epoxy compound to form leakproof seal.

## 2.04 PUMP DISCHARGE PIPING

- A. 1-1/4" diameter threaded galvanized steel, ASTM A120 seamless; Schedule 40 unless otherwise indicated on the Drawings.
- B. Provide a check valve with hydraulically sealed quick disconnect discharge flange, and a gate valve with stem extension in each pump discharge line.

## 2.05 SUMP BASIN

- A. Fiberglass Reinforced Polyester:
  - 1. Circumferential filament wound poly laminate construction of polyester resin reinforced with glass fiber capable of withstanding twice the loads

developed by placement at the depth indicated on the Drawings; bottom of the basin integrally sealed into basin wall.

2. Anti-flotation ring formed as an integral part of basin structure.

B. Basin inside diameter and height as indicated on the Drawings.

C. Steel basin cover and hinged hatch plate; epoxy coated.

D. Access ladder or steps as indicated.

E. Cast iron inlet hub, sized and compatible with gravity sewer influent pipe, attached to basin with rubber gaskets and stainless steel bolts.

#### 2.06 APPURTENANCES

A. Pump Guide Rails: Stainless steel pipe

B. Pump Mounting Plates and Guide Rail Braces: Stainless Steel

C. Guide Rail Supports: Stainless Steel

D. Pump Lifting Chains: Stainless Steel

E. Fasteners and Hardware: Stainless Steel

#### 2.07 LIQUID LEVEL CONTROLS

A. Sealed float-type mercury switches to control sump liquid level and signal alarm.

B. Suspended mercury tube switches sealed in shock-resistant solid polyurethane float.

C. Heavy neoprene-jacketed weighted cords suspended from a NEMA-4 junction box or wiring channel, level setting adjustable from top of basin.

D. Simplex Stations: Three switches required; one for pump start, one for low-level pump stop, and one for high-level alarm.

#### 2.08 OPERATION OF LIQUID LEVEL CONTROL (SIMPLEX STATIONS)

A. On rise of sump liquid level, the low-level pump stop switch energizes first.

B. As sump liquid level increases, the pump-start switch starts the pump.

- C. With pump running, sump liquid level decreases to the low-level pump-stop setting.
- D. If the sump liquid level continues to rise with pump in operation, alarm switch energizes the alarm signal when liquid level reaches high-level setting.

## 2.09 CONTROL PANEL

- A. NEMA-3R stainless steel weatherproof enclosure, stand-mounted on top of the basin cover; provide with hasp and all-bronze padlock keyed to Owner's master keying system.
- B. H/O/A switch and run indication light for each pump.
- C. Circuit breaker and magnetic starter with overload protection for each pump. Reset buttons.
- D. Control circuits wired completely separate from power circuits.
- E. Control circuit and alarm transformers; terminal strips for controls, pumps, and alarms; circuit lightning protection.

## 2.10 VISUAL AND AUDIBLE ALARMS

- A. Separate NEMA-3R stainless steel enclosure mounted at control box.
- B. Lights glow dim except become bright and flashing under alarm conditions.
- C. Audible alarm silencing button.
- D. Automatic reset.

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. Erect shop fabricated assemblies on the site in accordance with manufacturer's instructions.
- B. Provide necessary piping, fittings, and valves as indicated on the Drawings.
- C. Provide cast-in-place concrete anti-flotation collar around pump basin or anchor basin to concrete pad, as indicated on the Drawings for exterior installation.

### 3.02 START-UP

- A. Upon completion of erection, examine, adjust and test each unit for proper operation under the direction of the manufacturer's field engineer.
- B. Check and adjust liquid level control and alarm settings.

### 3.03 TESTING

- A. Test each pumping station with clean water through minimum of four complete cycles including high-level and low-level conditions to demonstrate correct sequence of pump operation, pump control settings, alarm settings, freedom from pump vibration, noise and overheating.
- B. Demonstrate provision for pump removal and replacement.

END OF SECTION

SECTION 02603

STORM INLETS, CATCH BASINS, ENDWALLS

PART 1 – GENERAL

1.01 DESCRIPTION

A. The work of this section includes, but is not limited to:

1. Storm drainage inlets
2. Storm drainage catch basins
3. Storm drainage pipe endwalls
4. Pipe culvert end sections

B. Related work specified elsewhere:

1. Trenching, backfilling, and compacting: Sections 02221a&b
2. Finish grading, seeding, and sodding: Section 02485
3. Bituminous paving and surfacing: Section 02500
4. Manholes: Section 02601
5. Storm drain pipe: Section 02618
6. Plain and reinforced concrete: Section 03000
7. Concrete for utility construction: Section 03300

C. Definitions: NONE

D. Applicable Standard Details: NONE

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. Pennsylvania Department of Transportation:

Publication 408 Specifications  
Publication 72, Standards for Roadway Construction

2. American Society for Testing and Materials (ASTM):

A36 Specifications for Structural Steel  
A47 Specifications for Malleable Iron Castings  
A48 Specifications for Gray Iron Casting  
A185 Standard Specification for Welded Steel Wire Fabric for  
Concrete Reinforcement  
A536 Specifications for Ductile Iron Castings  
A615 Standard Specification for Deformed and Plain Billet-Steel Bars

- B221 for Concrete Reinforcement  
Aluminum-Alloy Extruded Bars, Rods, Shapes, and Tubes (Alloy 6061-T6)
- C32 Specifications for Sewer and Manhole Brick
- C270 Specifications for Mortar for Unit Masonry

3. American Association of State Highway and Transportation Officials (AASHTO)

1.03 SUBMITTALS

- A. Provide material analysis for test reports to Township Engineer upon request.
- B. Provide documentation of materials placed to the Inspector on site or as otherwise directed by the Township Engineer.

1.04 JOB CONDITIONS - Section Not Used

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Precast Concrete Units:

- 1. After fabrication and curing, transport the units to the job site. Protect until required for installation.
- 2. Handle and store to avoid damage to surfaces, edges and corners and to avoid creation of stresses within the units.

B. Inspections

- 1. Inspection by the Township Engineer will, at a minimum, be made of materials upon delivery to the job site; of the subgrade, prior to construction or placement; and of the completed structure, prior to backfill.
- 2. Precast cement concrete products shall be subject to rejection for failure to conform with these specifications or if any one of the following conditions is noted:
  - a. Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
  - b. Defects that indicate incorrect proportioning, mixing, and molding.
  - c. Surface defects larger than 1/2" diameter indicating honey-combed or open texture.
  - d. Damaged or cracked ends, where such damage would prevent making a satisfactory joint.
  - e. Divots or spalling more than 1/4" deep or greater than three (3) inches in any surface dimension that indicates improper handling and storage.

3. Concrete Testing (For Cast-In-Place Work): Section 03000, Part 3.11.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Crushed Stone Subbase:
  1. AASHTO No. 57, Type C, Crushed Stone or Gravel aggregate, Section 703.2, Publication 408 Specifications. Do not use slag or cinders.
- B. Brick: ASTM C32 Grade SS, solid.
- C. Masonry Mortar: ASTM C270, Type S.
- D. Malleable Iron Castings: ASTM A47, Grade 35018, Domestic.
- E. Ductile Iron Castings: ASTM A536, Grade 60-40-18, Domestic.
- F. Structural Grade Carbon Steel: ASTM A36.
- G. Cast-in-Place Cement Concrete: Section 03300, Part 2.01.

### 2.02 FABRICATIONS

- A. Precast Cement Concrete Units:
  1. Comply with the requirements of Section 713.2(d), Publication 408 Specifications.
  2. Comply with the requirements of Publication 72.
  3. Minimum reinforcing WWF 6 x 6-W2.9 x W2.9 (6 ga.) wire mesh, placed 1" from each surface.
  4. 6' inlets shall be similar in all respects to standard inlets except that the longitudinal dimension shall be increased by 24".
- B. Pipe Culvert End Sections:
- C. Comply with the requirements of Standard Drawing RC-33M, Publication 72.
- D. Inlet Grates:
  1. No opening dimension greater than 6" per SALDO §289-38.F, 2" in bicycle lane or walking path. Grates shall not be located within 24" of accessible curb ramps or driveways.
  2. Comply with the requirements of Standard Drawing RC-34M, Publication 72, PennDOT approved diagonal only.
  3. 6' inlet grates shall be similar in all respects to standard inlet grates except that the longitudinal dimension shall be increased by 24".

- E. Precast Cement Concrete Grade Adjustment Risers: Risers shall be cast from 5000 psi concrete (28-day compressive strength), shall be a maximum of 2" thick, and shall be reinforced with a minimum of 2-1/4" diameter wires or steel bars.
- F. Cast-in-place. Concrete grade adjustment risers may be permitted only with written approval by the Township Engineer of the design and method of forming details submitted.

### PART 3 - EXECUTION

#### 3.01 EXCAVATION

- A. Excavate as specified in Section 02221a, Part 3.04.
- B. Excavate at location marked in the field.
- C. Excavate to the required depth and grade for the bottom of the unit plus that excavation necessary for placement of base material.

#### 3.02 CONSTRUCTION

- A. Construct inlets and catch basins of either precast cement concrete sections or of cast-in-place cement concrete, and of the type indicated on the Drawings.
  - 1. Place precast units on a minimum 12" compacted crushed stone base.
  - 2. Construct cast-in-place units on undisturbed earth.
  - 3. Shape bottom of inlet boxes to channel flow of water to the outlet pipe and to prevent water from standing in box.
  - 4. Unless units are cast in place, use precast cement concrete grade adjustment risers or solid concrete brick to adjust to grade. Mortar in place with full mortar bed and tool joints.
  - 5. Weep holes for under road drainage must be maintained.
- B. Construct endwalls to the dimensions and design indicated on Standard Drawing RC-31M, Publication 72, and of the type shown on the Drawings. Construct endwalls of monolithically cast reinforced concrete.
- C. Do not permit pipes to project more than 2" into structures. Do not expose end of pipe through faces of endwalls.
- D. Where indicated on the Drawings, provide pipe culvert end sections of the design and dimensions of Standard Drawing RC-33M, Publication 72.

#### 3.03 BACKFILLING

- A. Backfill structures only after inspection by the Township Engineer.
- B. Perform backfilling and compaction as specified in Section 02221a, Part 3.07.

3.04 DISPOSAL OF EXCAVATED MATERIAL: Section 02210, Part 3.09.

3.05 RESTORATION OF SURFACE AREAS

A. Restore paved areas in accordance with Section 02575.

B. Restore unpaved surfaces as specified in Section 02221a, Part 3.08.

END OF SECTION

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## SECTION 02610

### SANITARY SEWER PIPE

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Work of this section includes, but is not limited to:
  - 1. Sanitary sewer gravity pipelines
  - 2. Sanitary sewer pressure pipelines
  - 3. Laterals/service connections
  
- B. Related Work specified elsewhere:
  - 1. Sections 02221a&b - Trenching, Backfilling and Compacting
  - 2. Section 02601b - Sanitary Sewer Manholes
  - 3. Section 02651 - Sewer and Manhole Testing
  
- C. Applicable Standard Details:
  - 1. 5176B RC Pipe Load Table
  - 1. 5177 Pipe Bedding Details
  - 2. 5178A Pipe Trench Detail
  - 3. 5179 Concrete Cradle and Encasement Details
  - 4. 5180 Vertical Water Main Clearance
  - 5. 5180A Stream Crossing Detail
  - 6. 5187 Lateral Detail
  - 7. 5187A Sloped Riser Lateral Detail
  - 8. 5187B Vertical Riser Lateral Detail

##### 1.02 QUALITY ASSURANCE

- A. Reference Standards:
  - 1. American National Standards Institute (ANSI):
    - a. ANSI/AWWA C104/A21.4 Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water
    - b. ANSI/AWWA C110/A21.10 Ductile-Iron and Gray-Iron Fittings, 3" through 48", for Water and Other Liquids
    - c. ANSI/AWWA C111/A21.11 Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
    - d. ANSI/AWWA C151/A21.51 Ductile-Iron Pipe Centrifugally Cast
  - 2. American Society for Testing and Materials (ASTM):
    - a. ASTM C14 Concrete Sewer, Storm Drain and Culvert Pipe
    - b. ASTM C76 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

- c. ASTM C443 Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets
  - d. ASTM D1784 Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
  - e. ASTM D2241 Poly(Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR-Series)
  - f. ASTM D3034 Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
  - g. ASTM D3212 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
  - h. ASTM F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
  - i. ASTM F679 Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
3. American Water Works Association (AWWA):
- a. C301 Prestressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids

- B. Materials contaminated with gasoline, lubricating oil, liquid or gaseous fuel, aromatic compounds, paint solvent, paint thinner, acid solder, or degraded or discolored by exposure to ultraviolet light will be rejected. PVC pipe which is bent as to cause "ponding" in the pipe once it is laid will be rejected.

### 1.03 SUBMITTALS

- A. Submit each manufacturer's certification and shop drawings attesting that the pipe, pipe fittings, joints, joint gaskets and lubricants meet or exceed specification requirements.

### 1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Do not place materials on private property without written permission of the property owner.
- B. During loading, transporting and unloading, exercise care to prevent damage to materials.
- C. Do not drop pipe or fittings.
- D. Avoid shock or damage at all times.
- E. Take measures to prevent damage to the exterior surface or internal lining of the pipe.
- F. Do not stack pipe higher than recommended by the pipe manufacturer.

- G. Store gaskets for mechanical and push-on joints in a cool, dry location out of direct sunlight and not in contact with petroleum products. PVC pipe degraded by exposure to the sun will not be accepted.

## PART 2 - PRODUCTS

### 2.01 CONCRETE SEWER PIPE

- A. Reinforced Gravity Sewer Pipe and Fittings: ASTM C76, Reinforced Concrete Culvert, Storm Drain and Sewer Pipe Minimum Class II, Class II, III, IV, or V, Wall A, B or C.
- B. Provide in load class indicated in RC Pipe Load Table, Standard Detail 5176B.
- C. Non-reinforced Gravity Sewer Pipe for Sizes 4" to 36": ASTM C14, Concrete Sewer, Storm Drain and Culvert Pipe Minimum Class II, Class II or III.
- D. Joints: Tongue and groove, or bell and spigot.
- E. Gaskets: Solid circular cross-section O-ring, ASTM C443. Joints for circular concrete sewer and culvert pipe, using rubber gaskets.
- F. Prestressed Concrete Pressure Pipe and Fittings: AWWA C301, prestressed concrete pressure pipe – steel cylinder type for water and other liquids.
- G. Provide in the internal design pressure rating for the live and dead loads.

### 2.02 DUCTILE-IRON PIPE

- A. Pipe, ANSI/AWWA C151/A21.51, 350 psi; standard cement mortar lining, ANSI/AWWA C104/A21.4, outside coated.
- B. Ductile Iron Fittings:
  - 1. ANSI/AWWA C110/A21.10, 350 psi pressure rating.
  - 2. Fitting to be cement mortar lined and outside coated as for ductile iron pipe.
- C. Joints (ANSI/AWWA C111/A21.11): Where not specifically indicated on the Drawings, joints may be either mechanical joint or push-on joint.
- D. Rubber Gaskets, Lubricants, Glands, Bolts and Nuts: ANSI/AWWA C111/A21.11.

### 2.03 ACRYLONITRILE-BUTADIENE-STYRENE (ABS) SEWER PIPE

- A. Gravity Sewer Truss Pipe and Fittings: ASTM D2680, push-on joints.

B. Gravity Sewer Solid-Wall Pipe and Fittings: ASTM D2751, SDR-35, push-on joints

C. Gaskets for Elastomeric Joints: ASTM F477.

#### 2.04 POLYVINYL CHLORIDE (PVC) SEWER PIPE

A. Gravity Sewer Pipe and Fittings:

1. 4" to 15" Nominal Pipe Size: ASTM D3034, SDR-35; Material - ASTM D1784, 12454-B

2. 18" to 27" Nominal Pipe Size: ASTM F679

3. Where depth of pipe is greater than 14', ASTM D2241, SDR-26 is required.

4. Flexible Elastomeric Seals: ASTM D3212

5. Seal Material: ASTM F477

#### 2.05 RIP RAP STONE

A. Field stone or rough hewn quarry stone of approximate rectangular shape, hard and angular, and of such quality that it will not disintegrate on exposure to water or weathering.

B. 9" minimum thickness, measured perpendicular to face, with no face dimension less than the thickness of the stone.

C. Not less than 70% of the individual pieces weighing minimum of 150 lbs; not more than 10% of the individual pieces weighing less than 100 lbs.

#### 2.06 DETECTABLE UNDERGROUND UTILITY MARKING TAPE

A. See Section 02221.

#### 2.07 FLEXIBLE COUPLINGS

A. Elastomeric plastic sleeve resistant to chemicals and normal sewer gases leakproof and rootproof; positive seal against infiltration and exfiltration; stainless steel clamp bands.

B. Manufacturer: Fernco, Davison Michigan, or equal.

#### 2.08 SERVICE SADDLES

A. Where the use of service saddles is approved by the Township, PVC saddle "Y" fittings of the gasket and steel band type, not cement-on-type, must be used. Service saddles will not be approved for use on vitrified clay or transite pipe. Repair couplings must be used to install service wyes into PVC pipe.

Properly sized Fernco or equivalent sleeves will be used to insert service wyes into vitrified clay or asbestos cement pipe.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Perform trench excavation to the line and grade indicated on the Contract Drawings and as specified in Section 02221 - Trenching, Backfilling and Compacting.
- B. Unless otherwise indicated on the Contract Drawings, provide for a minimum cover of 4 feet above the top of piping laid in trenches.
- C. Provide pipe bedding as specified in Section 02221 - Trenching, Backfilling and Compacting for each type of pipe used.
- D. Provide Type IV pipe bedding for all pipe.
- E. Place aggregate in a manner to avoid segregation, and compact to the maximum practical density so that the pipe can be laid to the required tolerances.
- F. Install detectable utility marking tape above all plastic pipeline, 12" to 18" below final grade.

### 3.02 LAYING PIPE IN TRENCHES

- A. Give 48 hours (two (2) business days) notice to the Township in advance of pipe laying operations.
- B. Use laser alignment instruments.
- C. Lower pipe into trench using handling equipment designed for the purpose to assure safety of personnel and to avoid damage to pipe. Do not drop pipe.
- D. Lay pipe proceeding upgrade with the bell or groove pointing upstream.
- E. Lay pipe to a true uniform line with the barrel of the pipe resting solidly in pipe bedding material throughout its entire length.
- F. Excavate recesses in pipe bedding material to accommodate joints, fittings and appurtenances.
- G. Do not subject pipe to a blow or shock to achieve solid bearing or grade.

- H. Lay each section of pipe in such a manner as to form a close concentric joint with the adjoining section and to avoid offsets in the flow line. Ponding in any portion of the sewer shall be cause for rejection.
- I. Clean and inspect each section of pipe before joining.
- J. Assemble to provide tight, flexible joints that permit movement caused by expansion, contraction, and ground movement.
- K. Use lubricant recommended by the pipe or fitting manufacturer for making joints.
- L. If unusual joining resistance is encountered or if the pipe cannot be fully inserted into the bell, disassemble joint, inspect for damage, reclean joint components, and reassemble joint.
- M. Assemble joints in accordance with recommendations of the manufacturer.
- N. Push-on Joints:
  - 1. Clean the inside of the bell and the outside of the spigot.
  - 2. Insert rubber gasket into the bell recess.
  - 3. Apply a thin film of gasket lubricant to either the inside of the gasket or the spigot end of the pipe, or both.
  - 4. Insert the spigot end of the pipe into the socket using care to keep the joint from contacting the ground.
  - 5. Complete the joint by forcing the plain end to the bottom of the socket.
  - 6. Mark pipe that is not furnished with a depth mark before assembly to assure that the spigot is fully inserted.
- O. Mechanical Joints:
  - 1. Wash the socket and plain end.
  - 2. Apply a thin film of soapy water.
  - 3. Slip the gland and gasket over the plain end of the pipe.
  - 4. Apply soapy water to gasket.
  - 5. Insert the plain end of the pipe into the socket and seat the gasket evenly in the socket.
  - 6. Slide the gland into position, insert bolts, and finger-tighten nuts.
  - 7. Bring bolts to uniform tightness; tighten bolts 180 degrees apart alternately.
- P. Solvent Cemented Joints:
  - 1. Chamfer and deburr pipe.
  - 2. Clean socket and plain end.
  - 3. Measure and mark the socket depth on the outside of the pipe.
  - 4. Apply primer to inside socket surface using a scrubbing motion to ensure penetration; repeated applications may be necessary.

5. Soften surface of male end of pipe to depth of fitting socket by applying a liberal brush coat of primer.
  6. Do not pour primer on, or mix with cement.
  7. Assure entire surface is well softened.
  8. Repeat application of primer to inside socket surface, then apply cement to pipe while surfaces are still wet with primer.
  9. Apply cement uniformly taking care to keep excess cement out of socket.
  10. With truss pipe, seal truss section to avoid false air leaks.
  11. Immediately after applying the last coat of cement to the pipe, and while both the inside socket surface and outside pipe surface are soft and wet, forcefully seat the pipe into the socket.
  12. Turn the pipe 1/4 turn during assembly to distribute cement evenly.
  13. Assembly should be completed within 20 seconds after the last application of cement.
  14. Insert pipe with a steady, even motion.
  15. Do not use hammer blows.
  16. Hold joint in place until cement has set; wipe excess cement from the pipe.
- Q. Coupled Joints: Assemble in accordance with the manufacturer's recommendations.
- R. Disassemble and remake improperly assembled joints using a new gasket.
- S. Grade Check:
1. Check each pipe installed as to line and grade in place.
  2. Correct deviation from grade immediately.
  3. A deviation from the designed grade as shown on the Contract Drawings, or deflection of pipe joints, will be cause for rejection.
  4. Deviation from design grade is easily detected during television inspection as water "ponding" in the pipe. Areas of ponding during television inspection will be cause for rejection.
- T. Minimum Required Slope:
1. Minimum slope of sanitary sewer pipe is 0.4%.
  2. Minimum slope required from terminal manhole to next manhole downstream is 1.0%.
- U. Place sufficient backfill on each section of pipe, as it is laid, to hold firmly in place.
- V. Clean interior of the pipe as work progresses; where cleaning after laying is difficult because of small pipe size, use a suitable swab or drag in the pipe and pull forward past each joint immediately after the jointing has been completed.
- W. Keep trenches and excavations free of water during construction.

- X. When the work is not in progress, and at the end of each workday, securely plug open ends of pipe and fittings to prevent trench water, earth, or other substances from entering the pipes or fittings.
- Y. When it is necessary to deflect pressure sewer mains from a straight alignment horizontally or vertically, do not exceed the following limits:
  - 1. Ductile-Iron Pipe: Per AWWA C600.
  - 2. PVC Pipe: Per manufacturer's recommendations.

### 3.03 WYE BRANCHES

- A. Install wye branches at locations indicated on the Contract Drawings concurrently with pipe laying operations.
- B. Use standard fittings of the same material and joint type as the pipeline into which they are installed. Wye branches shall connect to the pipeline at a 45 degree angle from the horizontal. See Standard Detail 5187.
- C. For taps into an existing pipeline, for pipes 24" and larger use a saddle wye or tee with stainless steel clamps. Cement -on-type saddles are not permitted.
- D. Mount saddles with gasket and secure with metal bands.
- E. Layout holes with a template and cut holes with a mechanical hole cutter.
- F. When inserting a wye into dissimilar materials use a properly sized Fernco or equivalent sleeve.
- G. When inserting a wye branch into similar material as main line, use repair couplings. Fernco or equivalent sleeve will not be accepted.

### 3.04 LATERALS

- A. Construct laterals from the wye branch to a terminal point at the edge of right-of-way and in accordance with Standard Detail 5187. Laterals shall have a minimum of 1% slope for their entire length except that the connection to the main line shall be at 45 degrees.
- B. Where the depth of the main pipeline warrants, construct riser type laterals from the wye branch in accordance with Standard Detail 5187A or 5187B.
- C. The determination as to the type of riser, slope, and depth of lateral pipe at the termination point will be made by the Township's representative in the field.
- D. Install an approved watertight plug, braced to withstand pipeline test pressure thrust, at the termination of the lateral.

- E. Install a temporary marker stake extending from the end of the lateral to 1 foot above finished grade.

### 3.05 CAST-IN-PLACE CONCRETE CONSTRUCTION

- A. Conform to the applicable requirements of Section 03310 - Concrete for Utility Construction.

### 3.06 CRADLES AND ENCASEMENT

- A. Provide concrete cradles and encasement for pipeline where indicated on the Contract Drawings, or as directed by the Township, and in accordance with Standard Detail 5179. Encasements and cradles shall not be poured when there is a danger of freezing unless precautions are taken to prevent such freezing.

### 3.07 CARRIER PIPE IN CASINGS

- A. Applicable to casing pipe installed in open cut trenches; for installation by boring, jacking, or tunneling, consult with the Township's Engineer.
- B. Provisions regarding pipe laying specified above also apply to carrier pipe installed in casings.
- C. Excavate trench to the additional depth and width necessary to accommodate the casing pipe and to maintain the line and grade of the carrier as indicated on the Drawings.
- D. Minimum inside diameter of the casing pipe: 4" greater than the largest outside diameter of the carrier pipe joints.
- E. Support pipeline within casing so that no external loads are transmitted to the carrier pipe.
- F. Attach wooden skids to barrel of carrier pipe; do not rest carrier pipe on pipe joint bells.
- G. Fill annular space between carrier pipe and casing pipe with packed sand or grout per Drawings.
- H. Close ends of casing.

### 3.08 STREAM CROSSINGS

- A. Construct sanitary sewer pipeline stream crossings in accordance with Standard Detail 5180A.

- B. Provide concrete encased mechanical joint ductile-iron pipe backfilled with minimum 3" size stone to the level of the stream bed, between the limits of the stream crossing.
- C. Do not backfill until concrete has achieved its initial set and concrete work is examined by the Township.

### 3.09 BACKFILLING TRENCHES

- A. Backfill pipeline trenches only after examination of the pipe laying by the Township.
- B. Backfill trenches as specified in Section 02221b - Trenching, Backfilling and Compacting.

END OF SECTION

SECTION 02618  
STORM DRAIN PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The work of this section includes, but is not limited to:
  - 1. Storm sewer pipelines
- B. Related work specified elsewhere:
  - 1. Trenching, backfilling, and compaction: Section 02221a
  - 2. Finish grading, seeding, and sodding: Section 02485
  - 3. Trench paving and restoration: Section 02575
  - 4. Manholes: Section 02601
  - 5. Storm inlets, catch basins, endwalls: Section 02602
  - 6. Concrete for utility construction: Section 03300
- C. Definitions: NONE
- D. Applicable Standard Details: RC Pipe Load Table Buchart Horn Detail 5176B

1.02 QUALITY ASSURANCE

- A. Reference Standards:
  - 1. Pennsylvania Department of Transportation:
    - Publication 408 Specifications
    - Publication 72, Standards for Roadway Construction
  - 2. American Society for Testing and Materials (ASTM):
    - C76 Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
    - C507 Specifications for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
    - D2241 Specification for Poly(Vinyl Chloride)(PVC) Plastic Pipe (SDR-PR)
    - F405 Specification for Corrugated Polyethylene (PE) Tubing and Fittings
    - F667 Large Diameter Corrugated Polyethylene Tubing and Fittings

3. American Association of State Highway Transportation Officials (AASHTO):

M252	Corrugated Polyethylene Drainage Tubing
M278	Class PS50 Polyvinyl Chloride (PVC) Pipe
M294	Corrugated Polyethylene Pipe, 12" to 24" Diameter

1.03 SUBMITTALS

- A. Provide material analysis for test reports to Township Engineer upon request.
- B. Provide documentation of materials placed to the Inspector on site or as otherwise directed by the Township Engineer.

1.04 JOB CONDITIONS: Section not Used

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. During loading, transporting and unloading, exercise care to prevent damage to materials.
- B. Do not drop pipe or fittings. Avoid shock or damage at all times.
- C. Do not place materials on private property without written permission from the property owner.
- D. Take measures to prevent damage to materials during storage.

PART 2 - PRODUCTS

2.01 REINFORCED CONCRETE PIPE

- A. Pipe and Fittings:
  - 1. ASTM C76, Minimum Class II
- B. Joints:
  - 1. Tongue and groove or bell and spigot.

2.02 ELLIPTICAL REINFORCED CONCRETE PIPE

- A. Pipe:
  - 1. ASTM C507, Minimum Class HE-A or VE-II.

2.03 CORRUGATED POLYETHYLENE PIPE

- A. Tubing and Fittings - 3" to 6"
  - 1. AASHTO M252
  - 2. ASTM F405

- B. Pipe and Fittings - 12" to 36"
  - 1. Integrally formed smooth interior.
  - 2. AASHTO M294
  - 3. ASTM F667
- 2.04 POLYVINYL CHLORIDE PIPE 3" TO 6"
  - A. Pipe and Fitting
    - 1. AASHTO M278
    - 2. ASTM D2241

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Perform trench excavation and associated work as specified in Section 02221a, Part 3.
- B. Provide Type IV pipe bedding as specified in Section 02221a, Part 3.06A. Place aggregate and compact so that the pipe can be laid to the required tolerances.

#### 3.02 LAYING PIPE IN TRENCHES

- A. Only reinforced concrete pipe is permitted in street cartway to include roads built to Township standards.
- B. Give 72 hours (three business days) notice to the Township Engineer in advance of pipe laying operations, cancel or postpone with a minimum of twenty-four hours notice to Township Engineer.
- C. Lower pipe into trench using handling equipment designed for the purpose to assure safety of personnel and to avoid damage to pipe. Do not drop pipe.
- D. Lay pipe proceeding upgrade with the bell or groove pointing upstream.
- E. Lay pipe to a true uniform line with the barrel of the pipe resting solidly in bedding material throughout its length.
- F. Excavate recesses in bedding material to accommodate joints, fittings and appurtenances.
- G. Do not subject pipe to a blow or shock to achieve solid bearing or grade.
- H. Lay each section of pipe in such a manner as to form a close concentric joint with the adjoining section and to avoid offsets in the flow line.
- I. Clean and inspect each pipe and fitting before joining.

- J. Align pipe with previously laid sections.
- K. Assemble to provide tight, flexible joints that permit movement caused by expansion, contraction, and ground movement.
- L. Assemble joints in accordance with the pipe manufacturer's instructions.
- M. Check each pipe installed as to line and grade in place. Correct deviation from line and grade immediately. A deviation from the designed line or grade as shown on the Drawings will be cause for rejection.
- N. Place and compact sufficient backfill to hold each section of pipe firmly in place as the pipe is laid.

3.03 BACKFILLING TRENCHES

- A. Backfill pipeline trenches only after examination of pipe by the Township Engineer.
- B. Backfill and compact trenches as specified in Section 02221a, Part 3.07.

3.04 PAVEMENT BASE DRAINS AND PIPE UNDER DRAINS

- A. Construct drains of the size and type indicated on the Drawings in accordance with the requirements set forth in Section 610, Publication 408 Specifications and as shown on Standard Drawing RC-30M, Publication 72M.

3.05 SURFACE RESTORATION

- A. Restore unpaved areas in accordance with Section 02221a, Part 3.08.
- B. Restore paved surfaces in accordance with Section 02575.

END OF SECTION

## SECTION 02651

### SEWER AND MANHOLE TESTING

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Work of this section includes, but is not limited to:
  - 1. Vacuum Testing Sewer Manholes
  - 2. Testing Gravity Sewer Pipelines:
    - a. Low-pressure Air Test
    - b. Infiltration Test
  - 3. Hydrostatic Testing Pressure Pipelines
  - 4. Deflection Testing Plastic Pipelines
  - 5. Closed Circuit Television Inspection of New Sewer Mains
  
- B. Related Work specified elsewhere:
  - 1. Section 02312 - Closed Circuit Television Inspection of Existing Sewer Mains and Connections to Existing Manhole
  - 2. Section 02601b - Sanitary Sewer Manholes
  - 3. Section 02610 - Sanitary Sewer Pipe

##### 1.02 QUALITY ASSURANCE

- A. Reference Standards:
  - 1. American Society for Testing and Materials (ASTM):
    - a. C1244 Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test
    - b. F1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
  
- B. Test Acceptance:
  - 1. No test will be accepted until the results are below the specified maximum limits.
  - 2. The Developer shall determine and correct the causes of test failure and retest until successful test results are achieved.

##### 1.03 SUBMITTALS

- A. Submit the following prior to start of testing:
  - 1. Testing procedures
  - 2. List of test equipment
  - 3. Testing sequence schedule
  - 4. Provisions for disposal of flushing and test water
  - 5. Current certification of test gauge calibration must be provided.
  - 6. Deflection mandrel drawings and calculations

#### 1.04 JOB CONDITIONS

- A. Do not allow personnel in manholes during vacuum or pressure testing.
- B. Provide relief valves set at 10 psig to avoid accidentally over-pressurizing gravity sewer line during low-pressure air testing.
- C. Provide 72 hours notice to Township prior to testing. Cancel or postpone at least 24 hours prior to scheduled test.

#### PART 2 - PRODUCTS

##### 2.01 VACUUM TESTING EQUIPMENT

- A. Vacuum pump
- B. Vacuum line
- C. Vacuum tester base with compression band seal and outlet port
- D. Shut-off valve
- E. Stop watch
- F. Plugs
- G. Vacuum gauge, calibrated to 0.1" Hg

##### 2.02 AIR TEST EQUIPMENT

- A. Air compressor
- B. Air supply line
- C. Shut-off valves
- D. Pressure regulator
- E. Pressure relief valve
- F. Stop watch
- G. Plugs
- H. Pressure gauge, calibrated to 0.1 psi

## 2.03 HYDROSTATIC TEST EQUIPMENT

- A. Hydro pump
- B. Pressure hose
- C. Water meter
- D. Test connections
- E. Pressure relief valve
- F. Pressure gauge, calibrated to 0.1 psi

## 2.04 DEFLECTION TEST EQUIPMENT

- A. Go, No-Go mandrels
- B. Pull/retrieval ropes

## PART 3 - EXECUTION

### 3.01 TESTING MANHOLES

- A. Manhole construction must be complete and base course in place before testing can occur.
- B. Vacuum test in accordance with ASTM C1244 and as follows:
  - 1. Plug all pipe openings; take care to securely brace the plugs and pipe.
  - 2. Inflate the compression band to effect a seal between the vacuum base and the structure; connect the vacuum pump to the outlet port with the valve open; draw a vacuum to 10" of Hg; close the valve; start the test.
  - 3. Test:
    - a. Determine the test duration for the manhole from the following table:

VACUUM TEST TABLE  
Manhole Diameter      Test Period

48"	60 sec.
60"	75 sec.
72"	90 sec.

- b. Record the vacuum drop during the test period; if the vacuum drop is greater than 1.0" of Hg during the test period, the manhole shall be repaired and retested; if a vacuum drop of 1" of Hg does not occur during the test period, the test shall be discontinued and the manhole will be accepted.

- c. If the vacuum test fails to meet a 1" Hg drop in the specified time after repair, the unit shall be subjected to repair and retest as necessary.

### 3.02 PIPELINE PREPARATION

- A. Backfill trenches in accordance with Sections 02221a&b.
- B. Provide pressure pipeline with concrete reaction support blocking or the use of restrained mechanical joint glands.
- C. Remove all debris, rocks, bituminous sealants and other debris from manholes and flow channels.
- D. Clean pipelines by means of a high velocity hydraulic sewer cleaner manufactured specifically for the purpose. Clean from the upstream manhole to the downstream manhole capturing and removing any debris removed from the sewer. An alternative physical cleaning is permitted using a porcupine and swab both specifically manufactured for this purpose. The Contractor must demonstrate to the Township's representative that this procedure produces satisfactory cleaning. Chimney brushes and other devices not manufactured specifically for this purpose are not acceptable.
- E. Plug outlets, wye-branches and laterals; brace plugs to offset thrust.

### 3.03 TESTING GRAVITY SEWER PIPELINES

- A. Low-pressure Air Test:
  - 1. Test each newly installed section of gravity sewer line between manholes.
  - 2. Slowly introduce air pressure to approximately 4.0 psig.
    - a. If ground water is present, determine its elevation above the springline of the pipe for every foot of ground water above the springline of the pipe, increase the starting air test pressure reading by 0.43 psig; do not increase pressure above 9 psig.
  - 3. Allow pressure to stabilize for at least five minutes. Adjust pressure to 3.5 psig or the increased test pressure as determined above if ground water is present. Start the test.
  - 4. Test:
    - a. Determine the test duration for a sewer section with a single pipe size from the following table. No allowance will be made for laterals.

## AIR TEST TABLE (For Gravity Pipe)

Minimum Specified Time for a 1.0 psig Pressure Drop for Size and Length of Pipe Indicated for Q=0.0015

Pipe Diameter, in.	Min. Time, min:s	Length for Min. Time, ft.	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s								
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	398	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24	
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48	
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38	
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41	
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31	
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33	
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48	
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15	
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53	
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46	

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

### 3.04 TESTING PRESSURE SEWER PIPELINES

#### A. Hydrostatic Leakage Test:

1. Test each newly laid pressure pipeline, including any valved section thereof, hydrostatically at 1.5 times the working pressure of the pipeline based on the elevation of the lowest point in the pipeline corrected to the elevation of the test gauge; obtain test pressure from the Engineer.
2. Slowly fill the section to be tested with water, expelling air from the pipeline at the high points. Install corporation cocks at high points if necessary. After all air is expelled, close air vents and corporation cocks and raise the pressure to the specified test pressure.
3. Observe joints, fittings and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.

4. After visible deficiencies are corrected, continue testing at the same test pressure for an additional two hours to determine the leakage rate. Maintain pressure within plus or minus 5.0 psig of test pressure. Leakage is defined as the quantity of water supplied to the pipeline necessary to maintain test pressure during the period of the test.
5. Compute the maximum allowable leakage by the following formula:

$$L = \frac{ND (P)^{1/2}}{7400}$$

Where: L is the allowable leakage in gallons/hour  
N is the number of joints in the section tested  
D is the nominal diameter of the pipe in inches  
P is the average test pressure in psig

If line under test contains sections of various diameters, the allowable leakage shall be the sum of the computed leakage for each size.

6. If the test of the pipe indicates leakage greater than that allowed, locate the source of the leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of the amount of leakage.

### 3.05 DEFLECTION TESTING OF PLASTIC SEWER PIPE

- A. Perform vertical ring deflection testing on all portions of PVC and ABS sewer piping, in the presence of the Engineer, after backfilling has been in place for at least 30 days but not longer than 12 months.
- B. The maximum allowable deflection for installed plastic sewer pipe shall be limited to 5% of the original vertical internal diameter.
- C. Perform deflection testing using a properly sized rigid ball or 'Go, No-Go' mandrel; the rigid ball(s) or mandrel(s) shall be provided at the Contractor's expense and subject to the approval of the Engineer.
- D. The rigid ball or mandrel shall have a diameter not less than 95% of the base or average inside diameter of the pipe as determined by the specific ASTM Specification to which the pipe is manufactured. The pipe shall be measured in compliance with ASTM D2122.
- E. The test shall be performed without mechanical pulling devices.
- F. Pipe exceeding the allowable deflection shall be located, excavated, replaced, and retested.

3.06 CLOSED CIRCUIT TELEVISION INSPECTION OF NEW SANITARY SEWER MAINS

- A. Springettsbury Township will perform closed circuit television inspection of completed sanitary sewers when notified by the Contractor in writing that the sewer is ready to be inspected.
- B. Fees will be charged for this inspection according to the current Township fee schedule at the time of the inspection.
- C. If deemed necessary a reinspection will be performed and a fee will be charged at the time of the reinspection.
- D. The Developer has the option of performing the inspection in accordance with Section 02312.

END OF SECTION

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## SECTION 02722

### LOW-PRESSURE SEWER SYSTEM

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Work of this section includes, but is not limited to:
  - 1. Sanitary sewer low-pressure pipelines
  - 2. Service connections
  - 3. In-line cleanouts
  - 4. Terminal cleanouts
  - 5. Air release valves
  - 6. Pressure to gravity connections
  
- B. Township does not allow low-pressure sewer systems. Special approval must be obtained from the Township for the installation of a low-pressure sewer system.
  
- C. Related Work specified elsewhere:
  - 1. Section 02221b - Trenching, Backfilling & Compacting
  - 2. Section 02651 - Sewer and Manhole Testing
  
- D. Applicable Standard Details:
  - 1. 5180 Vertical Water Main Clearance
  - 2. 5220 Typical Pressure Sewer Service Connection
  - 3. 5223 Service Valve Detail
  - 4. 5224 Valve Box Detail
  - 5. 5225 In-line Cleanout Detail
  - 6. 5226 Terminal Cleanout Detail

##### 1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM D1784 Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
  - 2. ASTM D1785 Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120
  - 3. ASTM D2241 Poly(Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
  - 4. ASTM D2466 Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
  - 5. ASTM D2564 Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
  - 6. ASTM D3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
  - 7. ASTM F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe

### 1.03 SUBMITTALS

- A. Submit manufacturer's instructions for installation of adapters and maximum recommended deflection per pipe joint.
- B. Submit manufacturer's certification attesting that the pipe, pipe fittings, joints, joint gaskets and lubricants meet or exceed specification requirements.

### 1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. During loading, transporting and unloading, and storage on site, exercise care to prevent damage to materials.
- B. Do not drop pipe or fittings.

## PART 2 - PRODUCTS

### 2.01 POLYVINYL CHLORIDE (PVC) SEWER PIPE

- A. Pressure Sewer Pipe and Fittings:
  - 1. Pipe: ASTM D2241, SDR21.
  - 2. Flexible Elastomeric Seals: ASTM D3139.
  - 3. Seal Material: ASTM F477.
  - 4. Fittings: ASTM D2466, Socket type, Schedule 40.
  - 5. Solvent Cement: ASTM D2564.

### 2.02 DETECTABLE UNDERGROUND UTILITY MARKING TAPE

- A. Refer Section 02221b, Trenching, Backfilling, and Compacting.

### 2.03 AIR RELEASE VALVES

- A. Air release valve for sewage service, with backflushing and cleaning accessories.
- B. Cast iron body and cover, stainless steel stem and float, stainless steel trim, Buna-N orifice seats.
- C. Constructed with long bodies and float stems so that operating mechanisms and orifice openings are kept free from contact with sewage during purging of air.
- D. Provide valves with backflushing and cleaning accessories comprised of:
  - 1. Shut-off valve at bottom inlet
  - 2. Blow-off valve near bottom of valve body
  - 3. Clear water inlet valve with quick-disconnect coupling

4. Air inlet with quick-disconnect in the valve cover
5. Hose with quick-disconnect couplings

## 2.04 VALVES

- A. PVC valves manufactured from a compound conforming to ASTM D1784, Class 12454-B.
- B. PVC Ball Valves: True union, double entry; fluorocarbon base, o-ring seals, teflon seats; 150 psi rated.
- C. PVC Check Valves:
  1. Gravity-operated, flapper-type providing full-ported passageway when open.
  2. Stainless steel hinge pin; elastomeric seal.
  3. 150 psi working pressure.
- D. Plug Valves (Line Size Valves 3"):
  1. Semi-steel body, mechanical joint ends; eccentric plug, rectangular or semi-circular ports. For 4" diameter and smaller plug valves, where rectangular port is furnished, the cross-sectional area shall be not less than 100% of the connecting pipe cross-sectional area.
  2. Plug valves shall have a cast iron plug having a resilient neoprene or Buna-N facing. Valve bodies shall be furnished with an 1/8" minimum welded overlay seat of not less than 90% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to insure that the plug face contacts only nickel. Valves shall have corrosion resistant bearing. Valve shaft seals shall be in accordance with AWWA C504 or C507. Valves shall have a 150 psi working pressure. Provide a square operating nut.

## 2.05 ADJUSTABLE VALVE BOXES

- A. Plastic; PVC, ABS, or reinforced olefin polymers.
- B. Plastic top tube, belled bottom; bell arched and flanged; slide friction adjustment.
- C. Cast iron top collar and lid; lid cast with "Sewer".

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Perform trench excavation to the line and grade indicated on the Drawings and as specified in Section 02221b - Trenching, Backfilling and Compacting.
- B. Unless otherwise indicated on the Drawings, provide for a minimum cover of 4'-0" above the top of piping laid in trenches.

- C. Provide Type IV bedding as indicated on Standard Detail 5222; place aggregate in a manner to avoid segregation, and compact to the maximum practical density so that the pipe can be laid to the required tolerances.

### 3.02 LAYING PIPE IN TRENCHES

- A. Give ample notice to the Township in advance of pipe laying operations.
- B. Lower pipe into trench using handling equipment designed for the purpose to assure safety of personnel and to avoid damage to the pipe. Do not drop pipe.
- C. Lay pipe proceeding upgrade with the bell or groove pointing upstream.
- D. Excavate recesses in bedding material to accommodate joints, fittings and appurtenances. Do not subject pipe to a blow or shock to achieve solid bedding or grade.
- E. Lay each section of pipe in such a manner as to form a close concentric joint with the adjoining section and to avoid offsets in the flow line.
- F. Clean and inspect each pipe and fitting before joining. Assemble to provide tight, flexible joints that permit movement caused by expansion, contraction and ground movement. Use lubricant recommended by the pipe or fitting manufacturer for making joints. If unusual joining resistance is encountered or if the pipe cannot be fully inserted into the joint, disassemble joint, inspect for damage, reclean joint components, and re-assemble joint.
- G. Do not deflect joints in pressure piping more than the maximum recommended by the pipe manufacturer.
- H. Place sufficient backfill on each section of pipe, as it is laid, to hold pipe firmly in place.
- I. Clean the interior of the pipe as the work progresses.
- J. Keep trenches and excavations free of water during construction.
- K. When the work is not in progress, and at the end of each workday, securely plug ends of pipe and fittings to prevent trench water, earth or other substances from entering the pipe or fittings.

### 3.03 THRUST RESTRAINT

- A. Provide pressure pipeline with restrained joints or concrete thrust blocking at all bends, tees, and changes in direction; construct concrete thrust blocking in accordance with Standard Details 5195 and 5196. If restrained joints are utilized, submit design calculations showing determination of restrained lengths and submit joint restraint details. Method of joint restraint shall utilize devices

specifically designed for the application for which manufacturer's data is available for the application. Submit manufacturer's literature for approval.

#### 3.04 AIR RELEASE VALVES

- A. Install air release valves and vaults where indicated on the Drawings.

#### 3.05 SERVICE VALVES AND CLEANOUTS

- A. Provide service valves, in-line cleanouts, and terminal cleanouts where indicated on the Drawings.
- B. Construct as indicated on Standard Details 5225A thru 5226A.

#### 3.06 PRESSURE SEWER TO GRAVITY SEWER CONNECTIONS

- A. Connect low-pressure sewer system to gravity sewer system where indicated on the Drawings.
- B. Construct as indicated on Drawings.

#### 3.07 BACKFILLING TRENCHES

- A. Backfill pipeline trenches in accordance with Section 02221b - Trenching, Backfilling and Compacting and only after examination of pipe laying by the Township's Representative.
- B. Install detectable utility marking tape above all plastic sanitary sewer pressure pipeline, 12" to 18" below final grade.

#### 3.08 HYDROSTATIC LEAKAGE TEST

- A. Hydrostatically test each newly laid pressure pipeline, including any valved section thereof, in accordance with Section 02651 - Sewer and Manhole Testing.

END OF SECTION

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SECTION 02890

TRAFFIC SIGNALIZATION

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The work of this section includes, but is not limited to:
  - 1. Furnishing and installing operational traffic signals, including
    - a. Controller assemblies
    - b. Traffic signal supports
    - c. Electrical distribution
    - d. Traffic signal heads
    - e. Detectors
    - f. Communications
    - g. Systems
- B. In an effort to standardize equipment and provide for a future Closed Loop System compatibility, all Traffic Signal Controllers will be the ASC/3-2100 Series, NEMA TS-2 Type II, as manufactured by the Econolite Control Products – no exceptions.
- C. Words and phrases peculiar to traffic signals, not defined in these specifications, or in the regulations, are to be as defined in NEMA Standards Publication No. TS1.
- D. Related work specified elsewhere:
  - 1. Trenching, backfilling and compacting: Sections 02221a&b
  - 2. Paving and restoration: Section 02575
  - 3. Plain and reinforced cement concrete: Section 03000
  - 4. Concrete for utility construction: Section 03300

1.02 QUALITY ASSURANCE

- A. Reference Standards:
  - 1. Pennsylvania Department of Transportation:  
Publication 408 Specifications
- B. Testing:
  - 1. After the traffic signal installation becomes operational, conduct a continuous, 24-hour operating test for not less than 30 consecutive calendar days. Make the initial turn-on in the presence of the District Traffic Engineer between the hours of 9 a.m. and 2 p.m., Tuesday through Thursday, except holidays. Correct failures during the test period by

repairing or replacing malfunctioning parts or equipment or faulty workmanship, regardless of the cause, within 24 hours after having been notified by the Engineer. After correcting failures caused by defective equipment, material, or faulty workmanship, reconduct the 30-day test.

### 1.03 SUBMITTALS

#### A. Materials Acceptance:

1. Prior to the submission of a bid proposal, verify that Certificates of Approval, Sale or Provisional, have been issued by the PennDOT, for traffic signal equipment, as provided in 67 Pa. Code, Chapter 211. Within 3 weeks after the Notice to Proceed, submit to the PennDOT, for review and acceptance, a tabulation of all project traffic signal materials that are to have a Certificate of Approval. Include the type of material, manufacturer's name, model number, and the PennDOT's Certificate of Approval number for each item to be supplied.
2. As applicable, tabulate the following:
  - a. Controller Units
  - b. Flasher Units
  - c. Coordinators
  - d. Signal Heads all 12" LED
  - e. Detector Amplifiers
  - f. Auxiliary Equipment
  - g. Electrically Operated Signs

#### B. Writing Diagrams and Timing Plans:

1. Provide three copies of the cabinet wiring diagram and manufacturer's timing plan for each controller assembly.

#### C. Certification

1. Section 106.03(b)3 of PADOT Publication 408 Specifications. Certify that all signal supports satisfy the Department's criteria and are adequate to support the loads specified. Certify the structural adequacy of all sign and signal brackets.

#### D. Warrants, Instruction Manuals and Guarantees

1. Furnish, as specified in Section 1104.01 of PADOT Publication 408 Specifications.

#### E. Shop Testing

1. Submit results from shop tests to the Engineer, as specified in Section 1104.01 of PennDOT Publication 408 Specifications.

## PART 2 – PRODUCTS

- A. Controllers:
  - 1. Pedestrian isolation circuitry on all controller inputs.
  - 2. Surge protection on all controller inputs.
- B. Controllers Cabinets:
  - 1. Sized for future Fiber Optic Telemetry equipment.
- C. Master Controller, if required:
  - 1. ASC-2M as manufactured by Econolite Control Products.
- D. Interconnect, if required:
  - 1. Fiber Optic cable, 6 fiber 62.5/125 micron multimode, terminated in patch panels with ST connectors.
- E. Optical Preemption:
  - 1. All intersections will be equipped with Optical Preemption for all approaches to the intersection.
  - 2. Detectors will be positioned to achieve the proper distance for activation and control of the intersection.
  - 3. Optical preemption equipment will be Strobecom II as manufactured by Tomar Electronics, Inc. – no exceptions.
- F. Traffic Signal Supports will be Mastarms:
  - 1. Must be capable of having an extension to the shaft, and a luminaire mounting arm added at a future date.
  - 2. This specification is met by the Valmont SMA42X Series of Traffic Signal Mastarms – no exceptions.
- G. Battery Backup:
  - 1. All battery backup systems will be Econolite Control Systems, DBL-700 Series.
  - 2. Where battery backup systems will be used, the controller cabinet shall be base mounted to house the batteries.
  - 3. The batteries will be housed in an 18" base extension, mounted under the controller cabinet. The batteries will be placed on shelves supplied with the extension, so they are not on the concrete base.

H. Signals:

1. All vehicular signal heads will contain Dialight Red, Amber and tinted Green DuraLED modules model 433.
2. All arrow indications shall be Dialight model 430.
3. All pedestrian signals will be supplied with Dialight LEDs – no exceptions.
4. PennDOT approval where applicable, if not already received, for the use of these LED signals must be procured as part of this project.
5. The housing of each section shall be a yellow, one piece molded ultraviolet and heat stabilized polycarbonate unit.

I. Conduits:

1. Conduit runs will be sized for future use.
2. All main street crossing will, at a minimum, be 1 - 3" conduit.
3. Controllers should be located at the intersection of conduit runs, and not at the end of a conduit loop.
4. Each controller foundation or pole foundation if the controller is pole mounted, will have the equivalent of 2 - 3" conduits entering it from an adjacent junction box.
5. All loops will terminate in junction boxes, and there will be at least one junction box on each corner.

J. Street Name Signs:

1. All intersections will be signed with Street Name signs of the size and designation as required by the Township or PennDOT as applicable.

K. Pavement Markings:

1. Long lane line pavement markings are to be paint.
2. Gore transverse striping is to be epoxy.
3. All other pavement markings are to be cold inlaid plastic or hot surface applied thermoplastic.

L. Conflict Monitors

1. Shall be Eberlie Desing Inc. (ED)

- M. Loop Detector Amplifiers
  - 1. Shall be single channel shelf mounted unless specified by the Township Engineer.
- N. Generator/Utility Transfer Assembly
  - 1. Shall be Model #MTA97 as manufactured by Signal Services, Inc. The assembly shall be installed inside of a NEMA 3R cabinet measuring 14" x 10" x 7" and will be keyed to accommodate a standard traffic cabinet "police door" key.

### PART 3 – EXECUTION

#### 3.01 CONSTRUCTION

- A. Perform work, in accordance with applicable codes, regulations, and standards.
- B. Existing signals are to remain in operation, as is, until the new signals are put into operation.
- C. Remove all existing traffic signal supports and signal equipment, unless otherwise indicated. All equipment shall be returned to the Township Director of Public Works.
- D. Maintain existing controller assemblies, as a unit.
- E. Store material on the project site in a secure location.
- F. Provide a listing of equipment for the jurisdictional owner which indicates when and where items can be obtained.
- G. Assume responsibility for damage to claimed items during removal and storage.
- H. Abandon underground conduit, conductors, and detectors not interfering with new construction.
- I. Remove foundations and junction boxes to be abandoned in "off roadway" areas to 0.3 m (1 foot) below final grade and satisfactorily dispose of such items.
- J. Satisfactorily repair damage to galvanized finishes.

END OF SECTION

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SECTION 03000

PLAIN AND REINFORCED CEMENT CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The work of this section includes the construction of all cast-in-place plain and reinforced cement concrete structures.
- B. Related Work Specified Elsewhere:
  - 1. Cement concrete curb and sidewalk: Section 02525
  - 2. Concrete for utility construction: Section 03300
- C. Definitions:
  - 1. Exposed construction - Permanently exposed to view.
  - 2. Concrete - Normal weight concrete for which density is not a controlling attribute, made with aggregates of the types covered by ASTM C33, and having unit weights in the range of 135 to 160 lb. per cubic foot.
  - 3.  $f_c$  - The design compressive strength of the hardened concrete at an age of 28-days.
- D. Applicable Standard Details: NONE

1.02 QUALITY ASSURANCE

- A. Reference Standards:
  - 1. American Concrete Institute (ACI)
    - ACI 301 Specifications for Structural Concrete for Buildings
    - ACI SP-66-04 Detailing Manual
    - ACI 318 Building Code Requirements for Reinforced Concrete
  - 2. American Society for Testing and Materials (ASTM)
    - A185 Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement
    - A615 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
    - C31 Standard Method of Making and Curing Concrete Test Specimens in the Field
    - C33 Standard Specification for Concrete Aggregates
    - C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
    - C42 Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
    - C94 Standard Specification for Ready-Mixed Concrete

- C138 Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
- C143 Standard Test Method for Slump of Portland Cement Concrete
- C150 Standard Specification for Portland Cement
- C171 Standard Specification for Sheet Materials for Curing Concrete
- C172 Standard Method of Sampling Freshly Mixed Concrete
- C173 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
- C192 Standard Method of Making and Curing Concrete Test Specimens in the Laboratory
- C231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
- C260 Standard Specification for Air-Entraining Admixtures for Concrete
- D698 Tests For Moisture-Density Relations of Soils
- C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- C494 Standard Specification for Chemical Admixtures for Concrete
- D994 Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
- D1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- D1752 Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
- D4819 Standard Specification for closed cell, non-crosslinked, polyethylene foam expansion joint filler
- E329 Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction (Certificate of Accreditation Required)

3. National Ready-Mixed Concrete Association, 900 Spring Street, Silver Spring, MD 10910: Check list for certification of ready-mixed concrete production facilities.

B. Testing Agencies:

1. Testing services shall be performed by an independent testing agency acceptable to the Township Engineer at the Contractor's expense.
2. All testing agencies shall meet the requirements of ASTM E329.

1.03 SUBMITTALS

- A. Provide material analysis for test reports to Township Engineer upon request.
- B. Provide documentation of materials placed to the Inspector on site or as otherwise directed by the Township Engineer.

## PART 2 - PRODUCTS

### 2.01 CONCRETE

- A. Cement - Unless otherwise specified, Portland cement shall be Type I cement conforming to ASTM C150.
- B. Aggregates - Aggregates for normal weight concrete shall meet the requirements of ASTM C33.
- C. Water - Mixing water for concrete shall be clean, potable water meeting the requirements of ASTM C94.
- D. Admixtures - Concrete admixtures, when required and/or approved for use by the Engineer, shall conform to the following Specifications:
  - 1. Air-entraining admixtures - ASTM C260
  - 2. Water-reducing, retarding and accelerating admixtures - ASTM C494
- E. Storage of Concrete Materials:
  - 1. Cement shall be stored in weathertight containers.
  - 2. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates. Frozen or partially frozen aggregates shall not be used.
  - 3. Stockpiles of natural or manufactured sand shall be allowed to drain to insure a relatively uniform moisture content throughout the stockpile.
  - 4. Admixtures shall be stored in a manner that will avoid contamination, evaporation, or damage. For admixtures used in the form of suspensions or non-stable solutions, agitating equipment shall be provided to assure thorough distribution of the ingredients. Liquid admixtures shall be protected from freezing and from temperature changes which would adversely affect their characteristics.

### 2.02 REINFORCEMENT

- A. Reinforcing Bars - All reinforcing bars shall be deformed, except spirals, which may be plain bars. Reinforcing bars shall be Grade 60, billet-steel conforming to the requirements of ASTM A615, including supplementary requirement S1.
- B. Welded Wire Fabric - Welded wire fabric shall be fabricated from smooth or deformed wire of the size and spacing required on the Drawings and shall conform to the requirements of ASTM A185, except welded intersections shall be spaced not farther apart than 12 inches in the direction of the principal reinforcement.

2.03 JOINT MATERIALS

- A. Joint Filler - Premolded expansion joint filler shall be of the type required by the Drawings and shall conform to ASTM D994, ASTM D1751, ASTM D1752, or D4819.
- B. Waterstop - The material, design and location of waterstops in joints shall be as indicated on the Drawings.

2.04 FORM COATING MATERIALS

- A. Form release agents shall be non-staining, liquid chemical coatings free of kerosene, oil and wax which effectively prevent absorption of moisture into the forms and bonding of the concrete to the forms.

2.05 CONCRETE CURING COMPOUNDS

- A. Curing compounds shall be clear, non-staining liquid coatings containing no oil or wax and conforming to ASTM C309.

PART 3 - EXECUTION

3.01 PROPORTIONING

- A. General - Concrete for all parts of the work shall be of the specified quality and capable of being placed without excessive segregation. When hardened, concrete shall develop all characteristics required by these Specifications.
- B. Strength - Unless otherwise specified, the minimum 28-day compressive strength of the concrete,  $f_c$ , shall be 3000 psi.
- C. Durability - All concrete which will be subjected to potentially destructive exposure, including freezing and thawing, weather, and/or deicer chemicals, shall be air-entrained and shall conform to the following air content limits:

Nominal Maximum Size of Coarse Aggregate, Inches	Total Air Content, Percent by Volume
3/8	6-10
1/2	5-9
3/4	4-8
1	3.5-6.5

Measurement of air content shall meet the requirements of ASTM C231, ASTM C173 or ASTM C138.

- D. Cement Content - The water-cement ratio shall not exceed 0.50 by weight and the cement factor shall not be less than 6.0 bags of cement (94 pounds each) per cubic yard of concrete.
- E. Slump - The concrete shall be proportioned and produced to have a slump of not less than 1 inch and not more than 4 inches if consolidation is to be by vibration. Maximum slump may be 5 inches if consolidation is to be by methods other than vibration. The slump shall be determined by ASTM C143.

- F. Maximum size of coarse aggregate - The nominal maximum size of coarse aggregate shall not be more than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear spacing between reinforcing bars, and shall in no case exceed 1 inch.
- G. Admixtures - All concrete admixtures, when required or approved for use, shall be used in strict conformance with the manufacturer's instructions.
- H. Selection of Proportions - Proposed concrete proportions shall be subject to acceptance by the Township Engineer based on demonstrated ability to produce concrete meeting all requirements of this Specification. Proportions of materials for concrete shall be established to provide adequate workability and proper consistency to permit concrete to be worked readily into the forms and around reinforcement without excessive segregation or bleeding under conditions of placement to be employed. Concrete proportions shall be established on the basis of previous field experience or laboratory trial batches as specified in Section 3.9 of ACI 301.

### 3.02 FORMWORK

#### A. General:

1. Forms shall be used, wherever necessary, to confine the concrete and shape it to the required dimensions. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete, and shall have sufficient rigidity to maintain specified tolerances.
2. Earth cuts shall not be used as forms for vertical surfaces unless required or permitted.
3. Forms shall be dimensioned equal to or greater than the finished product dimensions (2x4 nominal lumber is not acceptable for 4" thick sidewalks).

#### B. Design and Installation of Formwork:

1. The design and engineering of the formwork, as well as its construction, shall be the responsibility of the Contractor.
2. The formwork shall be designed for loads and lateral pressure and for design considerations, wind loads, allowable stresses, and other applicable requirements of the controlling local building code.
3. Forms shall be sufficiently tight to prevent loss of mortar from the concrete. Chamfer strips shall be placed in the corners of forms to produce beveled edges on permanently exposed surfaces. Interior corners on such surfaces and the edges of formed joints will not require beveling unless required by the Drawings.
4. To maintain the specified tolerances, the formwork shall be cambered to compensate for anticipated deflections in the formwork prior to hardening of the concrete.
5. Positive means of adjustment (wedges or jacks) of shores and struts shall

be provided and all settlement shall be taken up during the concrete placing operation. Forms shall be securely braced against lateral deflections.

6. Temporary openings shall be provided at the base of column forms and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed.
  7. Form accessories to be partially or wholly embedded in the concrete, such as ties and hangers, shall be of a commercially manufactured type. Non-fabricated wire shall not be used. Form ties shall be constructed so that the ends or end fasteners can be removed without causing appreciable spalling at the surface of the concrete. After the ends or end fasteners of form ties have been removed, the embedded portion of the ties shall terminate not less than 2 diameters or twice the minimum dimension of the tie from the formed surface of concrete to be permanently exposed to view except that in no case shall this distance be less than 3/4 in. When the formed surface of the concrete is not to be permanently exposed to view, form ties may be cut off flush with the formed surfaces.
  8. At construction joints, contact surfaces of the form sheathing for flush surfaces exposed to view shall overlap the hardened concrete in the previous placement by not more than 1 in. The forms shall be held against the hardened concrete to prevent offsets or loss of mortar at the construction joint and to maintain a true surface.
  9. Wood forms for wall openings shall be constructed to facilitate loosening, if necessary, to counteract swelling of the forms.
  10. Wedges used for final adjustment of the forms prior to concrete placement shall be fastened in position after the final check.
  11. Formwork shall be so anchored to shores or other supporting surfaces or members that upward or lateral movement of any part of the formwork system during concrete placement will be prevented.
  12. Runways for moving equipment shall be provided with struts or legs, shall be supported directly on the formwork or structural member, and shall not rest on the reinforcing steel.
- C. Tolerances:
1. Unless otherwise specified, formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits listed in Table 4.3.1 of ACI 301.
  2. The Contractor shall establish and maintain in an undisturbed condition and until final completion and acceptance of the project sufficient control points and bench marks to be used for reference purposes to check tolerances.

D. Preparation of Form Surfaces:

1. All surfaces of forms and embedded materials shall be cleaned of all accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed.
2. Surfaces of forms shall be treated as follows:
  - a. Before placing the reinforcing steel or the concrete, the surfaces of the forms shall be covered with an acceptable coating material that will effectively prevent absorption of moisture, prevent bond with the concrete, and not stain the concrete surfaces.
  - b. Excess form coating material shall not stand in puddles in the forms nor shall such coatings come in contact with hardened concrete against which fresh concrete is to be placed.

E. Removal of Forms:

1. When repair of surface defects or finishing is required at an early age, forms shall be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations.
2. Top forms on sloping surfaces of concrete shall be removed as soon as the concrete has attained sufficient stiffness to prevent sagging. Any needed repairs or treatment required on such sloping surfaces shall be performed at once and be followed by the specified curing.
3. Wood forms for wall openings shall be loosened as soon as this can be accomplished without damage to the concrete.
4. Formwork for columns, walls, sides of beams, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations.
5. Forms and shoring in the formwork used to support the weight of concrete in beams, slabs and other structural members shall remain in place until the concrete has reached the minimum 28-day compressive strength.

3.03 REINFORCEMENT

- A. Welding - Welding of crossing bars (tack welding) for assembly of reinforcement is prohibited.
- B. Fabrication - All reinforcement shall be bent cold.
- C. Fabricating and Placing Tolerances:
  1. Reinforcing bars shall be fabricated in accordance with the standard fabricating tolerances in Fig. 4 and 5 of ACI 315 in ACI SP-66-04.

2. Reinforcement shall be placed to the tolerances indicated in ACI 301, Section 5.6.2.
3. When it is necessary to move bars to avoid interference with other reinforcement, conduits, or embedded items exceeding the specified placing tolerances, the resulting arrangement of bars shall be subject to acceptance by the Township Engineer.

D. Placing:

1. Minimum concrete cover for reinforcement shall be as indicated in ACI 301, Section 5.7.1.
2. All reinforcement, at the time concrete is placed, shall be free of mud, oil, or other materials that may adversely affect or reduce the bond. Reinforcement with rust, mill scale, or a combination of both shall be considered satisfactory provided the minimum dimensions, weight, and height of deformations of a hand-wire-brushed test specimen conform to ASTM A615 requirements.
3. All reinforcement shall be supported and fastened before concrete is placed and shall be secured against displacement.
4. Reinforcement supported from the ground shall rest on precast concrete blocks having a compressive strength equal to or greater than the specified compressive strength of the concrete being placed.
5. Reinforcement supported from formwork shall rest on bar supports made of concrete, metal, plastic, or other acceptable materials. Where the concrete surface will be exposed to the weather in the finished structure, the portions of all bar supports within 1/2 in. of the concrete surface shall be noncorrosive or protected against corrosion.
6. Welded wire fabric for slabs on grade shall extend to within 4 in. of the concrete edge. Welded wire fabric shall be adequately supported during placing of concrete to assure proper positioning in the slab. Hooking and lifting from the ground to place mesh will not be permitted.
7. Templates shall be furnished for placement of all column dowels and anchor bolts.
8. All splices shall be as indicated on the Drawings.
9. Bending or straightening of bars partially embedded in concrete shall not be permitted.

3.04 JOINTS AND EMBEDDED ITEMS

A. Construction, Control, and Expansion Joints:

1. Joints shall be located as indicated on the Drawings.
2. The surface of the concrete at all joints shall be thoroughly cleaned and all

laitance removed prior to placing adjoining concrete.

3. Joints shall be constructed in accordance with the Drawings.
4. Expansion material shall be held flush (or recessed to receive sealant) to all finished surfaces of the concrete.

B. Waterstops:

1. Each piece of premolded waterstop shall be of maximum practicable length in order that the number of end joints will be held to a minimum.
2. Joints at intersections and at ends of pieces shall be made in the manner most appropriate to the material being used. Joints shall develop effective watertightness fully equal to that of the continuous waterstop material, shall permanently develop not less than 50 percent of the mechanical strength of the parent section, and shall permanently retain their flexibility.

C. Other Embedded Items:

1. All sleeves, inserts, anchors, and embedded items required for adjoining work or for its support shall be placed prior to concreting.
2. All Contractors whose work is related to the concrete or must be supported by it shall be given ample notice and opportunity to introduce and/or furnish embedded items before the concrete is placed.

- D. Placing Embedded Items - Expansion joint material, waterstops, and other embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

### 3.05 PRODUCTION OF CONCRETE

- A. Production Method - All concrete shall be ready-mixed concrete batched, mixed and transported in accordance with ASTM C94. Plant equipment and facilities shall conform to "Certification of Ready-Mixed Concrete Production Facilities (Checklist with Instructions)" of the National Ready-Mixed Concrete Association.

B. Control of Admixtures:

1. Air-entraining admixtures and other required and/or approved admixtures shall be charged into the mixer as solutions and shall be measured by means of an acceptable mechanical dispensing device. The liquid shall be considered a part of the mixing water. Admixtures that cannot be added in solution may be weighed or may be measured by volume if so recommended by the manufacturer.
2. If two or more admixtures are used in the concrete, they shall be added separately to avoid possible interaction that might interfere with the efficiency of either admixture or adversely affect the concrete.

3. Addition of retarding admixtures shall be completed within 1 minute after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first.

C. Tempering and Control of Mixing Water:

1. Concrete shall be mixed only in quantities for immediate use. Concrete which has set shall be discarded and shall not be retempered.
2. When concrete arrives at the project with slump below that suitable for placing, as indicated by the Specifications, water may be added only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded. The water shall be incorporated by additional mixing equal to at least half of the total mixing required. Discharge of the concrete shall be completed within 1-1/2 hours, or before the truck drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates. Truck batch slips must include time of batching, total drum revolutions upon arrival at site, and quantity of water (in gallons) per cubic yard available to be added to attain the maximum design water-cement ratio.

D. Weather Conditions:

1. In cold weather, the temperature of the concrete when delivered at the site of the work shall conform to the temperature limitations in the following table:

Air Temperature, deg F	Minimum concrete temperature, deg F	
	For sections with a least dimension less than 12 in.	For sections with a least dimension 12 in. or greater
30 to 45	60	50
0 to 30	65	55
Below 0	70	60

2. If water or aggregate is heated above 100°F, the water shall be combined with the aggregate in the mixer before cement is added. Cement shall not be mixed with water or with mixtures of water aggregate having a temperature greater than 100°F.
3. Hot Weather - The ingredients shall be cooled before mixing, or flake ice or well-crushed ice of a size that will melt completely during mixing may be substituted for all or part of the mixing water if, due to high temperature, low slump, flash set or cold joints are encountered.

### 3.06 PLACING

#### A. Preparation Before Placing:

1. Hardened concrete and foreign materials shall be removed from the inner surfaces of the conveying equipment.
2. Formwork shall be completed; snow, ice and water shall be removed; reinforcement shall be secured in place; expansion joint material, anchors, and other embedded items shall be positioned; and the entire preparation shall be accepted.
3. Concrete shall not be placed on frozen ground.
4. Concrete shall not be placed in standing water or on saturated surfaces unless specifically designed for such application (see Part 3.06 F.)

#### B. Conveying:

1. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner which will assure that the required quality of the concrete is maintained.
2. Conveying equipment shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or work day. Conveying equipment and operations shall conform to the following additional requirements:
  - a. Truck mixers, agitators and nonagitating units and their manner of operation shall conform to the applicable requirements of ASTM C94.
  - b. Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An acceptable arrangement shall be used at the discharge end to prevent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.
  - c. Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 ft. long and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.
  - d. Pumping or pneumatic conveying equipment shall be capable of pumping the specified mix with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete. The loss of slump in pumping or pneumatic conveying equipment shall not exceed 2 in. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy.

C. Depositing:

1. General - Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be located as indicated on the Drawings. Placing shall be carried on at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened or has been contaminated by foreign materials shall not be deposited. Temporary spreaders in forms shall be removed when the concrete placing has reached an elevation rendering their service unnecessary. They may remain embedded in the concrete only if made of metal or concrete and if prior acceptance has been obtained.
2. Placing - Placing of concrete in supported elements shall not be started until the concrete previously placed in columns and walls is no longer plastic and has been in place at least two hours.
3. Segregation - Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to any procedure which will cause segregation.
4. Consolidation - All concrete shall be consolidated by vibration, spading, rodding or forking so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone pockets which may cause honey-combing, pitting, or planes of weakness. Internal vibrators used shall be the largest size and the most powerful that can be properly used in the work. They shall be operated by competent workmen. Use of vibrators to transport concrete within forms shall not be allowed. Vibrators shall be inserted and withdrawn at points approximately 18 in. apart. At each insertion, the duration shall be sufficient to consolidate the concrete but not sufficient to cause segregation, generally from 5 to 15 seconds. A spare vibrator shall be kept on the job site during all concrete placing operations. Where the concrete is to have an as-cast finish, a full surface of mortar shall be brought against the form by the vibration process, supplemented if necessary by spading to work the coarse aggregate back from the formed surface.

D. Protection:

1. Unless adequate protection is provided, concrete shall not be placed during rain, sleet, or snow.
2. Rainwater shall not be allowed to increase the mixing water nor to damage the surface finish.
3. The temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set, or cold joints and should not exceed 90°F. When the temperature of the steel is greater than 120°F, steel forms and reinforcement shall be sprayed with water just prior to placing the concrete.

E. Bonding:

1. The hardened concrete of construction joints and of joints between footings and walls or columns, between walls or columns and beams or floors they support, joints in unexposed walls and all others not mentioned below shall be dampened (but not saturated) immediately prior to placing of fresh concrete.
2. The hardened concrete of horizontal construction joints in exposed work; horizontal construction joints in the middle of beams, girders, joists, and slabs; and horizontal construction joints in work designed to contain liquids shall be dampened (but not saturated) and then thoroughly covered with a coat of cement grout of similar proportions to the mortar in the concrete. The fresh concrete shall be placed before the grout has attained its initial set.

- F. Concreting Under Water - When necessary and as approved by the Township Engineer, concrete may be deposited under water in a way that the fresh concrete enters the mass of previously placed concrete from within, causing water to be displaced with minimum disturbance at the surface of the concrete.

3.07 REPAIR OF SURFACE DEFECTS

- A. General - Surface defects, including tie holes, shall be repaired immediately after form removal.

B. Repair of Defective Areas:

1. All honeycombed and other defective concrete shall be removed down to sound concrete. If chipping is necessary the edges shall be perpendicular to the surface or slightly undercut. No feathered edges will be permitted. The area to be patched and an area at least 6 in. wide surrounding it shall be dampened to prevent absorption of water from the patching mortar. A bonding grout shall be prepared using a mix of approximately 1 part cement to 1 part fine sand passing a No. 30 mesh sieve, mixed to the consistency of thick cream, and then well brushed into the surface.
2. The patching mixture shall be made of the same materials and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 2-1/2 parts sand by damp loose volume. White portland cement shall be substituted for a part of the gray portland cement on exposed concrete in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch. The quantity of mixing water shall be no more than necessary for handling and placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.
3. After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to

leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, it shall be left undisturbed for at least 1 hr. before being finally finished. The patched area shall be kept damp for 7 days. Metal tools shall not be used in finishing a patch in a formed wall which will be exposed.

- C. Tie Holes - After being cleaned and thoroughly dampened, the tie holes shall be filled solid with patching mortar.
- D. Proprietary Materials - If approved by the Township Engineer, proprietary compounds for adhesion or as patching ingredients may be used in lieu of or in addition to the foregoing patching procedures. Such compounds shall be used in accordance with the manufacturer's recommendations. The contractor shall submit the manufacturer's specifications for such materials to the Township Engineer for approval prior to use.

### 3.08 FINISHING OF FORMED SURFACES

#### A. General:

1. After removal of forms the surfaces of concrete shall be given one or more of the finishes specified below in locations designated by the Drawings.
2. When finishing is required to match a small sample furnished to the Contractor, the sample finish shall be reproduced on an area at least 100 sq. ft. in an inconspicuous location designated by the Township Engineer before proceeding with the finish in the specified location.

#### B. As-Cast Finishes:

1. Rough form finish - No selected form facing materials shall be specified for rough form finish surfaces. Tie holes and defects shall be patched. Fins exceeding 1/4 in. in height shall be chipped off or rubbed off. Otherwise, surfaces shall be left with the texture imparted by the forms.
2. Smooth form finish - The form facing material shall produce a smooth, hard, uniform texture on the concrete. It may be plywood, tempered concrete-form-grade hardboard, metal, plastic, paper or other acceptable material capable of producing the desired finish. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to the practical minimum. It shall be supported by studs or other backing capable of preventing excessive deflection. Material with raised grain, torn surfaces, worn edges, dents, patches, or other defects which will impair the texture of the concrete surface shall not be used. Tie holes and defects shall be patched. All fins shall be completely removed.

#### C. Rubbed Finishes - The following finishes shall be produced on concrete with a smooth form finish (see Part 3.08.B.2 above). Where a smooth rubbed finish is to be applied, the forms shall have been removed and necessary patching completed as soon after placement as possible without jeopardizing the structure.

1. Smooth rubbed finish - Smooth rubbed finish shall be produced on newly

hardened concrete no later than the day following form removal. Surfaces shall be wetted and rubbed with carborundum brick or other abrasive until uniform color and texture are produced. No cement grout shall be used other than the cement paste drawn from the concrete itself by the rubbing process.

2. Grout cleaned finish - No cleaning operations shall be undertaken until all contiguous surfaces to be cleaned are completed and accessible. Cleaning as the work progresses shall not be permitted. Mix one part portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paint. White portland cement shall be substituted for a part of the gray portland cement in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout and apply the grout uniformly with brushes or a spray gun. Immediately after applying the grout, scrub the surface vigorously with a cork float or stone to coat the surface and fill all air bubbles and holes. While the grout is still plastic, remove all excess grout by working the surface with a rubber float, burlap, or other means. After the surface whitens from drying (about 30 minutes at normal temperatures), rub vigorously with clean burlap. The finish shall be kept damp for at least 36 hours after final rubbing.
  3. Cork floated finish - Remove forms at an early stage, within 2 to 3 days of placement where possible. Remove ties. Remove all burrs and fins. Mix one part portland cement and one part fine sand with sufficient water to produce a stiff mortar. Dampen wall surface. Apply mortar with firm rubber float or with trowel, filling all surface voids. Compress mortar into voids using a slow-speed grinder or stone. If the mortar surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with a fog sprayer. Produce the final texture with a cork float using a swirling motion.
- D. Unspecified Finish - If the finish is not designated on the Drawings, the following finishes shall be used as applicable:
1. Rough form finish - For all concrete surfaces not permanently exposed.
  2. Smooth rubbed finish - For all concrete surfaces permanently exposed.
- E. Related Unformed Surfaces - Tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be floated to a texture reasonably consistent with that of the formed surfaces. Final treatment on formed surfaces shall continue uniformly across the unformed surfaces.

### 3.09 SLABS

- A. General - Concrete for slabs shall be as specified in Part 3.01.
- B. Preparation Of Subgrade for Slabs on Ground:
  1. The subgrade shall be well drained and of adequate and uniform

loadbearing capacity. The minimum in-place density of the subgrade soils shall be not less than 95% of its maximum dry weight density at its optimum moisture content, plus or minus 2%, as determined by ASTM D698.

2. The subgrade shall be free of frost before concrete placing begins. If the temperature inside a building where concrete is to be placed is below freezing it shall be raised and maintained above 50°F long enough to remove all frost from the subgrade.
3. The subgrade shall be moist at the time of concreting. If necessary, it shall be dampened with water in advance of concreting, but there shall not be standing water on the subgrade nor any muddy or soft spots when the concrete is placed.

C. Edge Forms and Screeds:

1. Edge forms and intermediate screed strips shall be set accurately to produce the designated elevations and contours of the finished surface, and shall be sufficiently strong to support vibrating screeds or roller pipe screeds if the nature of the finish specified requires the use of such equipment. The concrete surface shall be aligned to the contours of screed strips by the use of strike-off templates or acceptable compacting type screeds.
2. When formwork is cambered, screeds shall be set to a like camber to maintain the proper concrete thicknesses.

D. Placement:

1. Mixing and placing shall be carefully coordinated with finishing. Concrete shall not be placed on the subgrade or forms more rapidly than it can be spread, straightedged, and darried or bull floated. These operations must be performed before bleeding water has an opportunity to collect on the surface.
2. To obtain good surfaces and avoid cold joints, the size of finishing crews shall be planned with due regard for the effects of concrete temperature and atmospheric conditions on the rate of hardening of the concrete.

E. Jointing - Joints in slabs on grade shall be located and detailed as indicated on the Drawings. If saw-cut joints are required, cutting shall be timed properly with the set of the concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking.

F. Consolidation - Concrete in slabs shall be thoroughly consolidated. Internal vibration shall be used in beams and girders of framed slabs and along the bulkheads of slabs on grade. Consolidation of slabs shall be obtained with vibrating screeds, roller pipe screeds, internal vibrators, or other acceptable means.

- G. Finishes - (See Part 3.09.I for Definitions of Tolerance Classes below):
1. Scratched finish - After the concrete has been placed, consolidated, struck off, and leveled to a Class C tolerance, the surface shall be roughened with stiff brushes or rakes before final set.
  2. Floated finish - After the concrete has been placed, consolidated, struck off, and leveled, the concrete shall not be worked further until ready for floating. Floating with a hand float or with a bladed power trowel equipped with float shoes, or with a powered disc float shall begin when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation. During or after the first floating, planeness of surface shall be checked with a 10-ft. straightedge applied at not less than two different angles. All high spots shall be cut down and all low spots filled during this procedure to produce a surface within Class B tolerance throughout. The slab shall then be refloated immediately to a uniform sandy texture.
  3. Troweled finish - The surface shall first be float-finished as specified in Part 3.09.G.2 above. It shall next be power troweled, and finally hand troweled. The first troweling after power floating shall produce a smooth surface which is relatively free of defects but which may still show some trowel marks. Additional trowelings shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be free of trowel marks, uniform in texture and appearance and shall be plane to a Class A tolerance, except tolerance for concrete on metal deck shall be Class B. On surfaces intended to support floor coverings, any defects of sufficient magnitude to show through the floor covering shall be removed by grinding.
  4. Broom or belt finish - Immediately after the concrete has received a float finish as specified in Part 3.09.G.2 above, it shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface.
- H. Unspecified Finish - When type of finish is not specified on the Drawings, the following finishes shall be used as applicable:
1. Scratched finish - For surfaces intended to receive bonded applied cementitious applications.
  2. Floated finish - For surfaces intended to receive roofing, waterproofing membranes, or sand bed terrazzo.
  3. Trowel finish - For floors intended as walking surfaces or for reception of floor coverings.
  4. Broom or belt finish - For sidewalks, garage floors, and ramps.

I. Finishing Tolerances:

1. Finishes with Class A tolerances shall be true planes within 1/8 in. in 10 ft., as determined by a 10-ft. straightedge placed anywhere on the slab in any direction.
2. Finishes with Class B tolerances shall be true planes within 1/4 in. in 10 ft., as determined by a 10-ft. straightedge placed anywhere on the slab in any direction.
3. Finishes with Class C tolerances shall be true planes within 1/4 in. in 2 ft., as determined by a 2-ft. straightedge placed anywhere on the slab in any direction.

3.10 CURING AND PROTECTION

A. General - Beginning immediately after placement, concrete shall be protected from premature drying, excessively hot or cold temperatures, and mechanical injury, and shall be maintained with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete.

B. Preservation of Moisture:

1. For concrete surfaces not in contact with forms, one of the following procedures shall be applied immediately after completion of placement and finishing:
  - a. Ponding or continuous sprinkling.
  - b. Application of absorptive mats or fabric kept continuously wet.
  - c. Application of sand kept continuously wet.
  - d. Continuous application of steam (not exceeding 150°F) or mist spray.
  - e. Application of waterproof sheet materials, conforming to ASTM C171.
  - f. Application of other acceptable moisture-retaining covering.
  - g. Application of a curing compound conforming to ASTM C309. The compound shall be applied in accordance with the recommendations of the manufacturer immediately after any water sheen which may develop after finishing has disappeared from the concrete surface. It shall not be used on any surface against which additional concrete or other material is to be bonded unless it is proven that the curing compound will not prevent bond, or unless positive measures are taken to remove it completely from areas to receive bonded applications.
2. Moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet

until they can be safely removed. After form removal the concrete shall be cured until the end of the time prescribed in Part 3.10.B.3 by one of the methods of Part 3.10.B.1.

3. Curing in accordance with Part 3.10.B.1 or 3.10.B.2 shall be continued for at least 7 days. Alternatively, if tests are made of cylinders kept adjacent to the structure and cured by the same methods, moisture retention measures may be terminated when the average compressive strength has reached 70 percent of the strength,  $f_c$ . Moisture retention measures may also be terminated when the temperature of the concrete is maintained at least at 50°F for the same length of time that laboratory-cured cylinders, representative of the concrete in-place, require to achieve 85 percent of  $f_c$ . If one of the curing procedures of Parts 3.10.B.1.a through 3.10.B.1.d is used initially, it may be replaced by one of the other procedures of Part 3.10.B.1 after the concrete is 1 day old provided the concrete is not permitted to become surface dry during the transition.

C. Temperature, Wind, and Humidity:

1. Cold weather - When the mean daily outdoor temperature is less than 40°F, the temperature of the concrete shall be maintained between 50° and 70°F for the required curing period of Part 3.10.B.3. When necessary, arrangements for heating, covering, insulating, or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature without injury due to concentration of heat. Combustion heaters shall not be used during the first 24 hr. unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.
2. Hot weather - When necessary, provision for windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as concrete hardening and finishing operations will allow.
3. Rate of temperature change - Changes in temperature of the air immediately adjacent to the concrete during and immediately following the curing period shall be kept as uniform as possible and shall not exceed 5°F in any 1 hr. or 50°F in any 24-hr. period.

- D. Protection from mechanical injury - During the curing period, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials or methods, by application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete.

3.11 TESTING

- A. General - Concrete materials and operations may be tested and inspected as the work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the Township Engineer for final acceptance.

- B. Testing Services - The following testing services shall be performed by the designated testing agency in accordance with ASTM E329 if required by the Township Engineer:
1. Conduct strength tests of the concrete during construction in accordance with the following procedures:
    - a. Secure composite samples in accordance with ASTM C172. Each sample shall be obtained from a different batch of concrete on a random basis, avoiding any selection of the test batch other than by a number selected at random before commencement of concrete placement.
    - b. Mold and cure three specimens from each sample in accordance with ASTM C31. Any deviations from the requirements of this Standard shall be recorded in the test report.
    - c. Test specimens in accordance with ASTM C39. Two specimens shall be tested at 28 days for acceptance and one shall be tested at 7 days for information. The acceptance test results shall be the average of the strengths of the two specimens tested at 28 days. If one specimen in a test manifests evidence of improper sampling, molding or testing, it shall be discarded and the strength of the remaining cylinder shall be considered the test result. Should both specimens in a test show any of the above defects, the entire test shall be discarded.
    - d. Make at least one strength test for each 50 cu. yd., or fraction thereof, of each mixture design of concrete placed in any 1 day. When the total quantity of concrete with a given mixture design is less than 20 cu. yd., the strength tests may be waived by the Township Engineer if adequate evidence of satisfactory strength is provided, such as strength test results for the same kind of concrete supplied on the same day and under comparable conditions to other work or other projects.
  2. Determine slump of the concrete sample for each strength test and whenever consistency of concrete appears to vary, using ASTM C143.
  3. Determine air content of the concrete sample for each strength test in accordance with either ASTM C231, ASTM C173, or ASTM C138.
  4. Determine temperature of the concrete sample for each strength test.
- C. Additional Services When Required - The following services shall be performed by the testing agency if required by the Township Engineer:
1. Inspect concrete batching, mixing and delivery operations to the extent deemed necessary by the Township Engineer.
  2. Sample concrete at point of placement and perform required tests.
  3. Review the manufacturer's report for each shipment of cement and reinforcing steel and conduct laboratory tests or spot checks of the

materials as received for compliance with specifications.

4. Mold three specimens from each sample (in addition to those required in Part 3.11.B.1.b above) in accordance with ASTM C31 and field cure in or on the structure providing the same method of cure for the specimens as that which the structure receives.

D. Other Services As Needed - The following services shall be performed by the testing agency if required by the Township Engineer:

1. Additional testing and inspection required because of changes in materials or proportions requested by the Contractor.
2. Additional testing of materials or concrete occasioned by their failure by test or inspection to meet specification requirements.

E. Duties and Authorities of Designated Testing Agency:

1. Representatives of the agency shall inspect, sample and test the materials and the production of concrete as required by the Township Engineer. When it appears that any material furnished or work performed by the Contractor fails to fulfill specification requirements, the testing agency shall report such deficiency to the Township Engineer and the Contractor.
2. The agency shall report all test and inspection results to the Township Engineer and Contractor immediately after they are performed. All test reports shall include the exact location in the work at which the batch represented by a test was deposited. Reports of strength tests shall include detailed information on storage and curing of specimens prior to testing.
3. The testing agency and its representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of these specifications, nor to approve or accept any portion of the work.

F. Responsibilities and Duties of Contractor:

1. The Contractor shall provide the necessary testing services for the following:
  - a. Qualification of proposed materials and the establishment of mixture designs.
  - b. Other testing services needed or required by the Contractor.
2. The use of testing services shall in no way relieve the Contractor of the responsibility to furnish materials and construction in full compliance with these specifications.
3. To facilitate testing and inspection, the Contractor shall:
  - a. Furnish any necessary labor to assist the testing agency in obtaining

and handling samples at the project or other sources of materials.

b. Advise the testing agency sufficiently in advance of operations to allow for completion of quality tests and for the assignment of personnel.

c. Provide and maintain for the sole use of the testing agency adequate facilities for safe storage and proper curing of concrete test specimens on the project site for the first 24 hrs. as required by ASTM C31.

### 3.12 EVALUATION AND ACCEPTANCE OF CONCRETE

#### A. Evaluation of Test Results:

1. Test results for standard molded and standard cured test cylinders shall be evaluated separately for each specified concrete mixture design. Such evaluation shall be valid only if tests have been conducted in accordance with procedures specified in Part 3.11 above.
2. For evaluation, each specified mixture design shall be represented by at least five tests.

#### B. Acceptance of Concrete - The strength level of the concrete will be considered satisfactory so long as the averages of all sets of three consecutive strength test results equal or exceed the specified strength $f_c$ , and no individual strength test result falls below the specified strength $f_c$ by more than 500 psi.

#### C. Testing of Concrete In Place:

1. Testing by impact hammer, sonoscope, or other nondestructive device may be permitted by the Township Engineer to determine relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other test data, shall not be used as a basis for acceptance or rejection.
2. Core tests
  - a. Where required, cores at least 2 in. in diameter shall be obtained and tested in accordance with ASTM C42. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60° to 80°F, relative humidity less than 60 percent) for 7 days before testing and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be tested after moisture conditioning in accordance with ASTM C42.
  - b. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores shall be determined by the Township Engineer to least impair the strength of the structure. If, before testing, one or more of the cores shows evidence of having been damaged subsequent to or during removal from the structure, it shall be replaced with a new core.
  - c. Concrete in the area represented by a core test will be considered

adequate if the average strength of the cores is equal to at least 85 percent of specified strength  $f'_c$  and if no single core is less than 75 percent of the specified strength  $f'_c$ .

d. Core holes shall be filled with low slump concrete or mortar. See Section 3.07, Repair of Surface Defects.

### 3.13 ACCEPTANCE OF STRUCTURE

#### A. General:

1. Completed concrete work which meets all applicable requirements will be accepted without qualification.
2. Completed concrete work which fails to meet one or more requirements but which has been repaired to bring it into compliance will be accepted without qualification.
3. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected as provided in these Specifications. In this event, modifications may be required to assure that the work complies with the design intent.

#### B. Dimensional Tolerances:

1. Formed surfaces resulting in concrete outlines smaller than permitted by the tolerances of Section 4.3.1 of ACI 301 shall be considered potentially deficient in strength and subject to the provisions of Part 3.13.D.
2. Formed surfaces resulting in concrete outlines larger than permitted by the tolerances of Section 4.3.1 of ACI 301 may be rejected and the excess material shall be subject to removal. If removal of the excess material is permitted, it shall be accomplished in such a manner as to maintain the strength of the section and to meet all other applicable requirements of function and appearance.
3. Concrete members cast in the wrong location may be rejected if the strength, appearance or function of the structure is adversely affected or misplaced items interfere with other construction.
4. Inaccurately formed concrete surfaces exceeding the limits of Section 4.3.1 of ACI 301, and which are exposed to view, may be rejected and shall be repaired or removed and replaced if required.
5. Finished slabs exceeding the tolerances of Part 3.09.I. may be repaired provided that strength or appearance is not adversely affected. High spots may be removed with a terrazzo grinder, low spots filled with a patching compound, or other remedial measures performed as permitted.

#### C. Appearance:

1. Other concrete exposed to view with defects which adversely affect the

appearance of the specified finish may be repaired only by acceptable methods.

2. Concrete not exposed to view is not subject to rejection for defective appearance.

D. Strength of Structure:

1. The strength of the structure in place will be considered potentially deficient if it fails to comply with any requirements which control the strength of the structure, including but not necessarily limited to the following conditions:
  - a. Low concrete strength as designated in Part 3.12.
  - b. Reinforcing steel size, quantity, strength, position, or arrangement at variance with the requirements of Part 3.03, Reinforcement, or the Drawings.
  - c. Concrete which differs from the required dimensions or location in such a manner as to reduce the strength.
  - d. Curing less than that specified.
  - e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
  - f. Mechanical injury (as defined in Part 3.10.D.), construction fires, accidents or premature removal of formwork likely to result in deficient strength.
  - g. Poor workmanship likely to result in deficient strength.
2. Structural analysis and/or additional testing may be required when the strength of the structure is considered potentially deficient.
3. Core tests in accordance with Part 3.12.C.2 may be required when the strength of the concrete in place is considered potentially deficient.
4. If core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be required and their results evaluated in accordance with ACI 318.
5. Concrete work judged inadequate by structural analysis or by results of a load test shall be reinforced with additional construction if so directed by the Township Engineer, or shall be replaced.
6. The Contractor shall pay all costs incurred in providing the additional testing, analysis and/or engineering services required by this section.

END OF SECTION

## SECTION 03300

### CONCRETE FOR UTILITY CONSTRUCTION

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Work of this section includes, but is not limited to:
  - 1. Cast-in-place Cement Concrete Construction
  - 2. Reaction and Support Blocking
  - 3. Cradles and Encasement
  
- B. Related Work specified elsewhere:
  - 1. Sections 02221a&b - Trenching, Backfilling & Compacting
  - 2. Section 02575 - Trench Paving and Restoration
  - 3. Section 02601a&b - Manholes
  - 4. Section 02603 - Storm Inlets, Catch Basins, Endwalls
  - 5. Section 02610 - Sanitary Sewer Pipe
  - 6. Section 03000 - Plain and Reinforced Cement Concrete
  
- C. Applicable Standard Details:
  - 1. 5119A Type A Drop Manhole Detail, PVC Pipe
  - 2. 5120A Type B Drop Manhole Detail, PVC Pipe
  - 3. 5179 Concrete Cradle and Encasement Details
  - 4. 5187A Sloped Riser Lateral Detail
  - 5. 5187B Vertical Riser Lateral Detail
  - 6. 5195 Thrust Block for Vertical Bends
  - 7. 5196 Thrust Block for Bends, Tees, Caps
  - 8. 03300-1 Concrete Anchor Details
  - 9. 03300-2 Thrust Blocking Details

##### 1.02 QUALITY ASSURANCE

- A. Inspections. Inspections will, at a minimum, be made of the Subgrade, formwork, supports, and reinforcement prior to placement of the concrete; and of the concrete prior to backfilling.

##### 1.03 REFERENCES

- A. Pennsylvania Department of Transportation (PennDOT): Publication 408/2007 Specifications.
  
- B. All materials used in the PennDOT Road right-of-way must be from a certified PennDOT supplier.

- C. American Society for Testing and Materials (ASTM):
  - 1. ASTM A615 Deformed and Plain Billet - Steel Bars for Concrete Reinforcement
  - 2. ASTM C31 Methods of Making and Curing Concrete Test Specimens in the Field
  - 3. ASTM C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
  - 4. ASTM C42 Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
  - 5. ASTM C94 Ready Mixed Concrete
  - 6. ASTM C143 Test Method for Slump of Portland Cement Concrete
  - 7. ASTM C172 Method of Sampling Fresh Concrete
  - 8. ASTM C173 Test Method for Air Content of Freshly Mixed Concrete - Volumetric Method
  - 9. ASTM C231 Test Method for Air Content of Freshly Mixed Concrete - Pressure Method

#### 1.04 SUBMITTALS

- A. Submit certification from the concrete producer attesting that the cement concrete conforms to the State Specifications for the class of concrete being used.
- B. Submit certified results of compressive strength tests performed by an independent testing laboratory.
- C. Submit detailed shop drawings of reinforcing steel.

### PART 2 - PRODUCTS

#### 2.01 CEMENT CONCRETE

- A. Ready-mixed, conforming to Section 704, cement concrete, Pub. 408/2007 Specifications.
- B. Requirements for State approved batch plants, design computations and plant inspection shall not apply; the acceptability of concrete will be based on conformance with the Cement Concrete Criteria specified below and the results of the specified tests.
- C. Cement Concrete Criteria:
  - 1. Class A:
    - a. 28-day compressive strength: 3300 psi
    - b. Slump: 1 to 3 inches

2. Class C:
  - a. 28-day compressive strength: 2000 psi
  - b. Slump: 2 to 6 inches
3. High Early Strength:
  - a. 3-day compressive strength: 3000 psi
  - b. Slump: 1 to 3 inches
4. Cement Factor and Maximum Water-Cement Ratio conforming to Table A, Section 704.1(b), Pub. 408/2007 Specifications.

## 2.02 REINFORCEMENT STEEL

- A. Reinforcement Bars:
  1. New billet-steel bars conforming to ASTM A615.
  2. Deformed, Grade 60.
- B. Steel Wire Fabric: Conforming to Section 709.3, Pub. 408/2007 Specifications.

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. Comply with applicable paragraphs of Section 1001, Pub. 408/2007 Specifications for construction requirements including formwork, curing, protection and finishing of cement concrete.
- B. Excavate and shape trench bottoms and sides to accommodate thrust block forms, encasement, manhole bases, inlets and vaults in accordance with Section 02221a Parts as applicable.
- C. Support pipe, valves and fittings at the required elevation with brick or concrete block. Do not use earth, rock, wood, or organic material as supports.
- D. Proper grade markers or stakes shall be used by Developer to establish grades for ramps, platforms, sidewalks, slopes to drains and inlets.

### 3.02 CONSTRUCTION

- A. Construct cast-in-place vaults, inlets, endwalls, curbs, sidewalks and miscellaneous reinforced structures of Class A concrete; Class A concrete shall be central-plant-mixed.
- B. Construct reaction and support blocking, cradles, encasements, and miscellaneous mass concrete of Class C concrete; Class C concrete may be from a mobile cement concrete plant or truck-mixed.
- C. Concrete Curbs:

1. Construct of Class A concrete with air entrainment, where indicated on Drawings; use expansion material between curbs and sidewalks and at control joints.
  2. Curbs shall include one construction joint every 10' and one expansion joint every 30'.
  3. Concrete curbs shall be installed according to local Government requirements.
- D. Construct reinforced and plain cement concrete roadway pavements and base courses of High Early Strength concrete; High Early Strength concrete shall be central-plant-mixed.
  - E. Provide spacers, chairs, bolsters, ties and other devices for properly placing, spacing, supporting and fastening reinforcement in place.
  - F. Place concrete utilizing all possible care to prevent displacement of pipe or fittings; return displaced pipe or fittings to line and grade immediately.
  - G. Insure tie rods, nuts, bolts and flanges are free and clear of concrete.
  - H. Do not backfill structures until concrete has achieved its initial set, forms are removed, and concrete work is inspected by the Township's Engineer.
  - I. Perform backfilling and compaction as specified in Section 02221a - Trenching, Backfilling and Compacting, Part 3.07.

### 3.03 FINISHING

- A. Integral Finishes: Obtain finishes on concrete slabs without applying separate topping coat, as follows.
  1. Broom Finish: Draw stiff broom over previously floated finish, to obtain non-slip finish, on exterior sidewalks, ramps, stairs, pads and similar locations.

### 3.04 FIELD TESTS OF CONCRETE DURING CONSTRUCTION

- A. Perform compressive strength tests, slump tests, and air content tests for each 50 cubic yards of each class of structural concrete placed, or fraction thereof. Testing is not required for non-structural applications such as sidewalks and other such uses.
- B. Retain an independent testing laboratory to test cylinders.
- C. Keep a slump cone and an air meter in close proximity to all concrete placements.
- D. Sample concrete in accordance with ASTM C172.
- E. Determine slump in accordance with ASTM C143.

- F. Determine air content in accordance with ASTM C231 or ASTM C173 as applicable.
- G. Test Cylinders:
  - 1. Cast at least 5 cylindrical test specimens for each batch.
  - 2. Test two cylinders at 7 days; test two cylinders at 28 days.
  - 3. Hold the remaining cylinder in reserve for testing in the event that any of the other cylinders are damaged prior to testing.
  - 4. Prepare and cure test cylinders in accordance with ASTM C31.
  - 5. Determine concrete compressive strength in accordance with ASTM C39.
  - 6. Compute and evaluate in accordance with ASTM C94.
- H. If test cylinders fail to meet compressive strength requirements, the Township may require additional core tests in accordance with ASTM C42 at the expense of the Developer.

END OF SECTION

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## SECTION 03400

### PRECAST CONCRETE STRUCTURES

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Work of this section includes, but is not limited to:
  - 1. Pump Stations
- B. Related Work Specified Elsewhere:
  - 1. Section 02220 - Earthwork

##### 1.02 QUALITY ASSURANCE

- A. Design Criteria:
  - 1. Watertight precast reinforced air-entrained concrete structures designed to ASTM C890 A-16 live loading and installation conditions, and manufactured to conform to ASTM C913.
  - 2. Minimum 28-day Compressive Strength: 5,000 psi
  - 3. Honeycombed or retempered concrete will not be acceptable.
- B. Reference Standards:
  - 1. American Society for Testing and Materials (ASTM):
    - a. A185 Specification for Welded Steel Wire Fabric for Concrete Reinforcement
    - b. A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
    - c. C33 Specifications for Concrete Aggregate
    - d. C150 Specification for Portland Cement
    - e. C260 Specification for Air-Entraining Admixtures for Concrete
    - f. C858 Underground Precast Concrete Utility Structures
    - g. C890 Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
    - h. C891 Practice for Installation of Underground Precast Concrete Utility Structures
    - i. C913 Specifications for Precast Concrete Water and Wastewater Structures.
    - j. C990 Specifications for Joints for concrete Pipe, Manholes, and Precast box Sections Using Preformed Flexible Joints Sealants
- C. The precast concrete structures shall have sufficient weight to counteract the buoyancy uplift from ground water that is at a level equal to the top of the

structures with a factor of safety of 1.5. Provide calculations demonstrating this requirement is being met. The Developer shall add additional weight as needed by installing a poured-in-place anchoring collar that is structurally anchored to the precast structure via screwed in dowel rods.

### 1.03 SUBMITTALS

- A. Shop Drawings and Product Data:
  - 1. Submit detailed shop drawings to the Township for approval prior to fabrication.
  - 2. Include details of reinforcing steel, joint design, concrete mix design, and loading calculations.
- B. Submit certification from the precast structures manufacturer attesting that the structures meet or exceed Specifications.

### 1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Transport and handle precast concrete units with equipment designed to protect the units from damage.
- B. Do not place units in position which will cause overstress, warp or twist.
- C. Separate stacked members with battens across the full width of each bearing point.
- D. Stack so that lifting devices are accessible and undamaged, and identification marks are discernible.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Portland Cement: ASTM C150, Type II
- B. Coarse Aggregates: ASTM C33; Graded 1" to No. 4 Sieve.
- C. Sand: ASTM C33; 2.35 fineness modulus
- D. Water: Potable; clean and free of injurious amounts of acids, alkalis, salts, organic materials, or other substances that may be incompatible with concrete or steel.
- E. Air-Entraining Admixtures: ASTM C260

- F. Reinforcing Steel:
  - 1. Deformed Bars: ASTM A615, Grade 40
  - 2. Welded Wire Fabric: ASTM A185

- G. Joint Sealant:
  - 1. ASTM C990

## 2.02 MIXES

- A. Design concrete mix to produce the required concrete strength, air-entrainment, watertight properties, and loading requirements.

## 2.03 FABRICATION AND MANUFACTURE

- A. Fabricate precast reinforced concrete structures in accordance with ASTM C913, to the dimensions indicated on the Drawings, and to the specified design criteria.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Unless otherwise specified herein below, the precast units shall be installed in accordance with ASTM C891.
- B. Install precast concrete units to the elevation and location indicated on the Drawings.
- C. Install required pipe connections, valves, baffles and other appurtenances as indicated on the Drawings.

### 3.02 BACKFILLING STRUCTURES

- A. Do not backfill precast concrete structures until after examination and approval of the Township.
- B. Backfill structures in accordance with Section 02220 - Earthwork.

END OF SECTION

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SECTION 16500  
STREET LIGHTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work of this section includes, but is not limited to installation of conduits, poles, controls, lighting fixtures, lamps and wire necessary for a complete and functioning street light system.

B. Related work specified elsewhere:

- |  |                |
|--|----------------|
| 1. Trenching, backfilling, and compacting: | Section 02221a |
| 2. Trench Paving and restoration:          | Section 02575  |
| 3. Plain and reinforced cement concrete:   | Section 03000  |
| 4. Concrete for utility construction:      | Section 03300  |

C. Definitions: NONE

D. Applicable Standard Details

- 16500-1 Street Lighting Installation Details
- 16500-2 Street Light Pole Type 1
- 16500-3 Street Light Assembly
- 16500-4 Street Light Fixture

1.02 QUALITY ASSURANCE

A. Reference Standards

- |       |   |
|-------|---|
| ANSI  | American National Standards Institute           |
| ASTM  | American Society for Testing and Materials      |
| NEMA  | National Electrical Manufacturers Association   |
| NECS  | National Electric Safety Code                   |
| NFPA  | National Fire Protection Association            |
| UL    | Underwriters' Laboratories, Inc.                |
| IES   | Illuminating Engineering Society                |
| IEEE  | Institute of Electrical & Electronics Engineers |
| IPCEA | Insulated Power Cable Engineers Association     |
| OSHA  | Occupational Safety & Health Administration     |
| NEC   | National Electrical Code                        |

B. Inspections

1. Upon completion of the work, customer/developer shall secure an electrical inspection from an electrical inspection agency acceptable to the Metropolitan Edison Company.

2. The Township will inspect, at a minimum, pole base and conduit installations as well as trench depth, backfill, and compaction of backfill.

C. Testing

1. All electrical conductors, after installation of wiring and apparatus has been completed, shall be tested by this Contractor to insure continuity, proper splicing, freedom from ground (except "made ground" and those required for protection) and insulation resistance in accordance with Underwriters requirements. This Contractor shall furnish and employ suitable instruments such as ammeters, volt meters, meggars, etc. Preliminary testing with magnetos will be permitted but will not be accepted as a final or conclusive test.
2. Prior to testing or adjusting, this Contractor shall consult with the Township Engineer to determine the intended function of any equipment, wiring or systems. This Contractor shall then perform such tests and make the necessary adjustments to ensure that the required function is obtained.
3. Where specific tests are specified to be performed on equipment or materials, test records shall be made by the Contractor in a neat and legible form on 8-1/2" paper. Records shall properly identify the location and type of equipment or system, the test date, and the name of person performing the tests. Three copies shall be delivered to the Township at the completion of the test.
4. Equipment and wiring systems not specified as requiring a specific test shall be tested in operation to determine that all design functions are satisfactorily performed.

1.03 SUBMITTALS

- A. Provide material analysis for test reports to Township Engineer upon request.
- B. Provide documentation of materials placed to the Inspector on site or as otherwise directed by the Township Engineer.

1.04 JOB CONDITIONS

A. Codes and Standards

1. All electrical Work shall meet the requirements of the National Electric Code of the National Fire Protection Association. In addition, any state, municipal or other authorities laws, rules or regulations applicable to the work shall be followed.
2. Where applicable, all materials and equipment shall bear the label of approval of the Underwriters Laboratory, Inc.
3. Reference to the codes and standards listed herein shall constitute the minimum acceptable requirements. Where drawings and specification requirements exceed those of the codes listed herein, Contractor shall follow the drawings and specifications.

1.05 COORDINATION - DEVELOPMENT STREET LIGHTING

- A. Met-Ed's street lighting service is only available to the Township. The developer must coordinate street lighting requests with the Township Engineer and all street lighting must conform to the Township's and Met-Ed's street lighting specifications.
- B. Customer/developer provides Met-Ed with a preliminary plan showing proposed locations(s) of street light standards. Met-Ed does not design or approve design of street lighting systems.
- C. Met-Ed returns plan showing the available source(s) for the street light feed(s) and, if not previously provided, this document which lists material requirements.
- D. Customer/developer shall provide street light luminaire(s) which is (are) equipped to operate with the material, as specified herein and as approved by Met-Ed.
- E. Requirements:
  - 1. Street lights shall be spaced at intervals of approximately 200 feet. Minor adjustments to spacing may be made to accommodate lot lines, driveways, etc.
  - 2. Customer/developer provides Met-Ed with a final plan showing location of facilities (street light, service equipment, conduit and cable routing, etc.) and size and type of cables and fusing.
  - 3. Prior to excavating, the contractor will call the PA OneCall System.
  - 4. Customer/developer installs facilities in accordance with requirements of Met-Ed, the Township, the manufacturer, the National Electric Code, and final plan. The customer/developer is required to provide and/or install:
    - a. All trenching and backfilling, including service cable from source to junction box.
    - b. All cable, conduit, foundations, standards, luminaires, lamps, and photoelectric controls as per developer agreement with municipality.
    - c. Service equipment at each source location designated by Met-Ed to facilitate street lighting cable connections.
  - 5. Customer/developer shall secure an electrical inspection from a Met-Ed accepted electrical inspection agency before Met-Ed will energize.
  - 6. Upon receipt of a street lighting agreement from the municipality and the electrical inspection certificate, Met-Ed will:
    - a. Install service to the line side of the service equipment.
    - b. Install on each streetlight standard and identification tag to show grid location and an additional tag to show the maintenance agreement, lamp type and size.

7. Refer to examples on Detail 16500-1, "Street Lighting Installation Detail".
8. Note that a contract for energy and maintenance of sodium vapor fixtures with Township and Met-Ed is required prior to Met-Ed energizing the street lighting system.

1.06 CALCULATIONS

- A. Voltage drop shall be calculated to ensure voltage drop will not exceed the requirements of the National Electrical Code.
- B. Point by point footcandle calculations shall be performed to ensure light distribution conforms to IES recommendations.

PART 2 - PRODUCTS

2.01 LAMPS

- A. High pressure sodium meeting the following requirements:

Lamp Watts:	150W residential, 250W commercial
Ballast Code:	Multi-Tap, HPF, ballast as compatible to the luminaire
Lamp Volts:	55V
Light Center Length:	5"
Burning Position:	Any

2.02 BALLASTS

- A. HID Fixture Ballasts: HID fixture ballasts shall conform to the following:

High power factor.  
 No inrush current condition.  
 Current during warm-up shall be less than normal operating current.  
 Lamp starting to -20 degrees F. for outdoor ballasts.  
 Input line voltage range plus or minus 10 percent, minimum.  
 Fused, fuse located in hand hole at bottom of pole.  
 Manufacturer: Advance  
 Substitutions: General Electric Universal (or same manufacturer as lighting fixture manufacturer)

2.03 POLES

- A. Street Light Pole (Type 1, Detail 16500-2 and Type 2, Detail 16500-3)
  1. All poles shall have a hand hole near base of pole.
  2. All anchor bolt nuts shall be covered, either by metal pole base cover furnished with pole or by nut covers furnished by pole manufacturer.
  3. Lighting standards shall have each luminaire separately ballasted. Each ballast shall be separately fused with all fuses located near the hand hole of the pole base, where easily accessible.

4. Weep holes shall be provided in the base of the pole shaft to prevent any accumulation of water.
5. The pole base shall contain a hand hole sufficiently large to allow inspection of splices, ground connection, and fuses, and ability to repull circuitry between poles. A ground pad shall be welded inside, ground smooth and tapped to receive a 1/4-20 thread, for lugged connection to ground rod.
6. Pole finish shall be anodized aluminum black, unless otherwise approved by the Director of Public Works, and shall not be painted.
7. Pole shall be 12' high for residential and 14' high for commercial including base.
8. Manufacturer: HADCO P2071-14 (Commercial); HADCO P2070-12 (Residential) or HADCO CPO496A

#### 2.04 FUSE AND FUSE HOLDER

- A. Fuse and fuse holder for the fuse disconnect in the customer's junction box shall be per Met-Ed requirements, fuse size as required.

#### 2.05 STRUCTURAL

- A. All poles, concrete bases, fixtures shall be installed as an integral unit to withstand 100 mph winds, 120 mph gusts.
- B. All pole embedded depths and/or concrete bases shall be shown on the drawings, shall be designed by and the design drawings sealed by a Registered Engineer, taking into account soil conditions at the location of the pole.
- C. All dimensions of the pole, base plate, material type and thickness, and welding information shall appear on the shop drawings along with wind loading for pole and lighting fixture.

#### 2.06 PHOTO ELECTRIC CONTROL

- A. Photo electric controls must be suitable for use with an EEI-NEMA standard twist lock receptacle, shall have a maximum load capability of 1800 volt-amperes, shall be equipped with suitable type surge protection, and have the following characteristics:

Operating Voltage: 120V  
Voltage Range: 105-130V  
Time Delay: 10 Sec. Max.

#### 2.07 CONDUIT

- A. Polyvinyl Chloride (PVC) - Schedule 40 Extruded from virgin polyvinyl chloride compound.

Resistant to water, oil, outdoor aging, exposure to sunlight, underground environments, and corrosive atmospheres.

Flame retardant for use above ground, resistant to low temperatures, and resistant to distortion due to heat under conditions likely to be encountered in intended service.

Sufficient strength to withstand abuse, such as impact and crushing during handling, installation, and service. Ten foot lengths with one coupling furnished for each length.

Minimum size: 1 inch.

Each length clearly and durably marked with manufacturer's name. Markings shall be permanent for PVC used above ground.

PVC conduit shall be UL listed.

Comply with applicable ASTM testing procedures and specifications.

B. Fittings:

Conform to applicable PVC Conduit Specifications above.

2.08 WIRE

A. All wire and cable shall conform to the following:

Copper, not less than 98 percent conductivity.

Single conductor, unless otherwise indicated.  
Color coded.

Marked with classification type, conductor size, and voltage rating every foot, where applicable.

Minimum Size: #12 AWG, unless otherwise specified.

Sizes #8 and larger shall be stranded

UL listed.

B. Wire Specification No. 1

Type THW insulation, UL listed.

600 volt insulation.

Ampacity based upon maximum conductor temperature of 75 degrees C. in wet or dry locations, continuous operation.

Conform to ASTM B3 for solid conductors and ASTM B8 for stranded conductor.

Annealed, uncoated copper conductor.

Flame retardant, moisture and heat resistant thermoplastic (PVC) insulation.

C. Wire Specification No. 2

Type XHHW insulation, UL listed.

600 volt insulation.

Ampacity based upon maximum conductor temperature of 90 degrees C. dry locations and 75 degrees C. wet locations, continuous operation.

Moisture and heat resistant cross linked polyethylene (XLP) insulation.

Conform to applicable NEMA and IPCEA requirements.

Conform to ASTM B3 for solid conductors and ASTM B8 for stranded conductors.

Soft copper conductor.

D. Wire Specification No. 4

Type THHN/THWN insulation, UL listed.

600 volt insulation.

Ampacity based upon maximum conductor temperature of 90 degrees C. dry locations (THHN) and 75 degrees C. dry and wet locations (THWN), continuous operation.

Flame retardant, moisture and heat resistant thermoplastic (PVC) insulation with nylon jacket.

Soft copper conductor.

Conform to applicable NEMA and IPCEA requirements.

Conform to ASTM B3 for solid conductors and ASTM B8 for stranded conductors.

2.09 CONNECTORS

A. Connector Specification no. 1 - Splice Connectors

For insulated wire, 600 volt and under, #8 AWG and smaller.

Compression solderless connector.

Insulated or non-insulated.

UL listed.

B. Connector Specification No. 2 - Splice Connectors

For insulated wire, 600 volt and under, #6 AWG and larger.

Split bolt pressure connector.

Bronze.

UL listed.

C. Connector Specification No. 3 - Splice Connectors

For insulated wire, 600 volt and under, #6 AWG and larger.

Compression or crimp connector, short sleeve.

Copper.

UL listed.

D. Connector Specification No. 4 - Lug Connector

For insulated wire, 600 volt and under, #8 AWG and larger.

Compression or crimp connector, short sleeve.

Copper.

UL listed.

E. Connector Specification No. 5 - Lug Connector

For insulated wire, 600 volt and under, #8 AWG and larger.

Bolted type pressure connection, hex head or hex socket pressure bolts.

Copper.

UL listed.

F. Connector Specification No. 6 - Lug Connector

For insulated wire, 600 volt and under, #10 AWG and smaller.

Compression or crimp type.

Standard barrel, insulated for 600 volts.

Ring terminal or flanged or flared block spade terminal.

Copper.

UL listed.

G. Connector Application

Unless otherwise noted, connectors shall be used for insulated wire, 600 volts and under, as follows:

<u>Application</u>	<u>Connector Spec No.</u>
--------------------	---------------------------

Splice Connectors:

#8 AWG and smaller	1
#6 AWG and larger	2 or 3

Lug Connectors:

Stranded wire connection under head of binding screw or bolt	4 or 6
--	--------

Connection to screw or bolt terminals	4, 5, 6
---------------------------------------	---------

2.10 TAPE

- A. Tape specification No. 1 - Tape for Insulation 600 Volts or Less

Vinyl plastic all weather electrical tape.

- B. Tape specification No. 2 - Underground Marker Tape

Material: Red, plastic, 6 inches wide.

Marking: CAUTION - BURIED ELECTRIC LINE BELOW, or similar wording.

- C. Type Installation

Refer to Part 3 - Execution, this Section, for tape installation.

2.11 WIRE MARKERS

- A. Wire Marker Specification No. 2 - Vinyl plastic or vinyl polyester.

Temperature Range: to 250 degrees F.

Self-sticking adhesive backing.

Waterproof, solvent proof.

Printing permanently protected.

- B. Wire Marker Installation

Refer to Part 3 - Execution, this Section, for installation of wire markers.

## 2.12 GROUND RODS

### A. Type: High strength steel core.

Construction: Copper exterior welded to the steel core. Chamfered top to prevent mushrooming. Pointed end.

Minimum Diameter:

10 foot rod - 3/4 inch diameter.  
Above 10 feet - 1 inch diameter.

For lengths over 10 feet, sectional rods with steel driving bolt may be furnished.

## 2.13 GROUND CONNECTORS

### A. Ground Connector Specification No. 2

Type: Ground grid clamps. Compression connection to cable or rod.

High conductivity cast copper fittings.

Cable, rod, plate or combination connector, as required.

Suitable for direct burial or imbedded in concrete.

### B. Ground Connector Application

Unless otherwise noted, ground connectors shall be installed as follows:

Connection of ground wire or ground grid cable to ground rod, building steel or another ground grid cable.

## 2.14 LIGHTING FIXTURES

### A. Street Light Fixture

1. Volts: 120/240V
2. Mounting: Post-top
3. Type: High Pressure Sodium
4. Description: Cast aluminum, fully enclosed and gasketed. UL listed "suitable for wet locations". Traditional style with white diffuser.
5. Lamps: 150 watt (Residential) or 250 watt (Commercial) High Pressure Sodium
6. Manufacturer: HADCO C0496 (Residential); HADCO S5290 (Commercial)

## PART 3 - EXECUTION

### 3.01 RACEWAY INSTALLATION

- A. PVC conduit shall be installed as follows:
1. Expansion joints shall be installed where expansion and contraction of PVC occurs due to changing temperature conditions.
  2. Joints in PVC conduit runs shall be in accordance with manufacturer's recommendations.
  3. PVC conduit shall not be used where subject to ambient temperature exceeding those which conduit has been approved.
  4. Fittings as specified under Raceway Specification No. 4 shall be used when installing PVC conduit.
  5. Install ground wire, sized per NEC in all PVC conduit runs.
  6. Underground raceways or duct banks shall have a marker or warning tape installed above raceway, 12 inches below finished grade. Use Tape Specification No. 2. Duct banks with widths over 12 inches shall have 6 inch wide tape runs installed side-by-side on 12 inch (maximum) centers.

### 3.02 WIRING METHODS

- A. Wiring shall be installed in raceways unless otherwise noted.
- B. Use color coded wire throughout as required by National Electric Code for convenience in testing and maintenance. Neutral conductors shall be color coded neutral gray or white; grounding conductors shall be green.
- C. Pull wire into conduit so that insulation will not be damaged. Approved pulling compound shall be used to assist in pulling of 600 volt wire into conduit. Oil or grease will not be permitted. Pulling compound shall be compatible with wire insulation and conduit.
- D. Conductors shall be installed continuous from outlet to outlet, without splicing except within outlet or junction boxes.
- E. Noninsulated splices in insulated wire, 600 volts and under shall have insulation of a factory fabricated type or shall be insulated as follows:

Rubber and friction tape coated with Scotchkote or similar coating.

Scotchfil or equivalent electrical putty with tape as specified under Tape Specification No. 1.

Insulation of splices shall provide same insulation qualities as insulation of wire being spliced.

- F. Stranded wire shall not be placed under the head of a binding screw or bolt.

Refer to Part 2 - Products, this Section, for connectors used in stranded wire connections under head of binding screw or bolt.

- G. Wire shall be identified by use of wire markers at termination points, including outlet boxes, pull boxes, junction boxes, wireways and at locations where wire changes direction within an enclosure. Unless otherwise specified, wire markers shall be as specified under Wire Marker Specification No. 2.

### 3.03 GROUND ROD INSTALLATION

- A. Ground rods shall be installed as required by National Electric Code near the customer's junction box for the electrical service ground.
- B. Ground rods shall be driven to a depth so that top of rod is 2 feet below grade.

### 3.04 GROUNDING

#### A. Equipment Grounding

1. Unless otherwise specified, conductive noncurrent carrying electrical materials and equipment shall be grounded. Non-electrical items of equipment shall be grounded as indicated on Drawings. Grounding shall be in accordance with NEC requirements.
2. Grounding shall be by separate insulated grounding conductors pulled with phase conductors. Grounding system shall be electrically and mechanically continuous from all lighting poles and distribution equipment to service ground point.
3. Bonds and jumpers shall be furnished and installed where required during construction and where necessary to ensure both operation and safety.
4. Service ground point shall be ground rods near the customer's junction box.
5. Neutral conductors shall be continuous throughout system and shall be grounded only at the service neutral.
6. Ground wire shall be installed in all PVC raceway runs. Ground wires shall be insulated.

#### B. Grounding Tests

1. Ground resistance of service grounding point shall be inspected and shall not exceed values required by NEC. Inspection shall be made using two auxiliary ground rod (three point) method or other approved method. If resistance is found to be higher than that allowed by NEC, additional ground rods shall be driven until a resistance below allowed value is obtained.
2. Outside inspections shall not be performed during unusually wet conditions. Tests shall be made during dry weather conditions.

3. Complete inspection record shall be submitted to Township Engineer showing resistance values and calculations and shall indicate method of test.

3.05 EXCAVATION

- A. Excavate trenches and for pole bases as specified in Section 02221, Part 3.02. Provide 30" cover from the top of the conduit to the finished grade elevation.

3.06 PAVING AND RESTORATION

- A. Paving and restoration shall be as specified in Section 02575.

3.07 CONCRETE

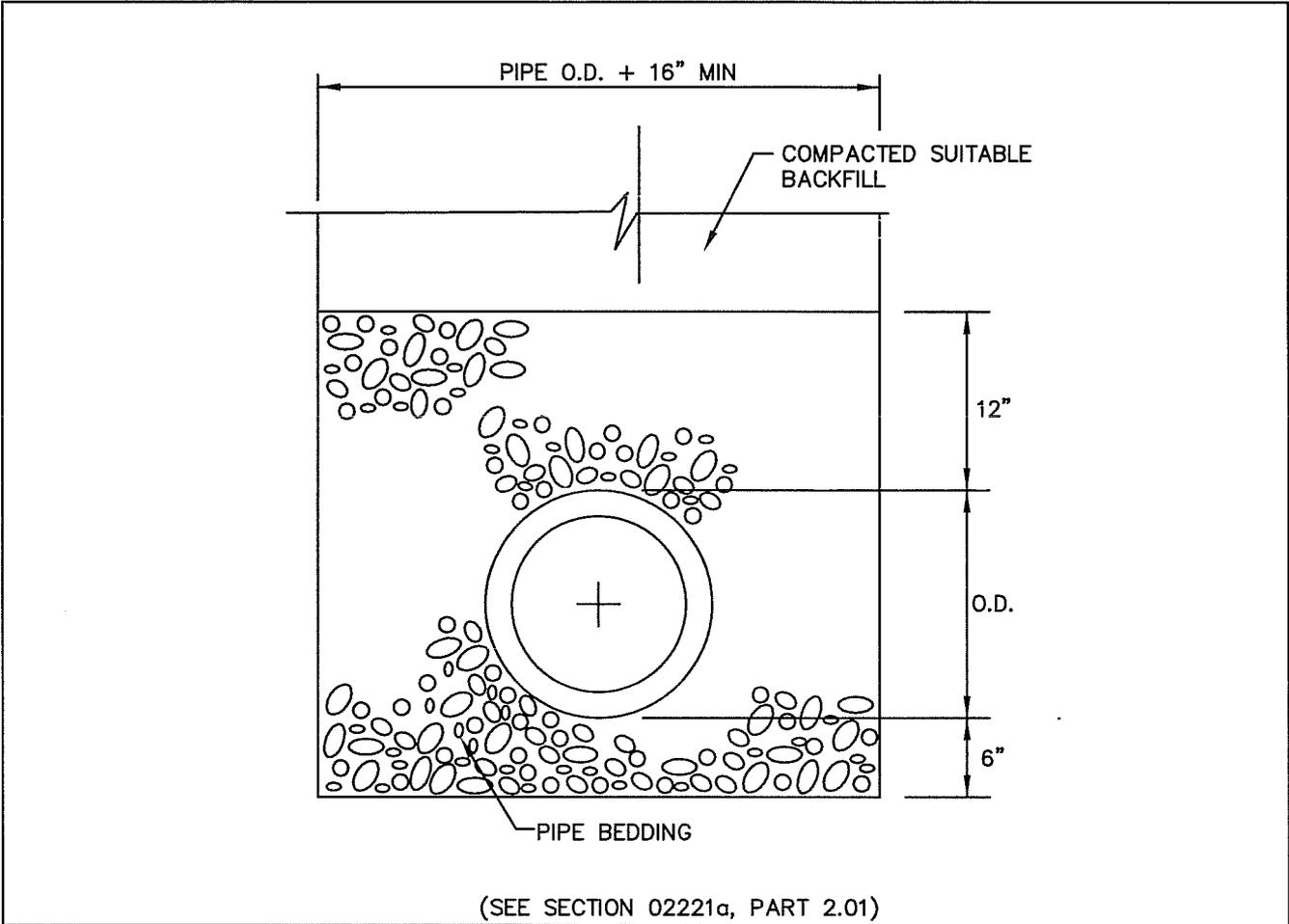
- A. Cement concrete shall be as specified in Sections 03000 and 03300.

END OF SECTION

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# **STANDARD DETAILS**

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(SEE SECTION 02221a, PART 2.01)

 **PIPE BEDDING DETAIL TYPE IV**  
NOT TO SCALE

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**02221-1**

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SPECIFICATIONS**  
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**PIPE BEDDING DETAIL**

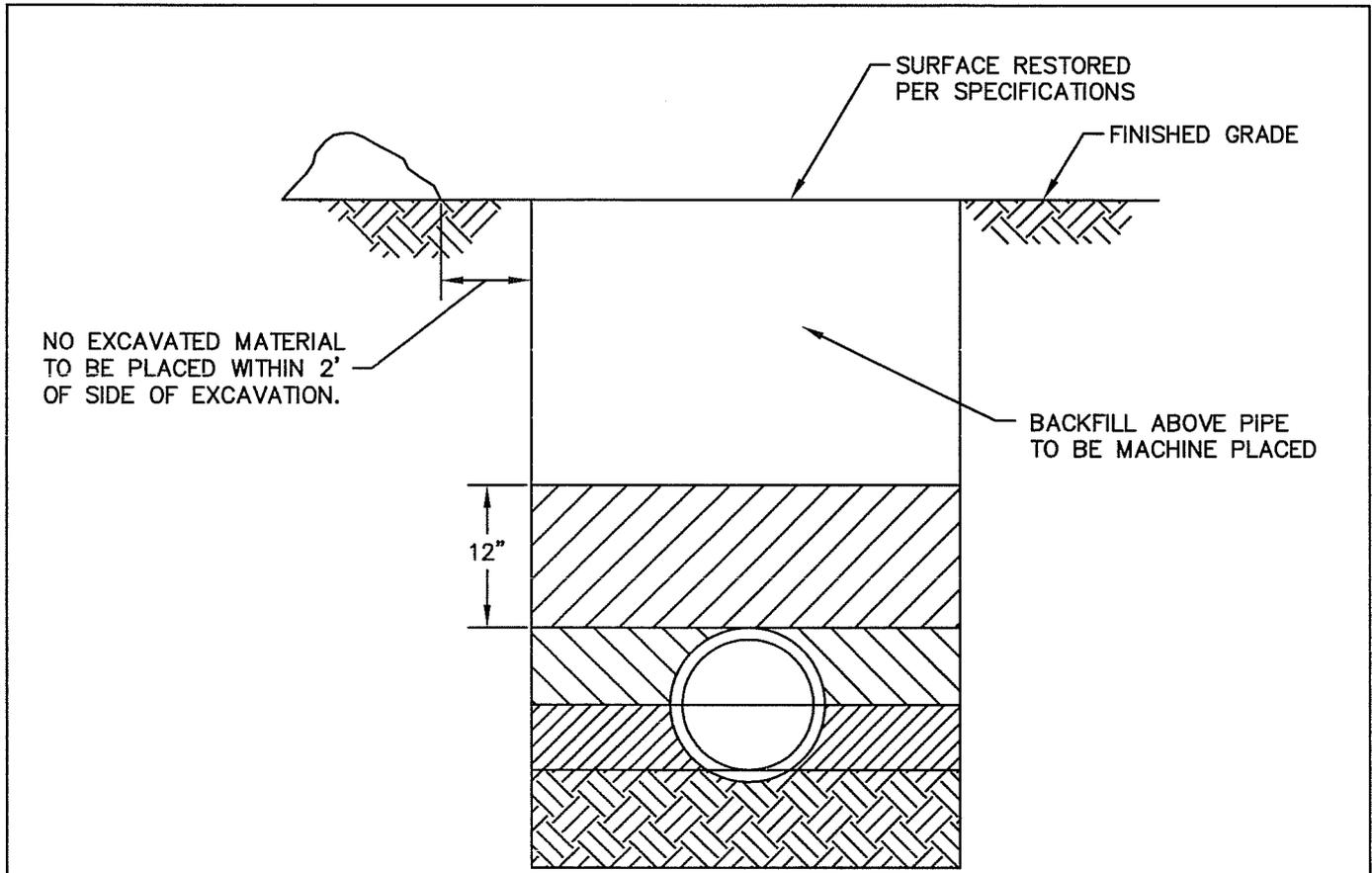
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SECTION

NOTES:  
 SHORING REQUIRED FOR ALL TRENCHES IN ACCORDANCE WITH APPLICABLE  
 REGULATIONS LAWS & SAFETY CODES

BACKFILL MATERIAL SHALL BE IN ACCORDANCE WITH SECTION 02221a-2 PART 2.02,  
 BACKFILL MATERIAL



**TRENCH RESTORATION DETAIL**

NOT TO SCALE

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**02221-2**

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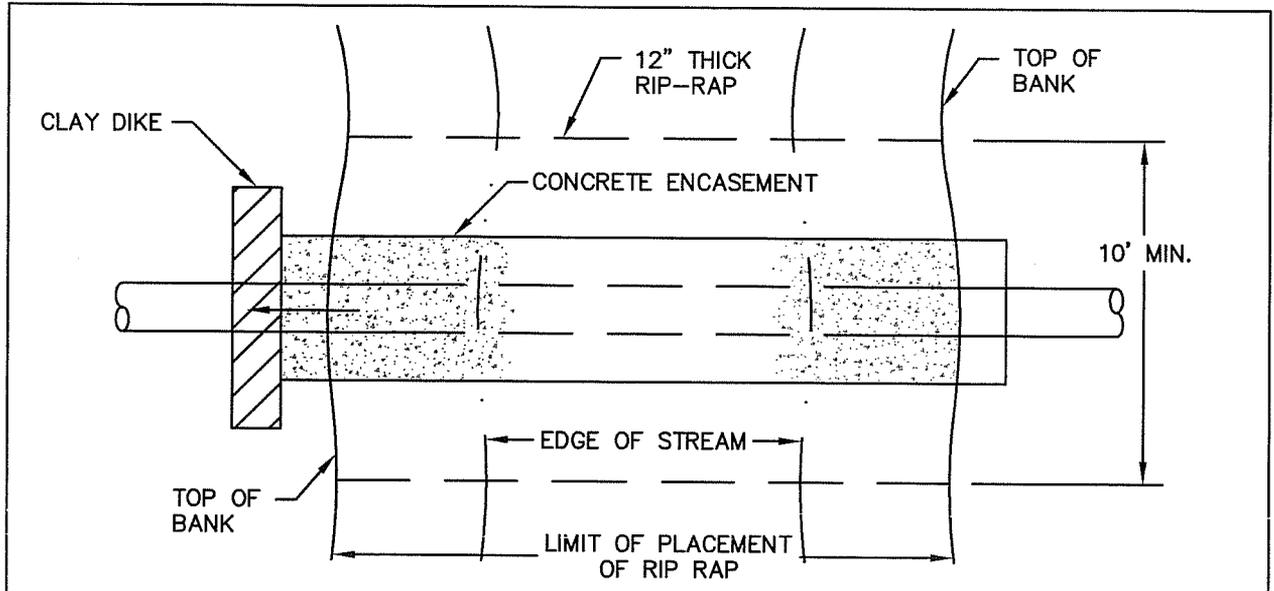
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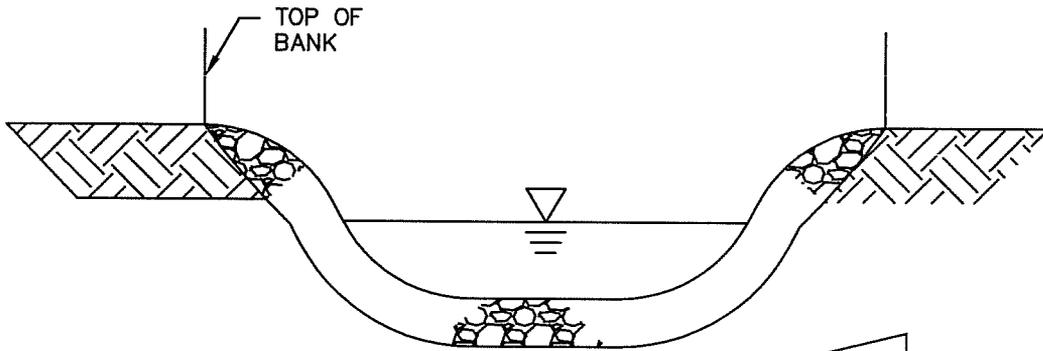
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**PLAN**



**PROFILE**

NOTE:  
 STREAM CROSSING BID ITEMS INCLUDES EXCAVATION, BACKFILL, AND  
 OTHER WORK INCIDENTAL TO STREAM CROSSING CONSTRUCTION



**STREAM CROSSING DETAIL**

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STREAM CROSSING DETAIL	

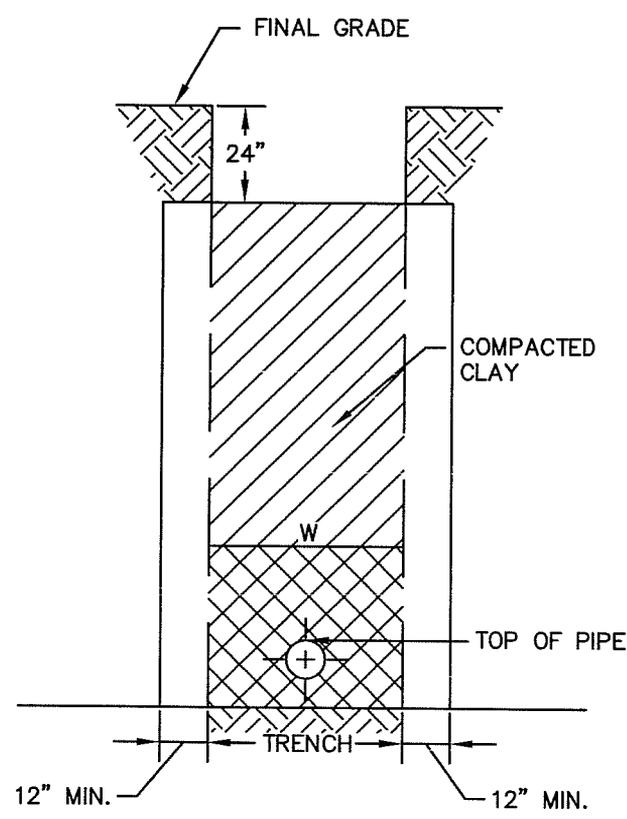
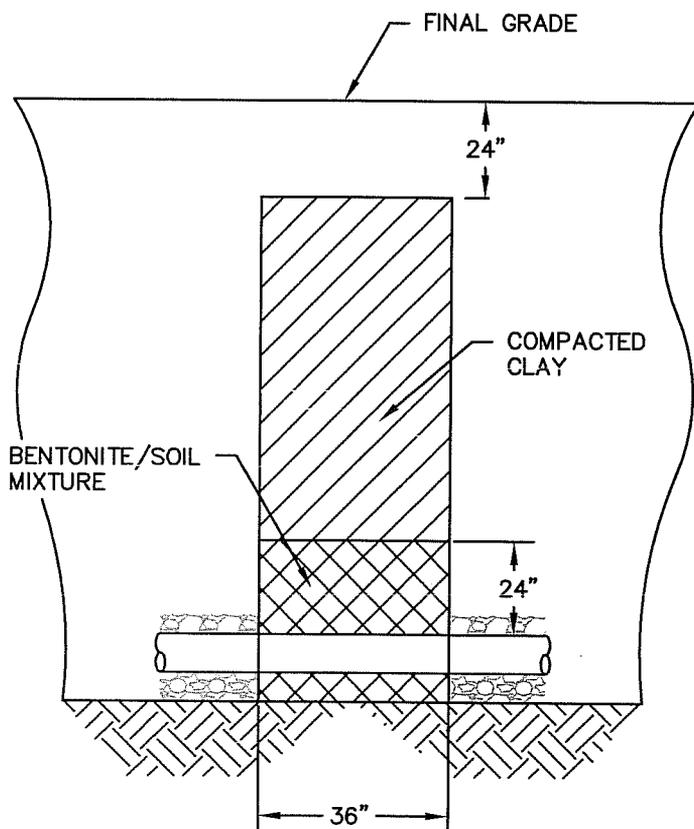
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**NOTES:**

1. COMPACTED CLAY DIKES SHALL EXTEND VERTICALLY FROM UNDISTURBED GROUND AT BOTTOM OF TRENCH TO WITHIN TWO (2') FEET OF FINAL GRADE, AND FROM UNDISTURBED GROUND ON TRENCH SIDES FOR WIDTH OF TRENCH SIDES FOR WIDTH OF TRENCH AND 12" BEYOND EACH SIDE OF TRENCH.
2. CLAY BACKFILL TO A POINT TWO (2') FEET OVER THE PIPE SHALL CONSIST OF A BENTONITE /SOIL MIXTURE AT A 5:1 MIX.
3. REMAINING BACKFILL SHALL CONSIST OF CLAY CONTAINING NO MORE THAN 15% (BY VOLUME) STONE NOT LARGER THAN TWO (2") INCHES IN DIAMETER. CLAY SHALL BE PLACED IN SIX (6") INCH LIFTS AND COMPACTED BY MECHANICAL TAMPER TO NOT LESS THAN 95% OF MAXIMUM DENSITY AT OPTIMUM MOISTURE CONTENT.



**CLAY DIKE DETAIL**

NOT TO SCALE

**SHEET**  
**02221-4**

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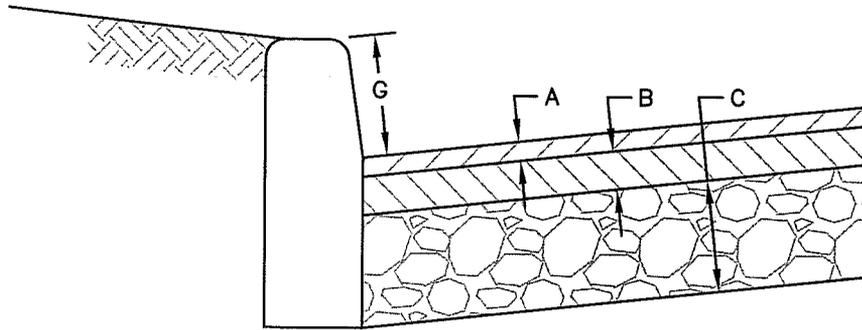
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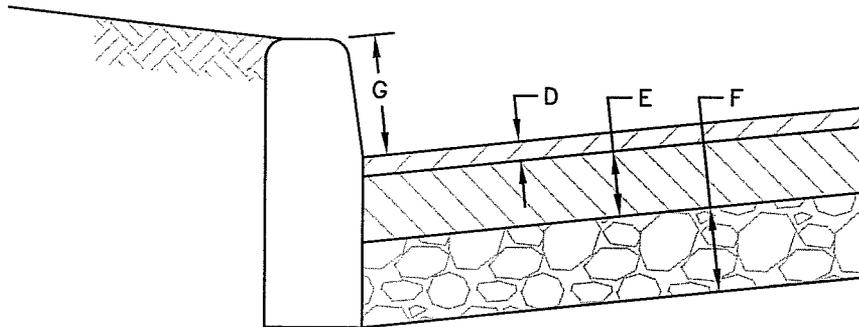


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**MARSHALL MIX - ALTERNATE 1**

- A. 1 1/2" SURFACE COURSE: ID-2 OR APPROVED EQUAL
- B. 3" BINDER COURSE: ID-2 OR APPROVED EQUAL
- C. 8" CRUSHED STONE BASE #4 STONE, SCREENED, & CHOKED



**MARSHALL MIX - ALTERNATE 2**

(WHEN JUSTIFIED AND APPROVED)

- D. 1 1/2" SURFACE COURSE: ID-2 OR APPROVED EQUAL
- E. 5" THICK B.C.B.C.
- F. 4" THICK 2RC STONE BASE
- G. 8" CURB REVEAL
  - 1. 1" MAX AT DRIVEWAY DEPRESSIONS
  - 2. 1/4" MAX AT ACCESSIBLE CURB RAMPS
- H. ALTERNATE 1 & 2 MUST BE APPROVED BY TOWNSHIP ENGINEER PRIOR TO USE.



**MARSHALL MIX STREET CONSTRUCTION DETAIL**

NOT TO SCALE

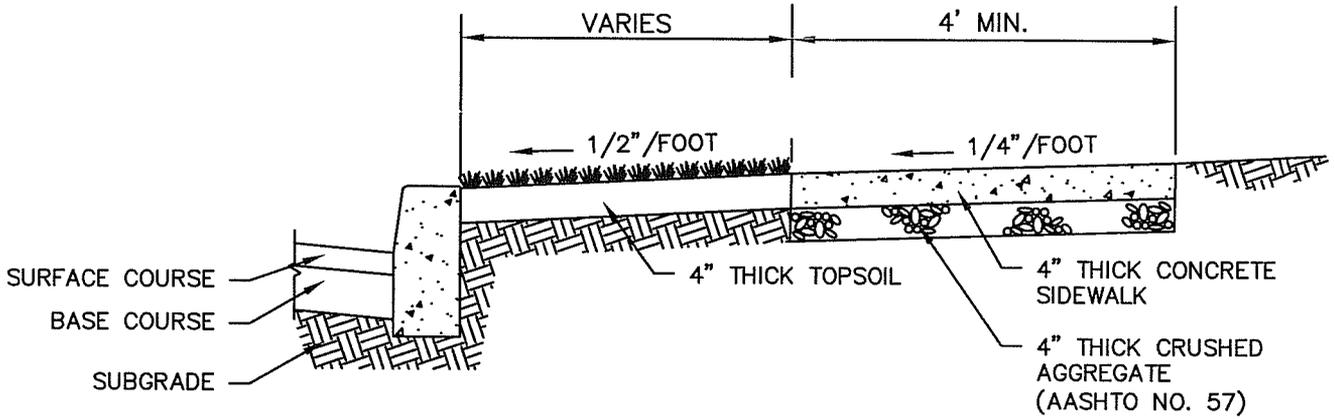
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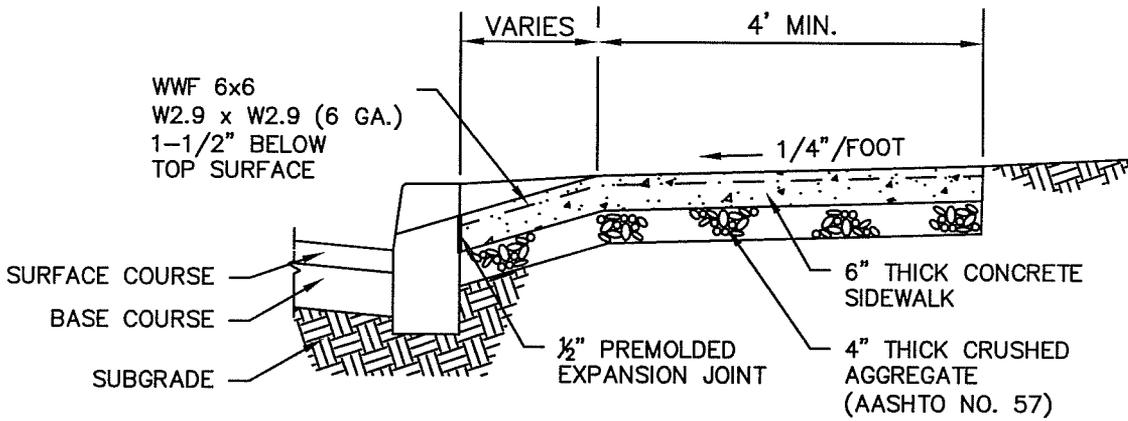
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TYPICAL SECTION THROUGH CONCRETE CURB & SIDEWALK



TYPICAL SECTION THROUGH CONCRETE CURB & SIDEWALK AT DRIVEWAY DEPRESSION



**CONCRETE SIDEWALK DETAIL**

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CONCRETE SIDEWALK DETAIL	

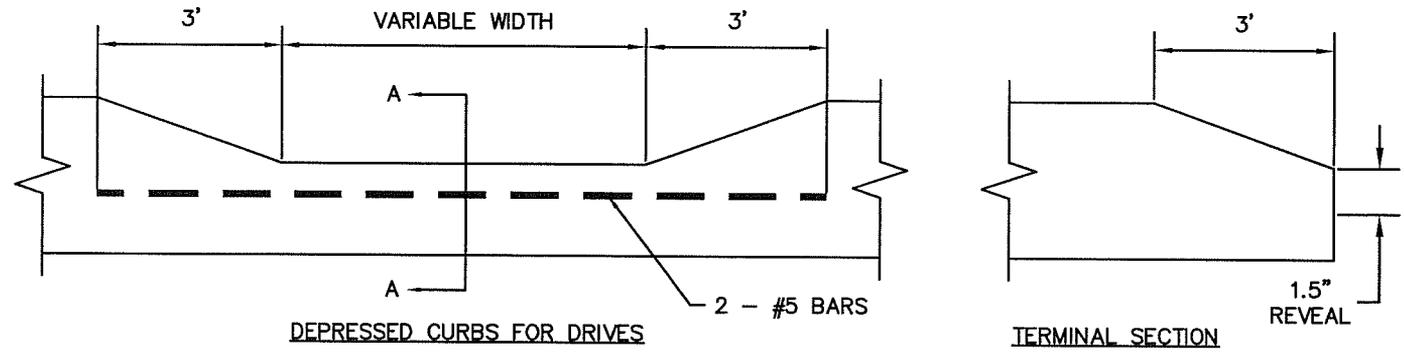
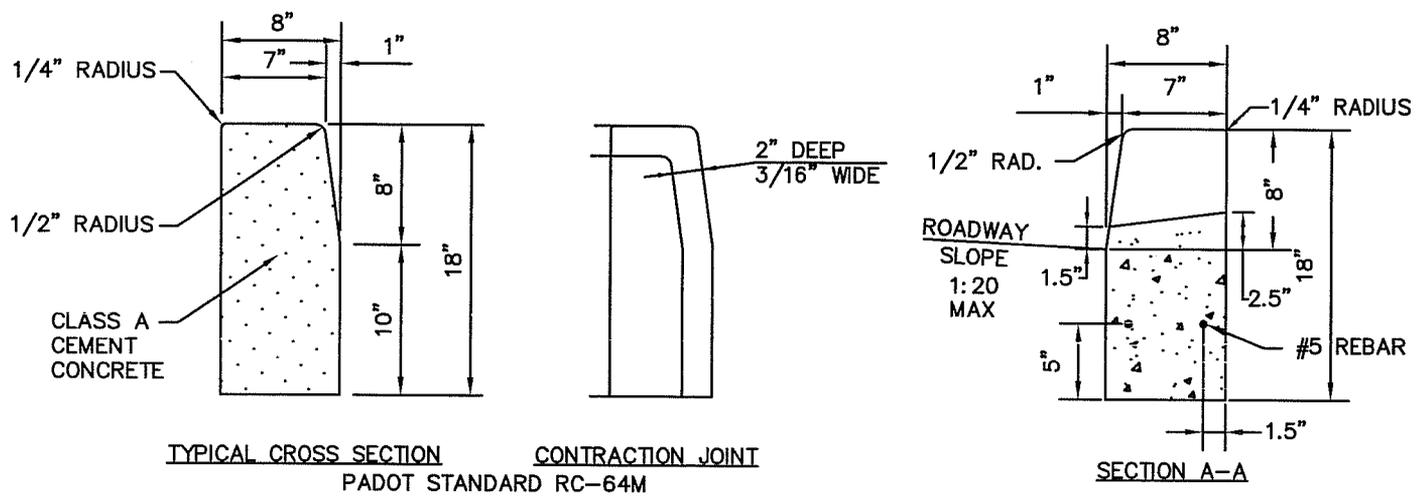
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**02525-2**

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**STANDARD CONCRETE CURB DETAIL**

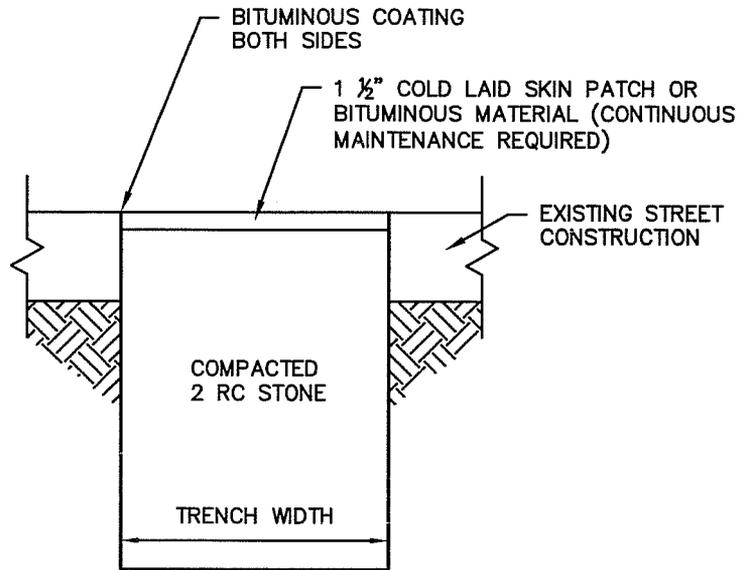
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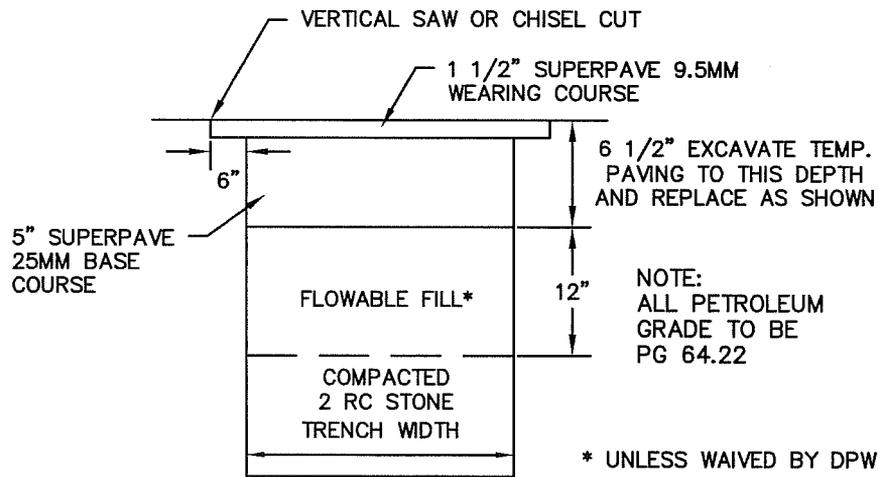
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**STEP 1**  
 TEMPORARY REPAVING DETAIL  
 (MINIMUM 3 MONTHS IN PLACE)



**STEP 2**  
 PERMANENT PAVING  
 (INSTALLATION ONLY BETWEEN  
 APRIL 15 TO OCTOBER 1ST)



**NOTES:**

ALL BITUMINOUS MATERIAL & BLACK BASE FURNISHED & LAID IN PLACE IN ACCORDANCE WITH PENNDOT SPECS.

STEP 1 MUST PRECEDE STEP 2

STEP 2 MUST BE COMPLETED WITHIN SIX (6) MONTHS AFTER INSTALLATION OF STEP 1.



**SUPERPAVE TRENCH REPAVING DETAIL**

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**SUPERPAVE TRENCH REPAVING DETAIL**

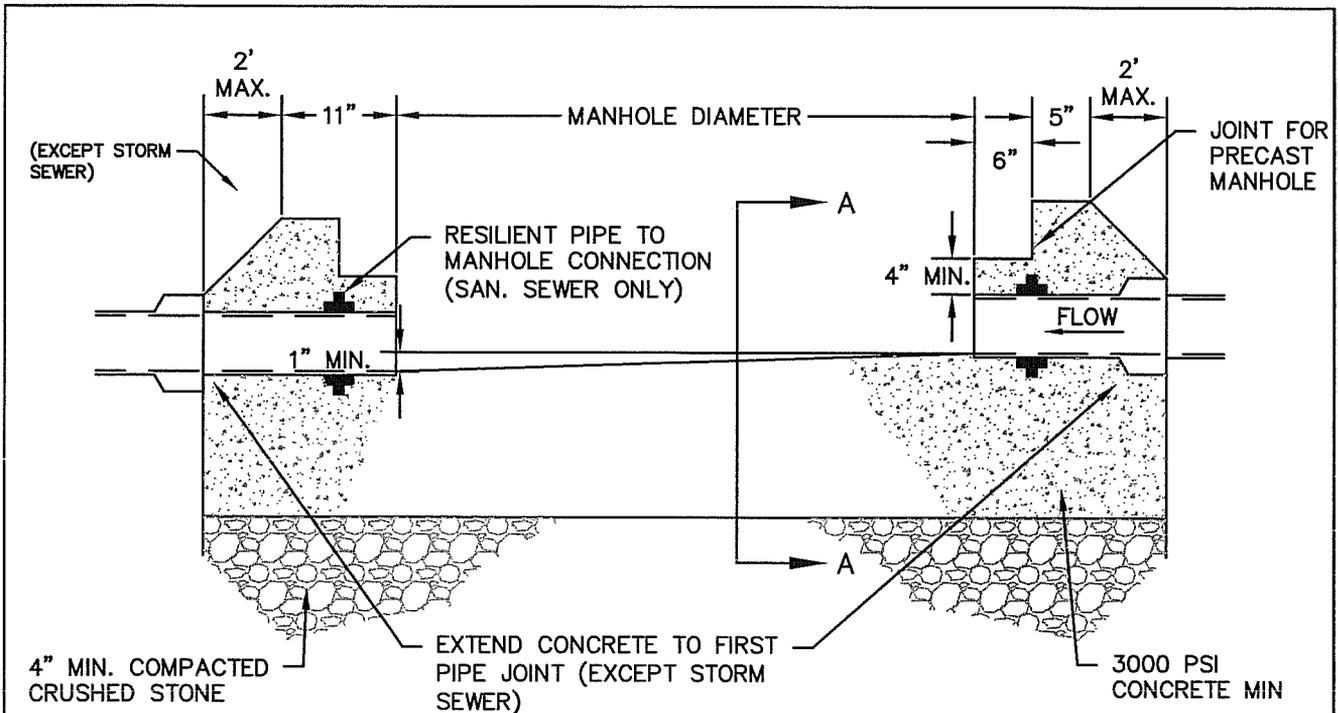
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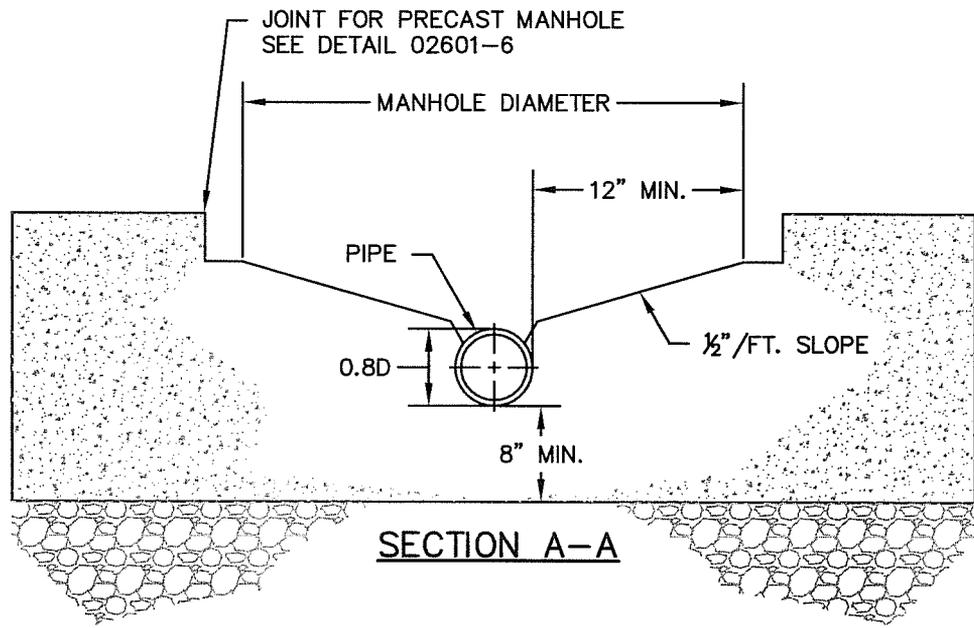
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**ELEVATION**



**SECTION A-A**

**CAST-IN-PLACE MANHOLE BASE DETAIL**  
NOT TO SCALE

**SHEET**  
**02601-1**

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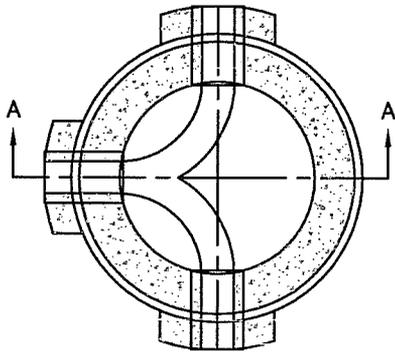
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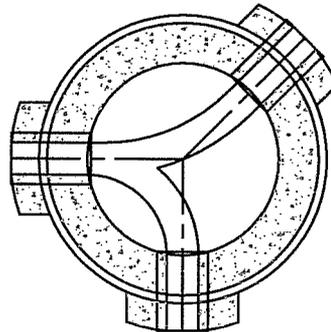
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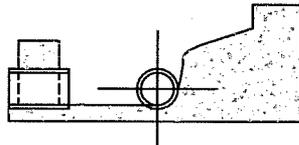
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PLAN

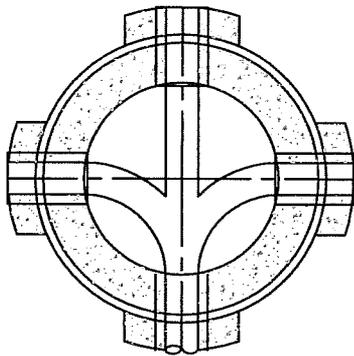


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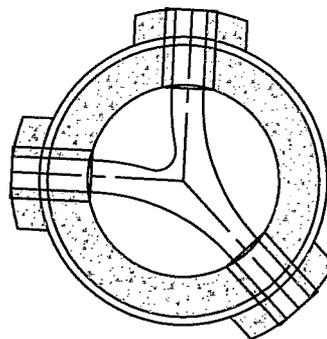


SECTION A-A

FLOW CHANNELS MUST ACCOMMODATE EQUIPMENT IN CURRENT USE BY AUTHORITY HAVING JURISDICTION.



PLAN



PLAN



**MANHOLE BASES DETAIL**

NOT TO SCALE

SHEET

02601-2

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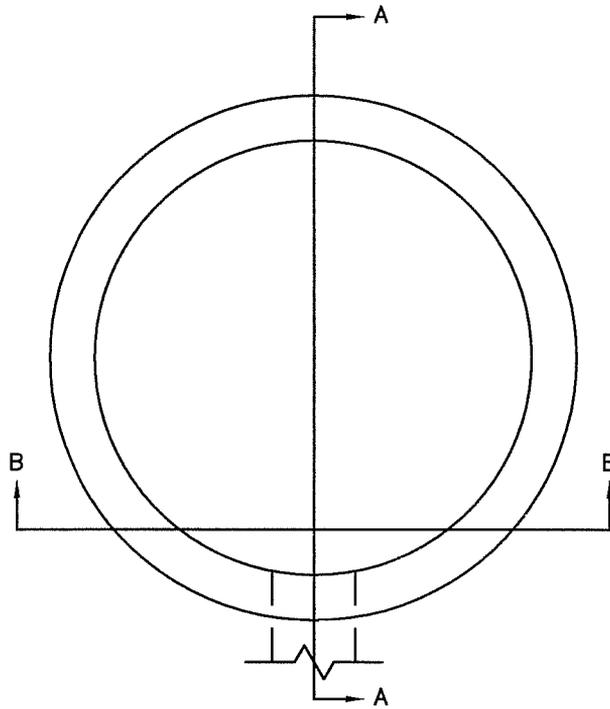
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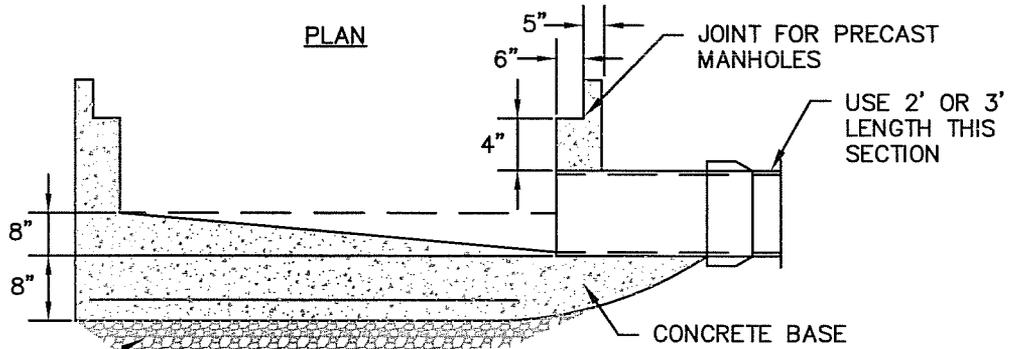
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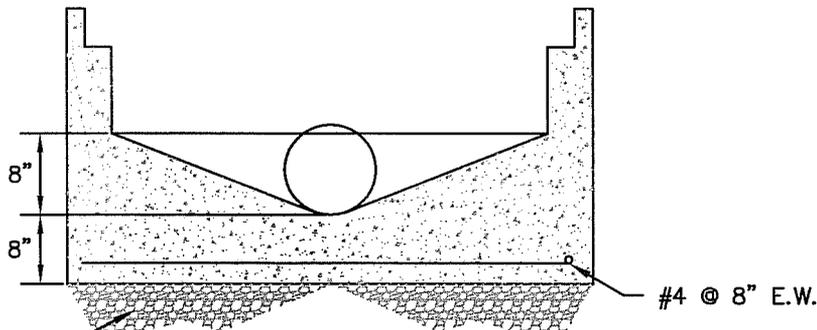


PLAN



SECTION A-A

4" MIN. CRUSHED STONE INCLUDED IN UNIT PRICE OF MANHOLE



SECTION B-B

4" MIN. CRUSHED STONE INCLUDED IN UNIT PRICE OF MANHOLE



TERMINAL MANHOLE TYPE I BASE DETAIL

NOT TO SCALE

SHEET

02601-3

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SPECIFICATIONS	
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TERMINAL MANHOLE TYPE I BASE DETAIL	

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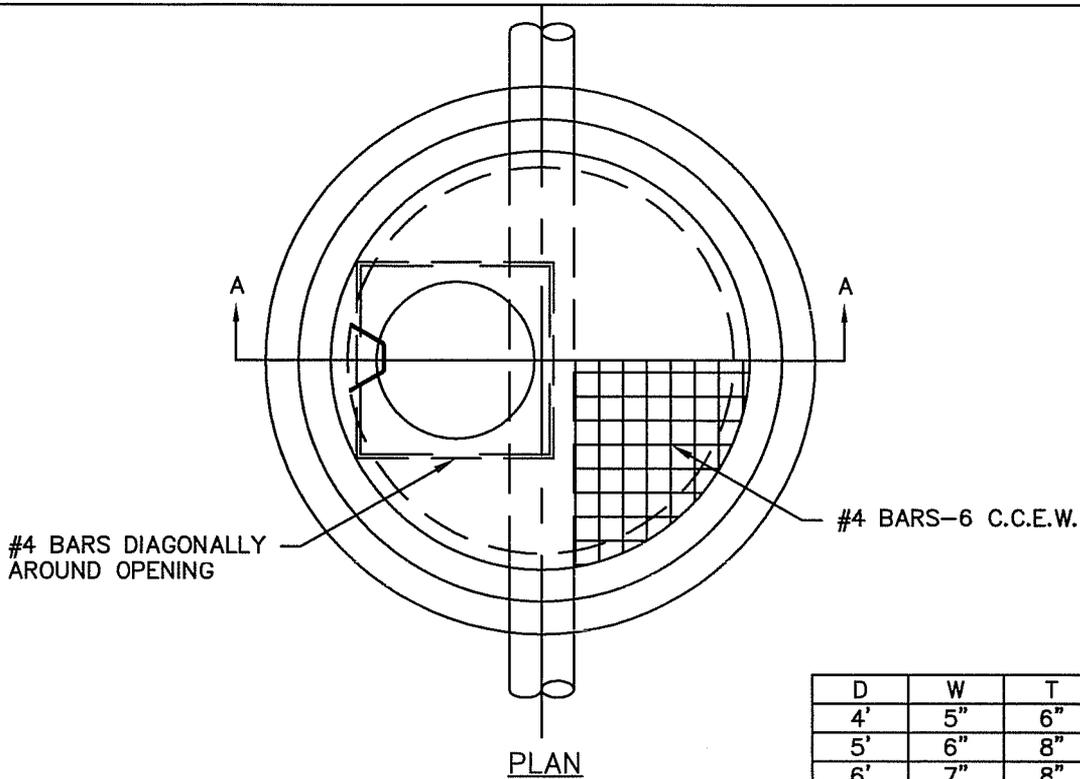
46 South Highland Avenue  
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FAX (717) 868-7681



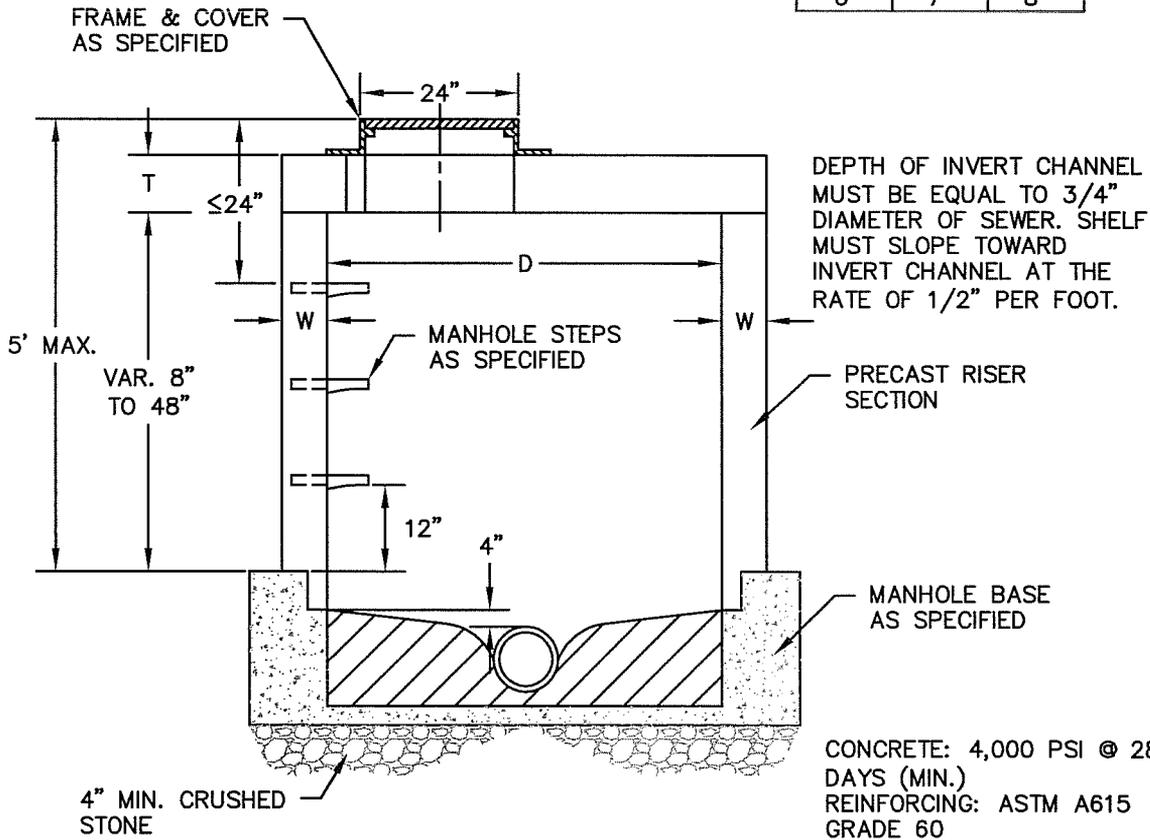
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D	W	T
4'	5"	6"
5'	6"	8"
6'	7"	8"



CONCRETE: 4,000 PSI @ 28 DAYS (MIN.)  
 REINFORCING: ASTM A615 GRADE 60



**STANDARD SHALLOW MANHOLE DETAIL**

NOT TO SCALE

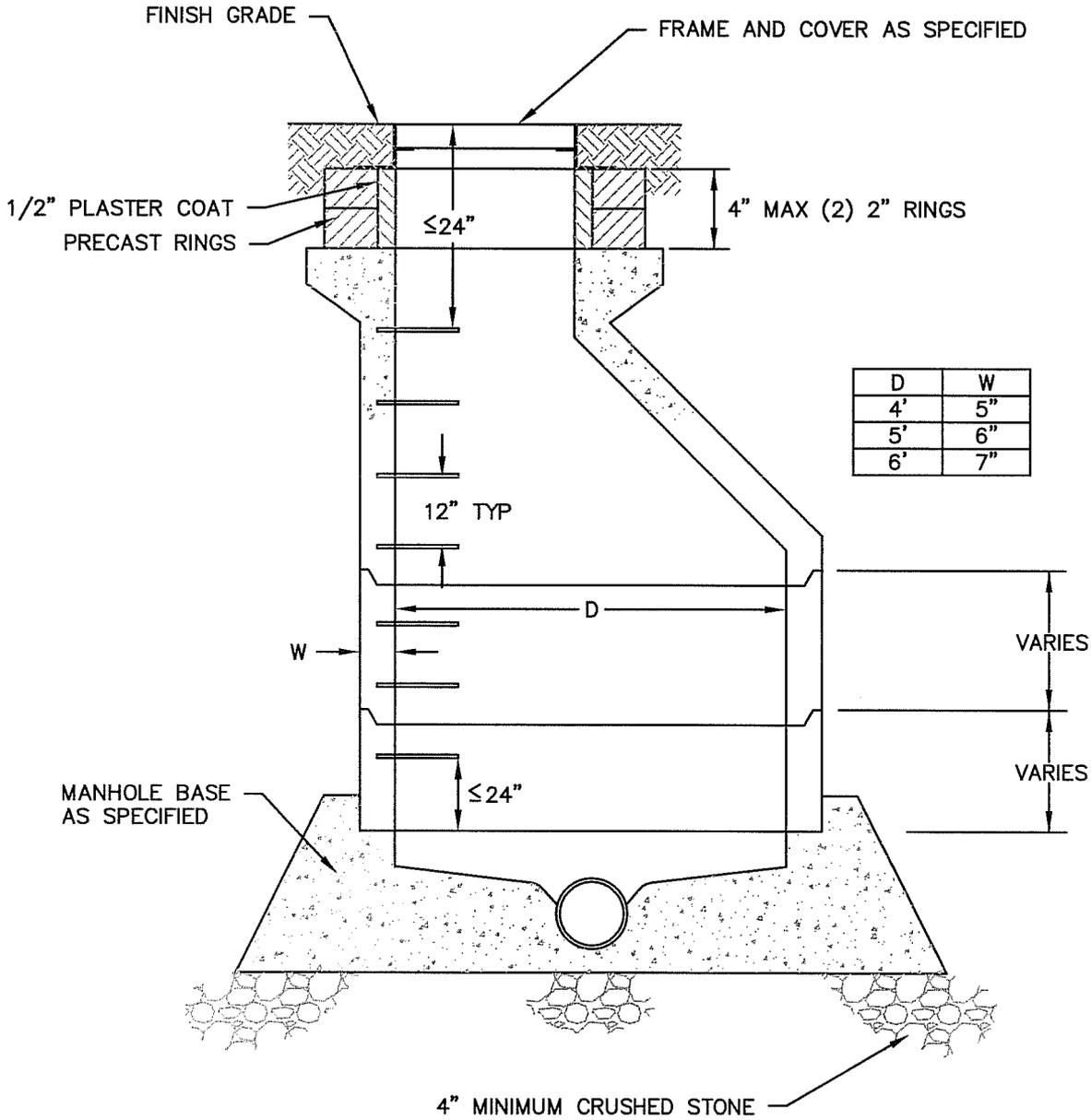
**SHEET**  
**02601-4**

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D	W
4'	5"
5'	6"
6'	7"

SEE DETAIL 02601-7  
FOR STEP DETAIL



**STANDARD DEEP MANHOLE DETAIL**

NOT TO SCALE

**SHEET**  
**02601-5**

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**STANDARD DEEP MANHOLE DETAIL**

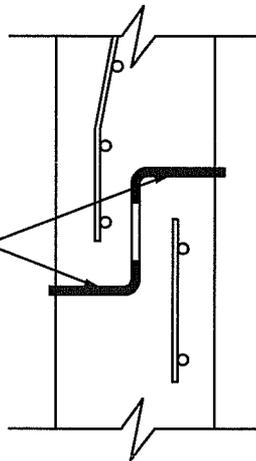
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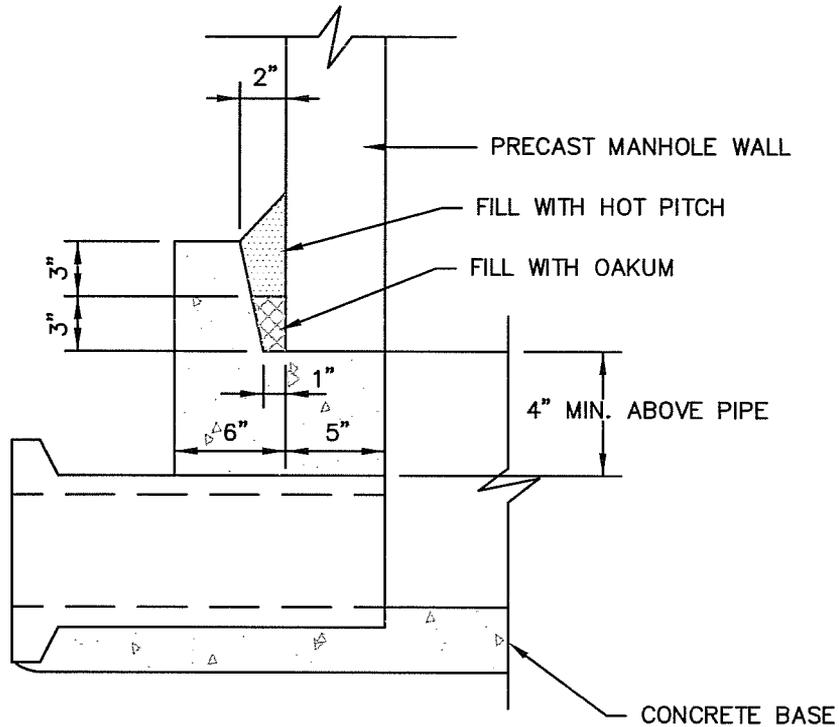
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JOINTS SHALL BE SEALED  
WATERTIGHT BY APPLICATION OF  
PREFORMED JOINT SEALING  
COMPOUND. JOINT SEALANT  
COMPOUND SHALL "SQUEEZE-OUT"  
ON BOTH SIDES OF JOINT.



DETAIL A  
TYPICAL ALL JOINTS



DETAIL B



**PRECAST MANHOLES TYPICAL ALL JOINTS**

NOT TO SCALE

SHEET

02601-6

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PRECAST MANHOLES TYP ALL JOINTS	

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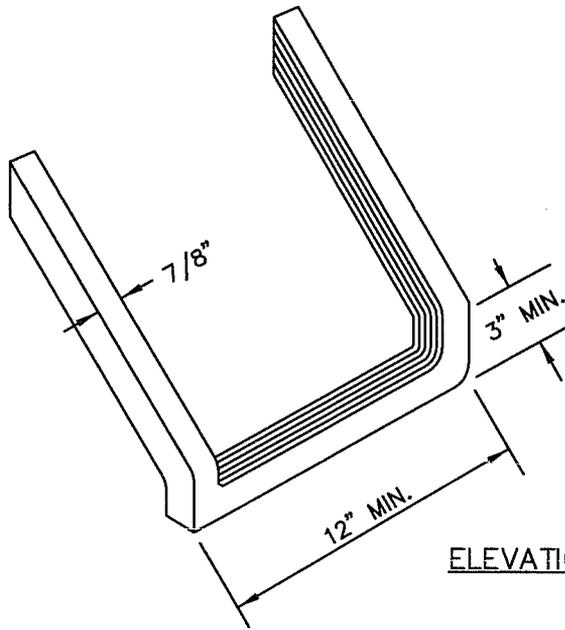
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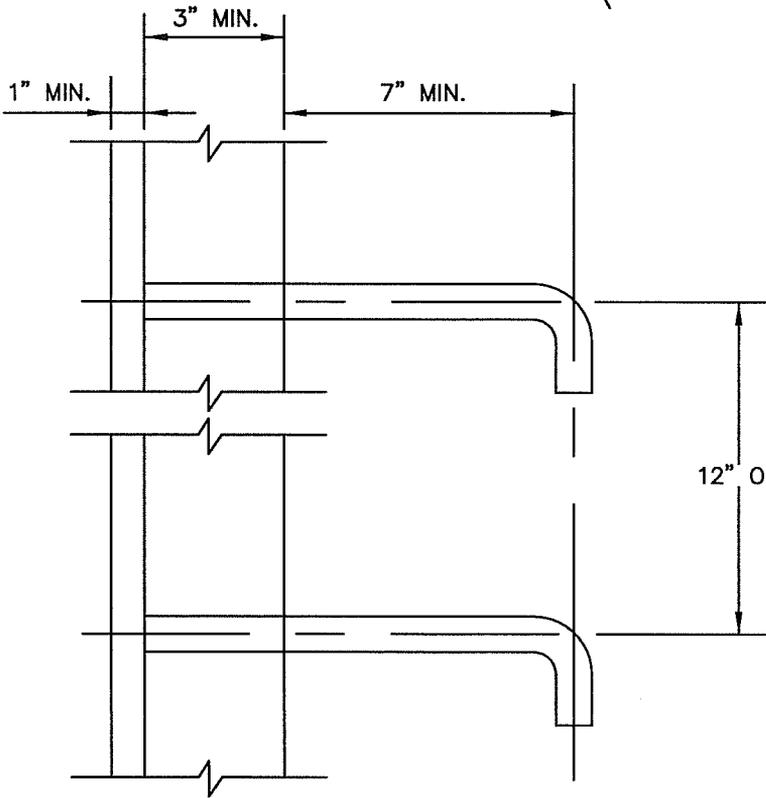
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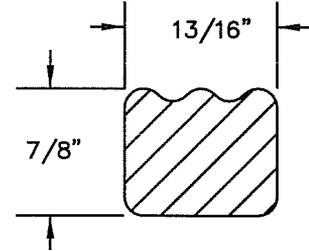
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ELEVATION



ELEVATION



FULL SIZE SECTION

NOTES:

1. DISTANCE FROM RIM OF MANHOLE TO TOP STEP SHALL NOT BE GREATER THAN 24".
2. DISTANCE FROM BOTTOM STEP TO FLOOR OF MANHOLE SHALL NOT BE GREATER THAN 2 FEET.
3. EMBEDDED PORTION OF STEP TO BE COATED WITH ASPHALT CONFORMING TO AASHTO M-190.
4. DO NOT LOCATE STEPS OVER CHANNELS.



**ALUMINUM MANHOLE STEP DETAIL STORM WATER APPLICATIONS**

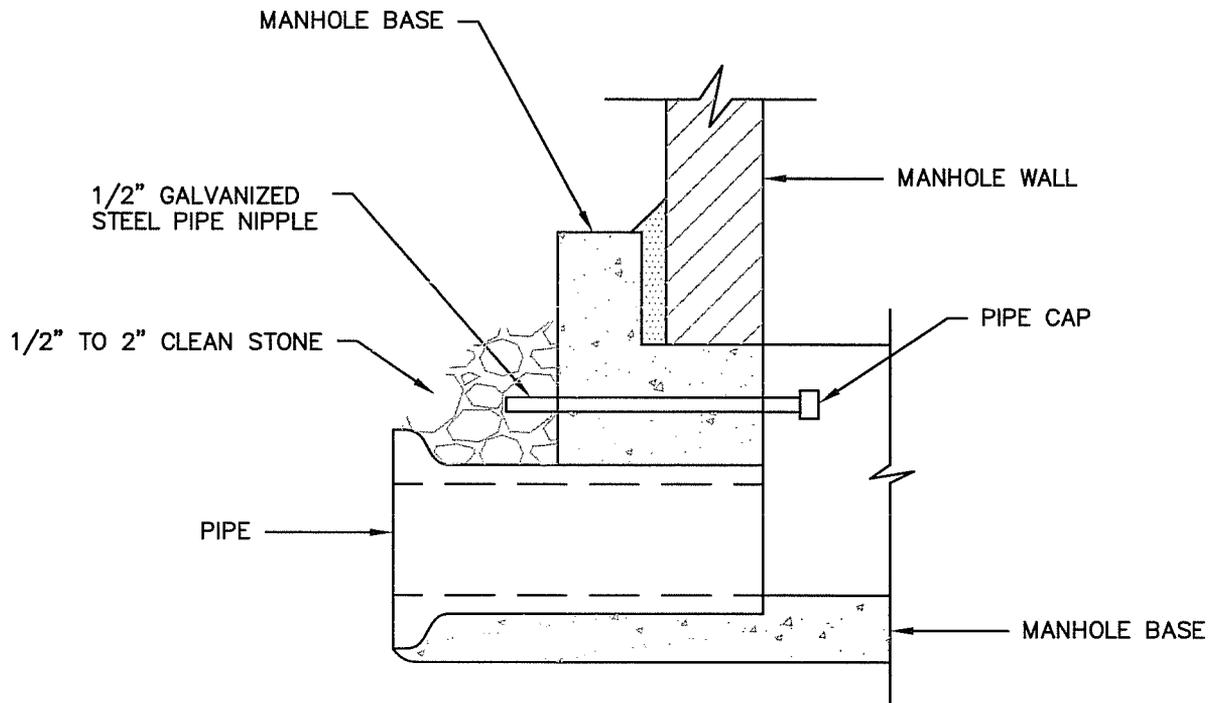
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SHEET  
**02601-7**

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GROUND WATER HEIGHT INDICATOR

PRIOR TO AIR TEST, HEIGHT OF GROUND WATER SHALL BE DETERMINED.

1. REMOVE PIPE CAP AND BLOW AIR THROUGH PIPE NIPPLE TO CLEAR IT.
2. CONNECT A VERTICALLY HELD CLEAR PLASTIC TUBE TO THE NIPPLE.
3. MEASURE HEIGHT IN FEET OF WATER OVER SPRINGLINE OF PIPE.
4. REPLACE PIPE CAP AFTER DETERMINING GROUND WATER LEVEL.

NOTE:

1. FOR AIR TEST, THE HEIGHT IN FEET SHALL BE MULTIPLIED BY 0.43 TO ESTABLISH POUNDS OF PRESSURE THAT WILL BE ADDED TO ALL READINGS. 10 P.S.I. IS THE MAXIMUM INTERNAL PRESSURE.



**GROUND WATER HEIGHT INDICATOR**

NOT TO SCALE

SHEET

02601-8

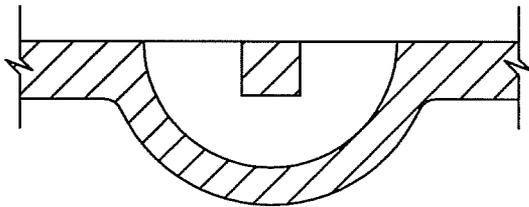
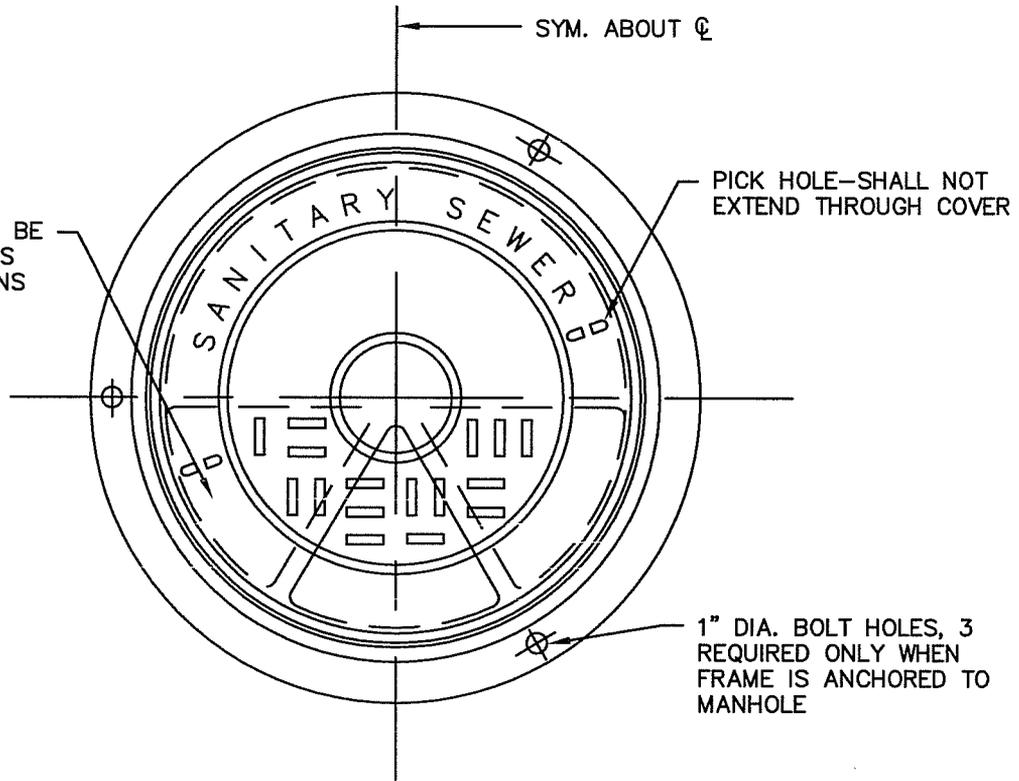
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GROUND WATER HEIGHT INDICATOR	

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OWNERS NAME TO BE  
CAST IN COVER AS  
PER SPECIFICATIONS

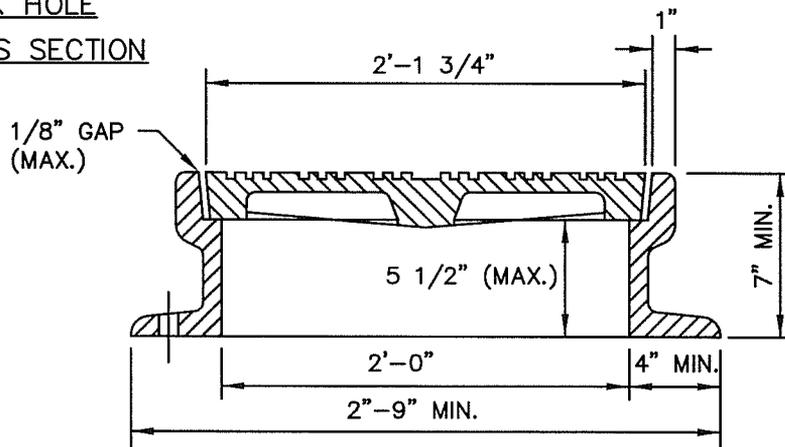


PLAN

NOTE:

MINIMUM FRAME AND COVER TOTAL  
WEIGHT 400 LBS. (MIN.)

PICK HOLE  
CROSS SECTION



SECTION C-C



**HEAVY TRAFFIC SANITARY SEWER MANHOLE FRAME & COVER**

NOT TO SCALE

SHEET

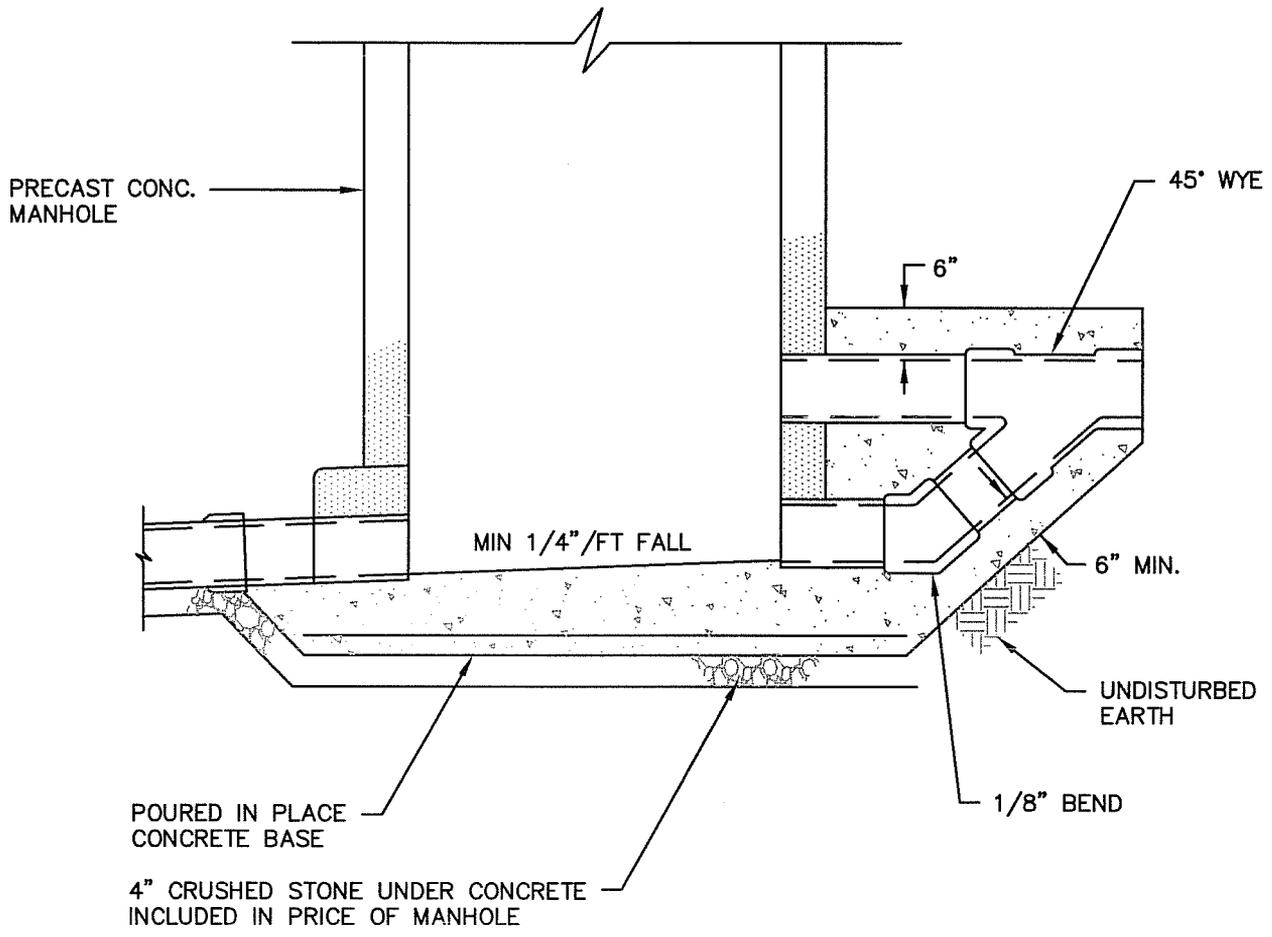
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HEAVY TRAFFIC SS MH FRAME & COVER	

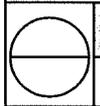
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ELEVATION  
TYPE A DROP MANHOLE DETAILS

<u>SIZE OF SEWER</u>	<u>MIN. DROP</u>	<u>MAX. DROP</u>
8"	1'-9"	2'-8"
10"	2'-0"	2'-10"
12"	2'-2"	3'-3"
15"	3'-2"	6'-8"



**PVC PIPE TYPE A DROP MANHOLE DETAILS**  
NOT TO SCALE

**SHEET**  
**02601-10**

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SPRINGETTSBURY TOWNSHIP YORK COUNTY, PENNSYLVANIA  
**PVC PIPE TYPE A DROP MANHOLE DETAILS**

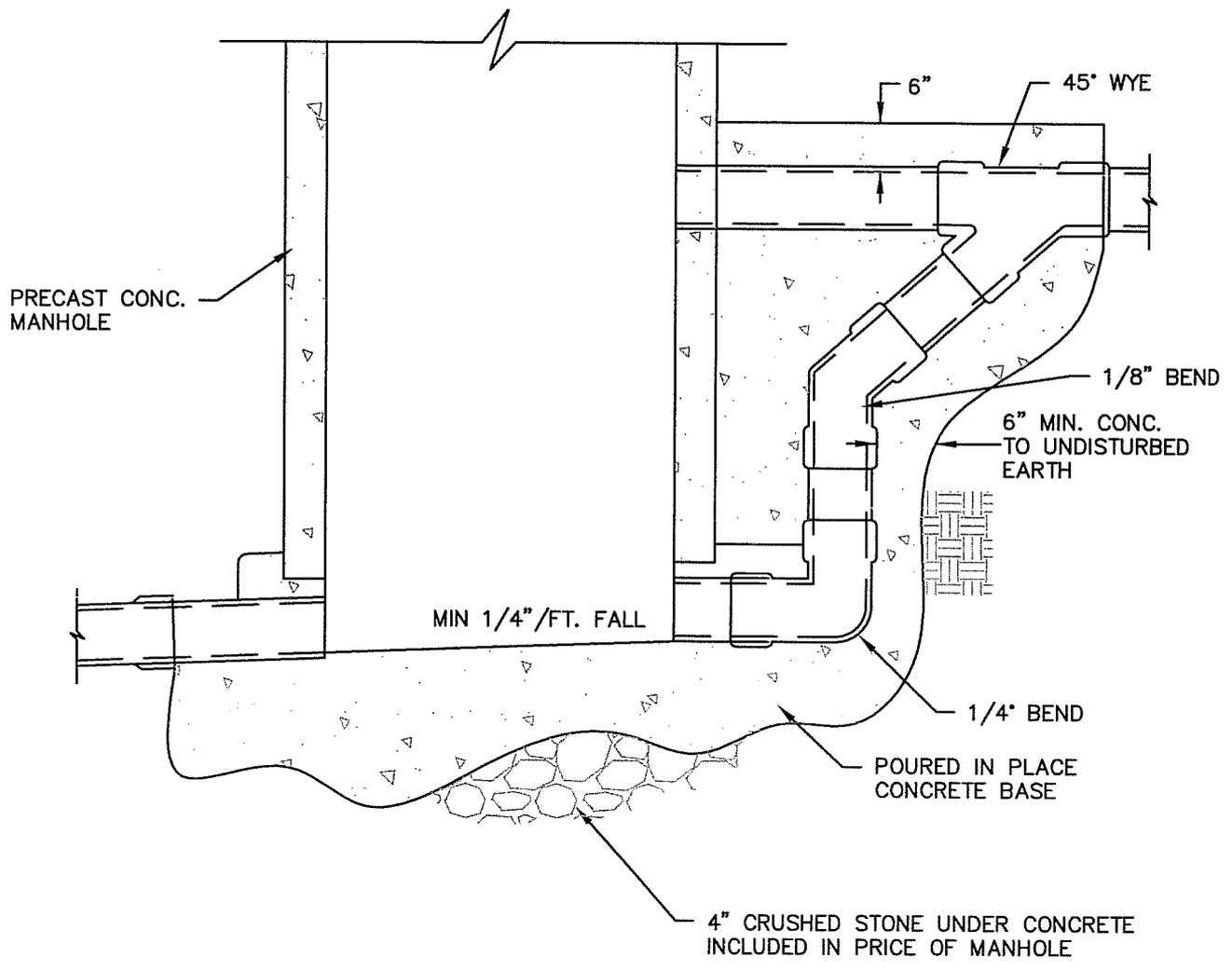
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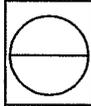
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ELEVATION  
TYPE B DROP MANHOLE DETAILS

<u>SIZE OF SEWER</u>	<u>MIN. DROP</u>
8"	2'-8"
10"	2'-10"
12"	3'-3"
15"	6'-8"



**PVC PIPE TYPE B DROP MANHOLE DETAILS**  
NOT TO SCALE

SHEET  
**02601-11**

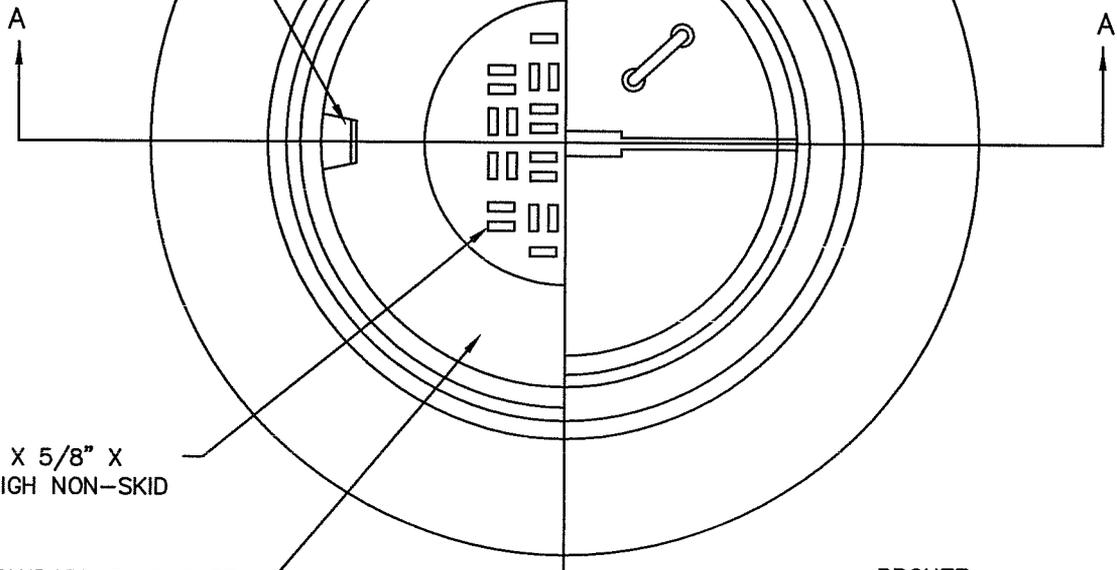
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**PVC PIPE TYPE B DROP MANHOLE DETAILS**

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PICKHOLE  
MUST NOT EXTEND  
THROUGH COVER



1 7/8" X 5/8" X  
3/8" HIGH NON-SKID  
LUGS

2" STANDARD FLAT FACE  
GOTHIC LETTERS  
(AS SPECIFIED)

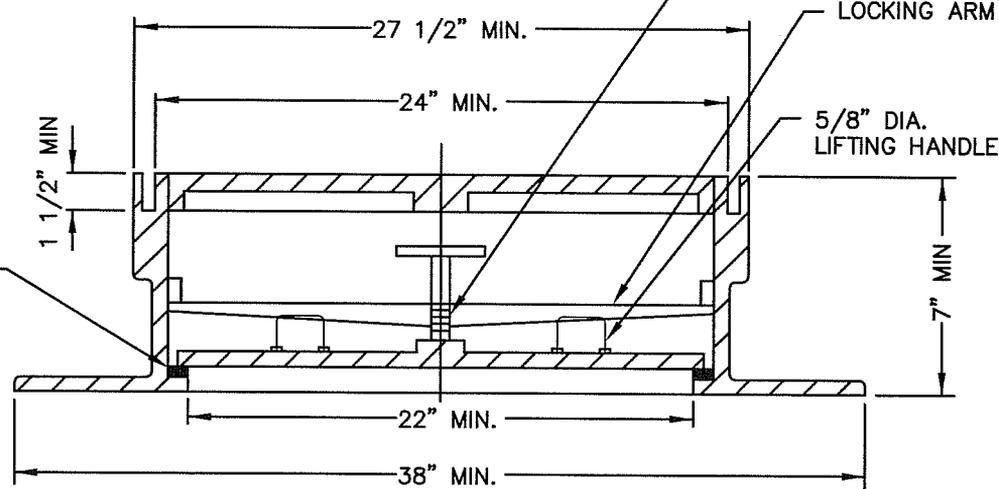
PLAN

BRONZE  
HANDLE

LOCKING ARM

5/8" DIA.  
LIFTING HANDLE

NEOPRENE  
GASKET



SECTION A-A



**WATERTIGHT MANHOLE FRAME AND COVER**

NOT TO SCALE

SHEET  
**02601-12**

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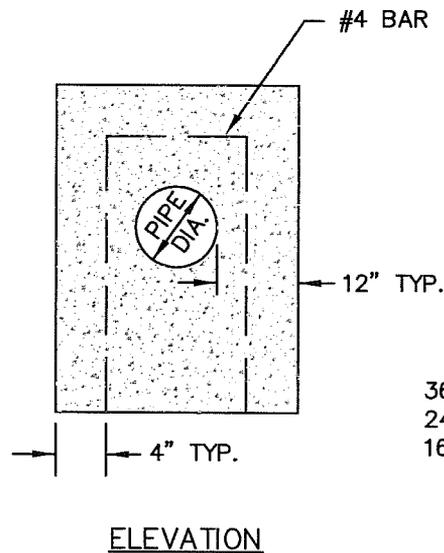
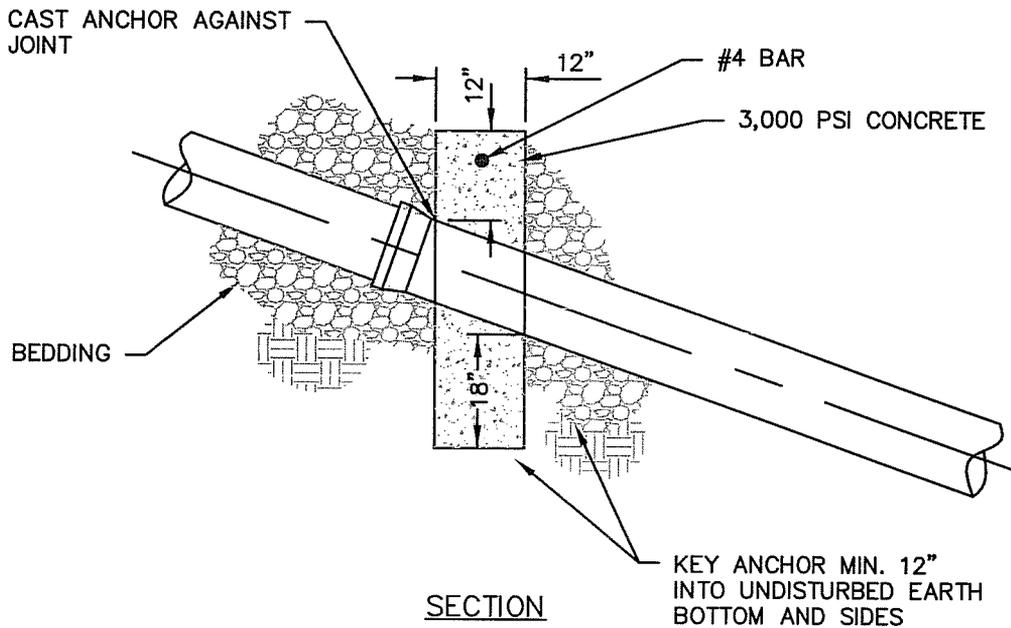
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MAXIMUM SPACING

36' O.C. 20% TO 35% SLOPES

24' O.C. OVER 35% TO 50% SLOPES

16' O.C. OVER 50% SLOPES



**CONCRETE ANCHOR DETAILS**

NOT TO SCALE

SHEET

03300-1

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CONCRETE ANCHOR DETAILS	

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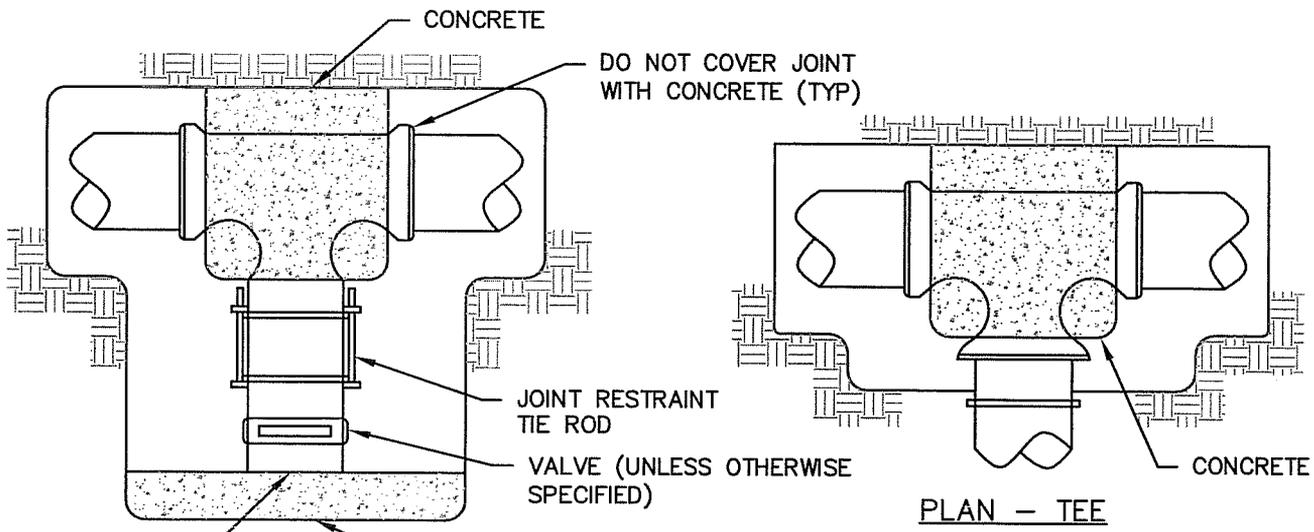
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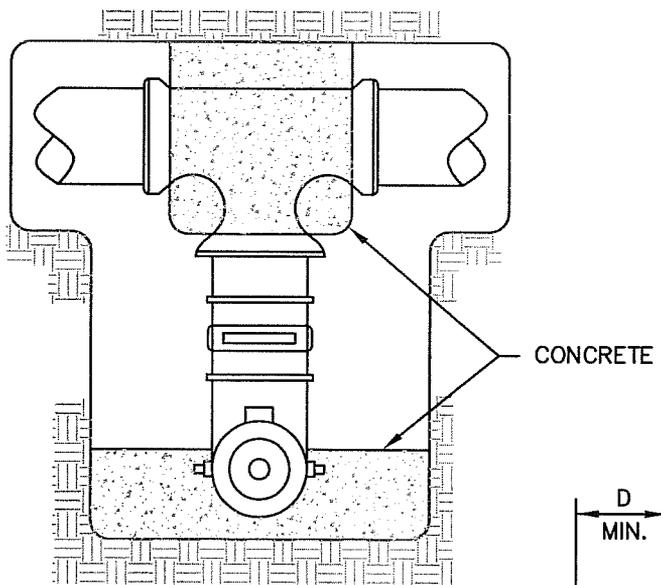
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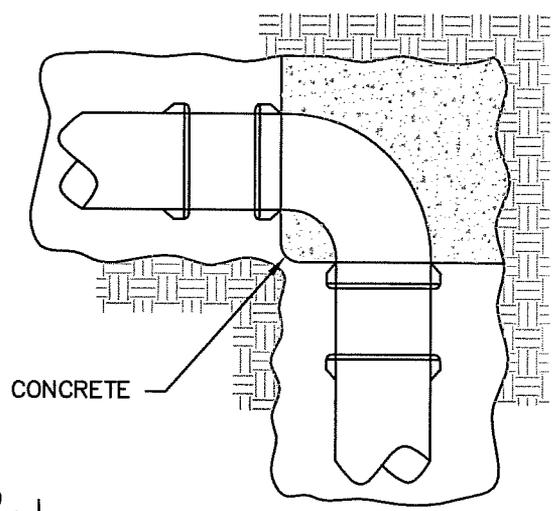


**PLAN - CAPPED TEE**  
(CAPPED RUN OF TEE SIMILAR)

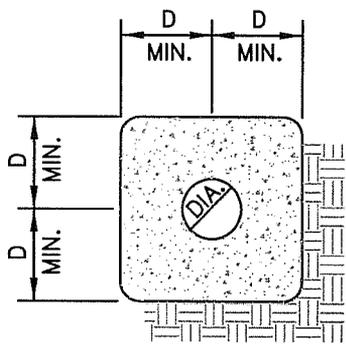
**PLAN - TEE**



**PLAN - HYDRANT**



**PLAN - 90° BEND**  
(LESSER BENDS SIMILAR)



**TYPICAL SECTION**

**THRUST BLOCKING DETAILS**  
NOT TO SCALE

**SHEET**  
**03300-2**

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**SERVICE EQUIPMENT  
INSTALLATION REQUIREMENTS**

CUSTOMER FURNISHES, INSTALLS, AND MAINTAINS

**1. SERVICE SUPPORT**

SERVICE SUPPORT SHALL BE A SOLID 6 INCH BY 6 INCH PRESSURE TREATED TIMBER WITH A MINIMUM SETTING DEPTH OF 36 INCHES. IF SERVICE IS FROM MET-ED'S UNDERGROUND FACILITIES, THE SERVICE SUPPORT MUST BE LOCATED A MINIMUM OF 24 INCHES AND A MAXIMUM OF 72 INCHES FROM THE REAR OF THE TRANSFORMER FOUNDATION, HANDHOLE OR PEDESTAL. IF SERVICE IS FROM MET-ED'S OVERHEAD FACILITIES, THE SERVICE SUPPORT MUST BE A MINIMUM OF 60 INCHES OR A MAXIMUM OF 72 INCHES FROM THE POLE.

**2. SERVICE DISCONNECT EQUIPMENT**

PROVIDE A MANUAL RESET BREAKER OR FUSED DISCONNECT WITH ASSOCIATED GROUNDING INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE (NEC) AND ANY LOCAL CODE. TERMINAL LUGS MUST ACCEPT #12 AWG SOLID THROUGH #4 AWG STRANDED ON DISCONNECT EQUIPMENT RATED GREATER THAN 30 AMPS. ENCLOSURE MUST PREVENT ACCESS BY UNAUTHORIZED PERSONS AND SHALL BE A NEMA TYPE 3R.

**3. SERVICE LATERAL CONDUIT, CONNECTORS, AND CLAMPS**

THE MINIMUM SIZE SERVICE LATERAL CONDUIT IS 3/4 INCH SCHEDULE 40 PVC ON 30 AMP DISCONNECT EQUIPMENT AND 1 INCH SCHEDULE 40 PVC ON DISCONNECT EQUIPMENT RATED GREATER THAN 30 AMPS. THIS CONDUIT MUST EXTEND FROM THE SERVICE DISCONNECT TO 12 INCHES BELOW GROUND LINE.

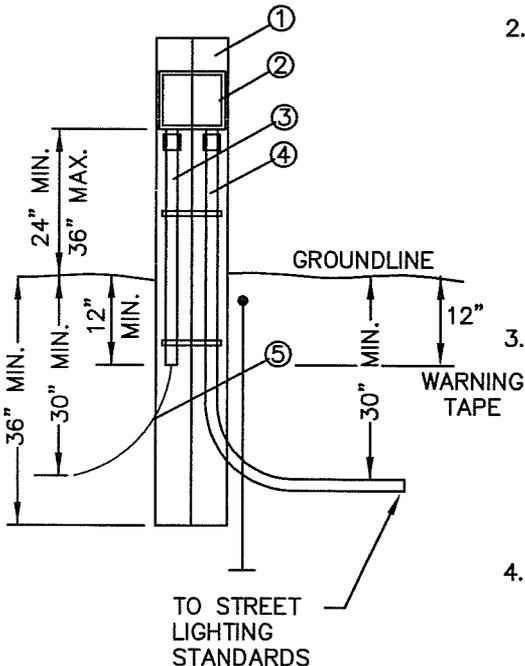
**4. DISTRIBUTION CONDUIT, CABLE, CONNECTORS, AND CLAMPS**

THIS EQUIPMENT MUST MEET THE REQUIREMENTS OF THE NEC AND ANY LOCAL MUNICIPAL CODES.

WARNING TAPE INDICATING "BURIED ELECTRIC LINE" MUST BE LAID ABOVE ALL CONDUIT OR CABLE 12" BELOW FINISH GRADE.

MET-ED FURNISHES, INSTALLS, AND MAINTAINS

**5. SERVICE LATERAL CONDUCTORS IN CUSTOMER PROVIDED TRENCH**



**STREET LIGHTING INSTALLATION DETAILS**

NOT TO SCALE

SHEET

16500-1

DRAWN BY: CJG	CHECK BY: SAG
CADD FILE No. 173-389 DT-28	
DATE: 5-28-08	JOB No.: 173-389
SCALE: AS NOTED	

SPRINGETTSBURY TOWNSHIP	
CONSTRUCTION & MATERIAL	
SPECIFICATIONS	
SPRINGETTSBURY TOWNSHIP	YORK COUNTY, PENNSYLVANIA
STREET LIGHTING INSTALLATION DETAILS	

**FIRST CAPITAL ENGINEERING**

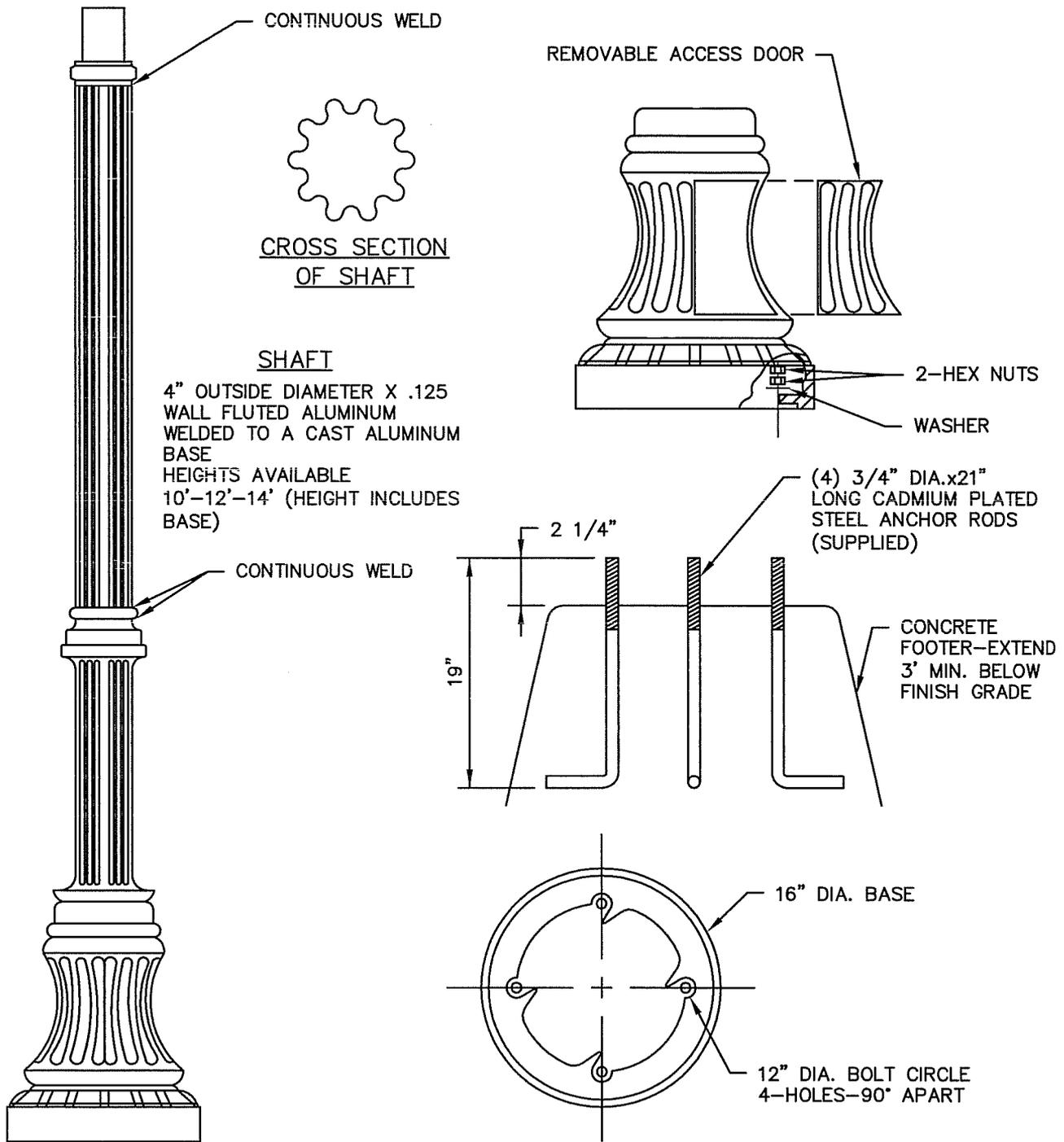
48 South Richland Avenue  
York, PA 17404  
Phone (717) 846-7047  
FAX (717) 858-7021

Gettysburg, PA 17385  
Phone (717) 887-8687  
www.FCEP.com

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**STREET LIGHT POLE TYPE 1**

NOT TO SCALE

SHEET

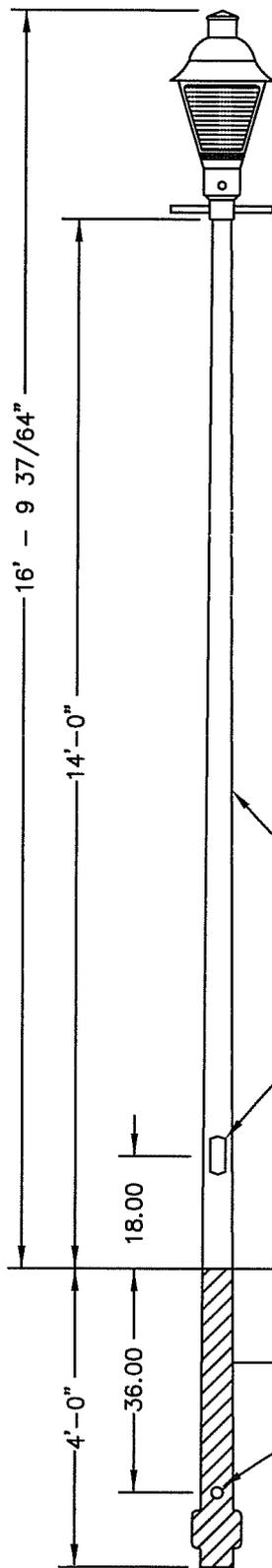
16500-2

DRAWN BY: C.J.G.	CHECK BY: <b>SAS</b>
CADD FILE No. 173-389 DT-29	
DATE: 5-28-08	JOB No.: 173-389
SCALE: AS NOTED	

SPRINGETTSBURY TOWNSHIP	
CONSTRUCTION & MATERIAL	
SPECIFICATIONS	
SPRINGETTSBURY TOWNSHIP	YORK COUNTY, PENNSYLVANIA
STREET LIGHT POLE TYPE 1	

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FINISH:  
BLACK

ORDERING GUIDE

C0496: LUMINAIRE  
CP0496A: POLE

POLE: 18' DIRECT BURIAL  
SHAFT: 2.9'x5.7' ROUND  
TAPERED COMPOSIT

HAND HOLE:  
LOCATED ON  
SIDE OF SHAFT

GRADE

WARNING TAPE

WIREWY:  
BELOW GRADE

FIGURE 1  
LUMINAIRE DETAIL  
SCALE 1:10

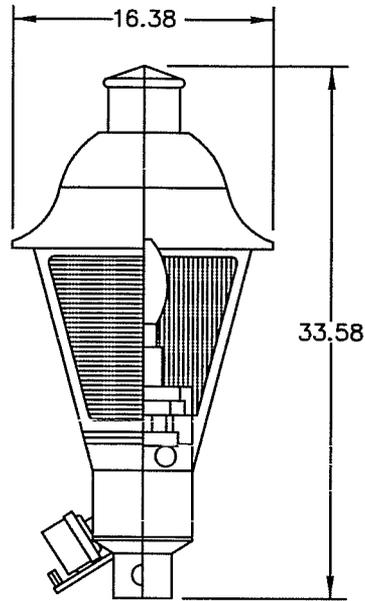


FIGURE 2  
LUMINAIRE  
MATRIX

FINISH:  
BLACK

OPTICS:  
TYPE III REFR.

PHOTO CONTROL:  
TWIST LOCK RECEPT.

SOCKET:  
MOGUL

WATTAGE:  
150W HPS

VOLTAGE:  
120V



LIGHTING ASSEMBLY RESIDENTIAL

NOT TO SCALE

SHEET

16500-3

DRAWN BY: CJG	CHECK BY: SAS
CADD FILE No. 173-389 DT-30	
DATE: 5-28-08	JOB No.: 173-389
SCALE: AS NOTED	

SPRINGETTSBURY TOWNSHIP  
CONSTRUCTION & MATERIAL  
SPECIFICATIONS

SPRINGETTSBURY TOWNSHIP YORK COUNTY, PENNSYLVANIA  
LIGHTING ASSEMBLY RESIDENTIAL

FIRST CAPITAL ENGINEERING

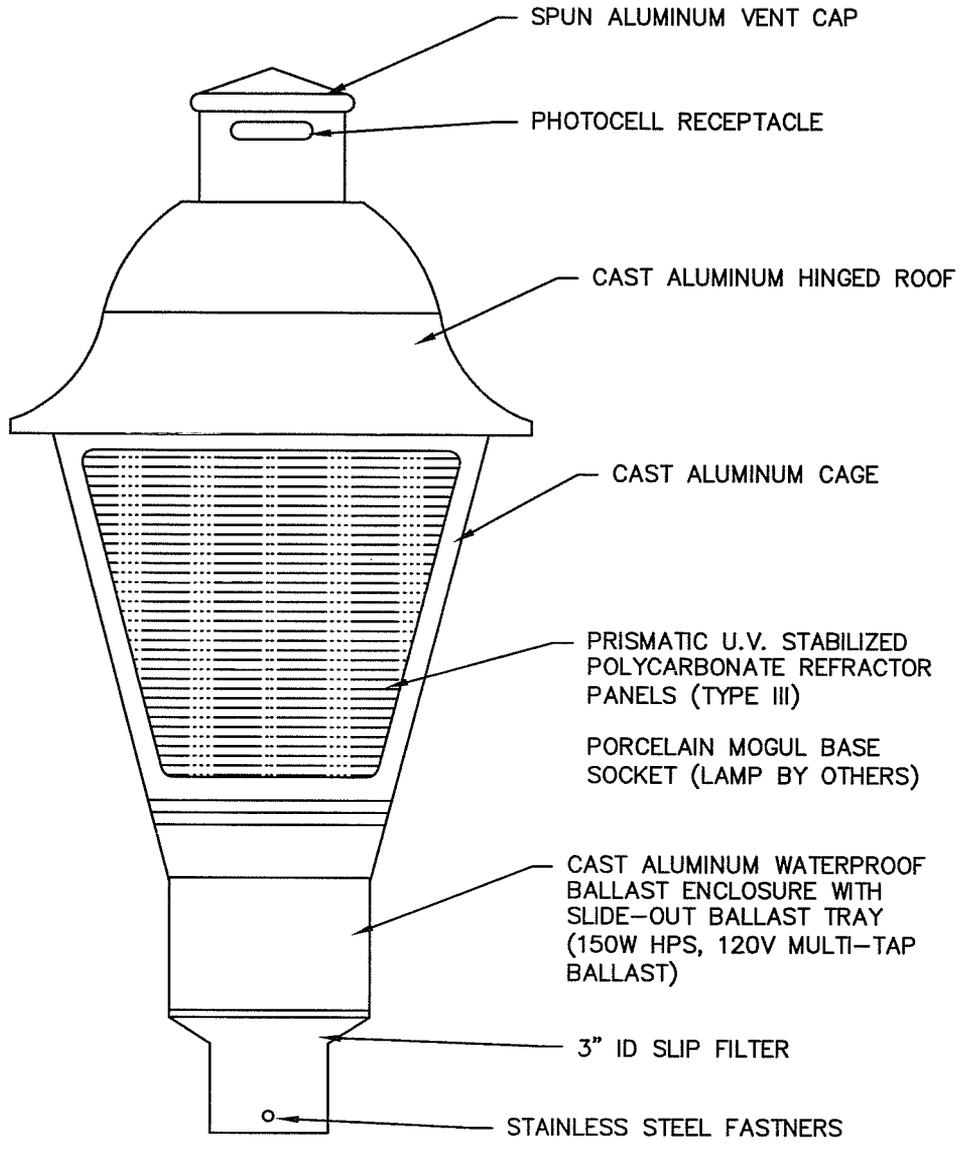
48 South Eichland Avenue  
York, PA 17404  
Phone (717) 840-7047  
FAX (717) 840-7001



Gettysburg, PA 17325  
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FIXTURE DIMENSIONS  
 HEIGHT: 31 1/2"  
 WIDTH: 15 1/2"  
 BLACK POLYESTER  
 POWDERCOAT FINISH

 LIGHTING ASSEMBLY (HADCO S5290)  
 NOT TO SCALE

SHEET  
 16500-4

DRAWN BY: SMG	CHECK BY: <b>SAS</b>
CADD FILE No. 173-389 DT-30A	
DATE: 5-13-08	JOB No.: 173-389
SCALE: AS NOTED	

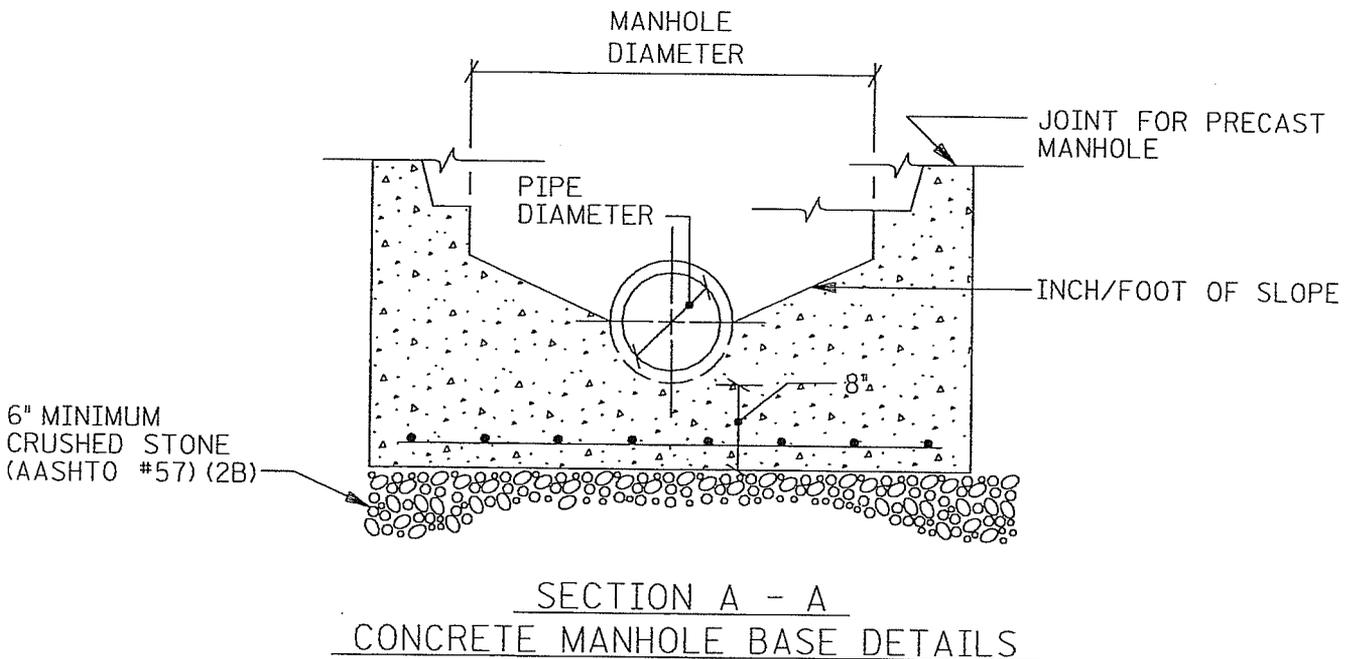
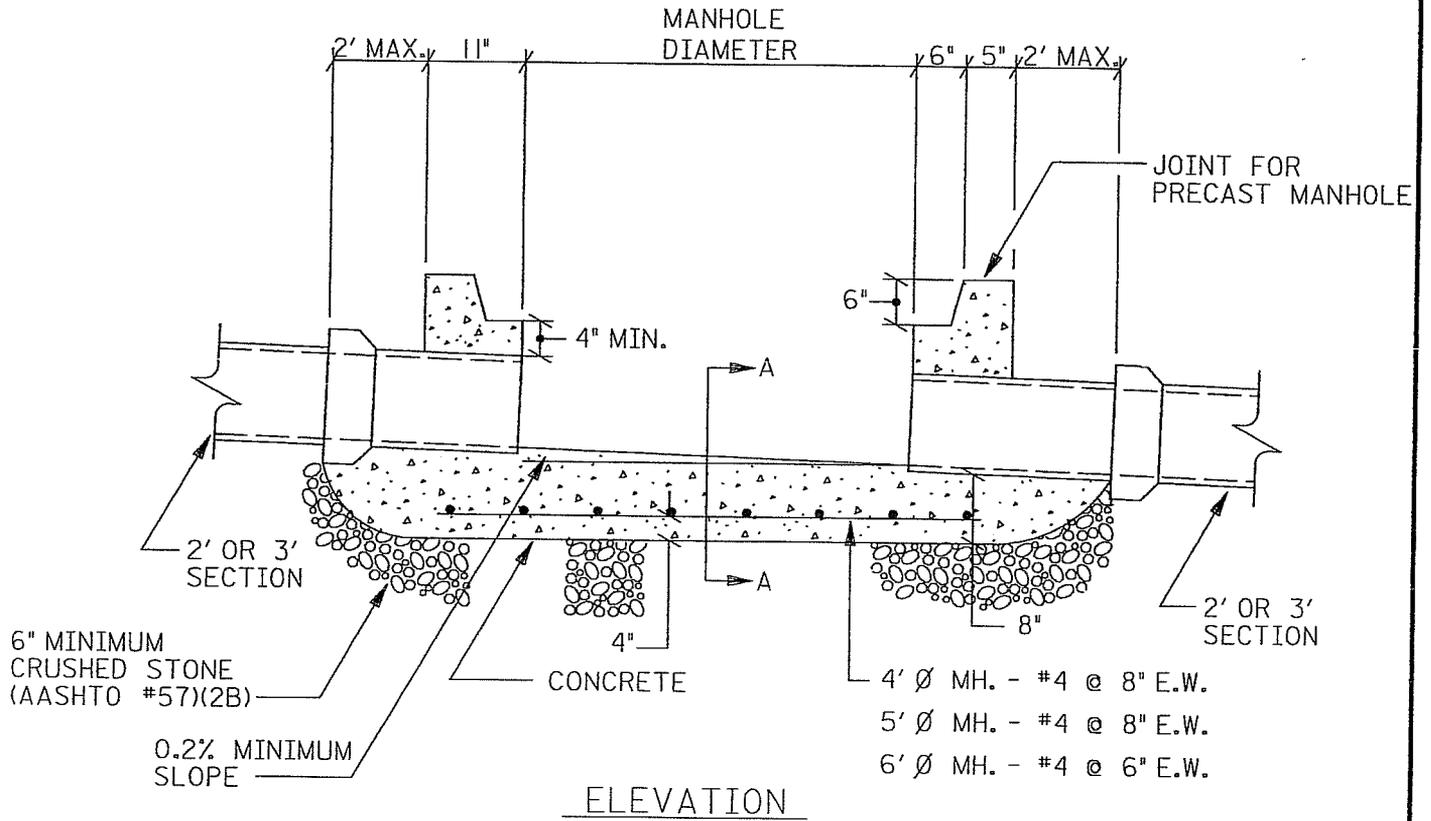
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 CONSTRUCTION & MATERIAL  
 SPECIFICATIONS  
 SPRINGETTSBURY TOWNSHIP YORK COUNTY, PENNSYLVANIA  
 LIGHTING ASSEMBLY

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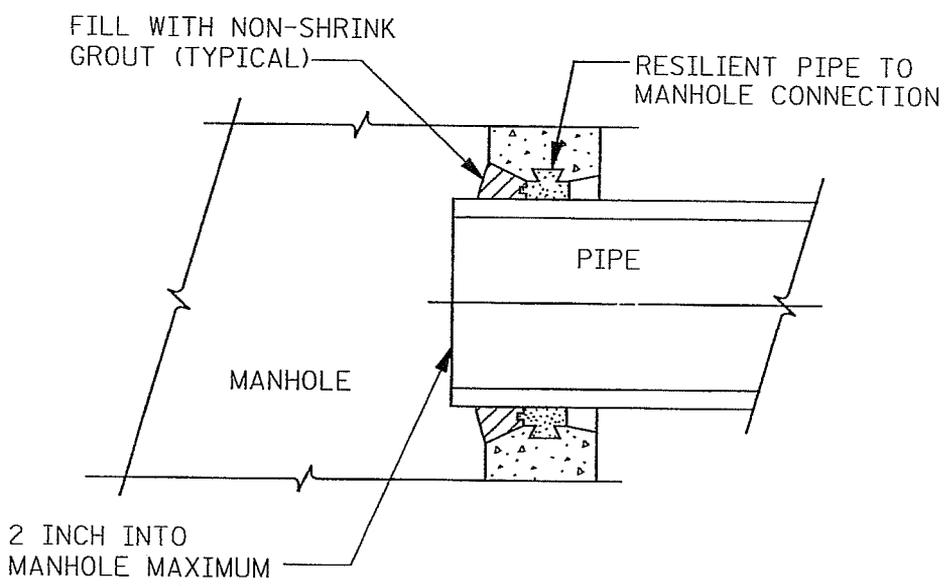
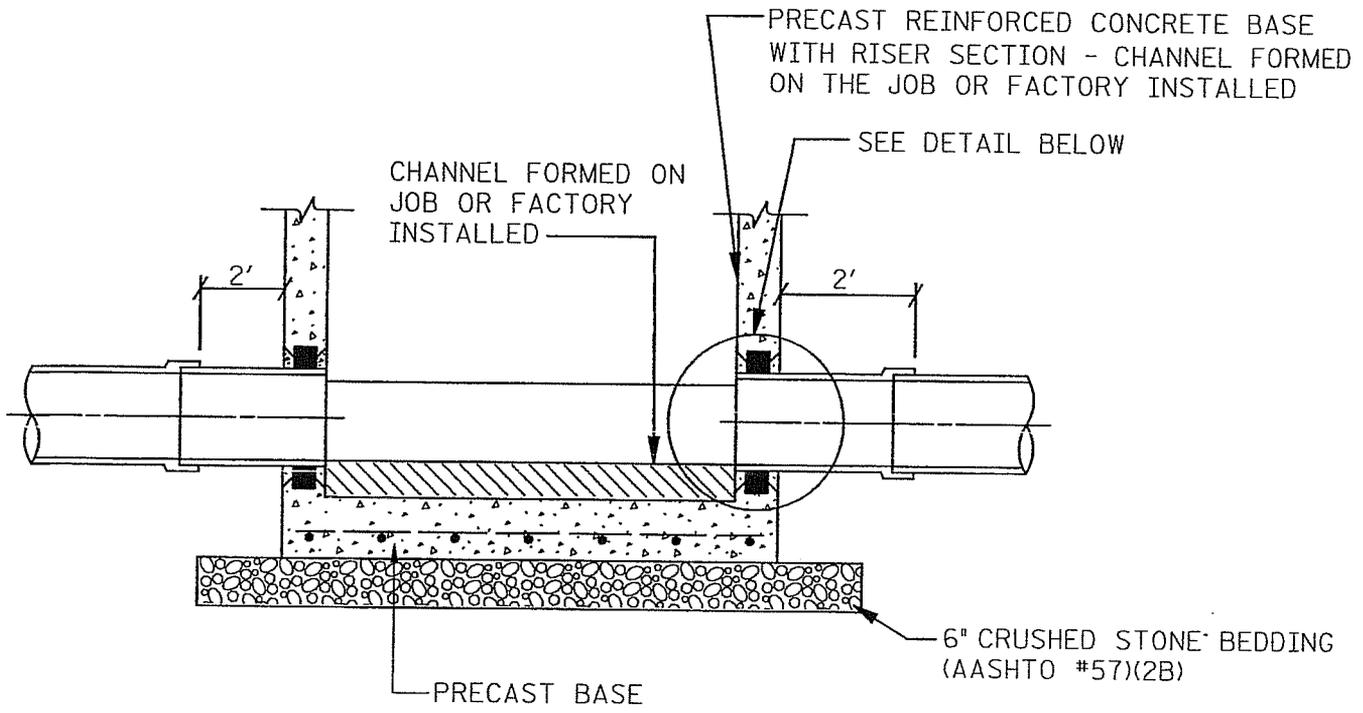


PROJECT NO.:
ENGR./ARCH.:
DRAWN BY:
DESIGN BY:
CHECKED BY:
CAD FILE:
DATE:



CONCRETE MANHOLE  
BASE DETAILS

5100A  
DRAWING NO.



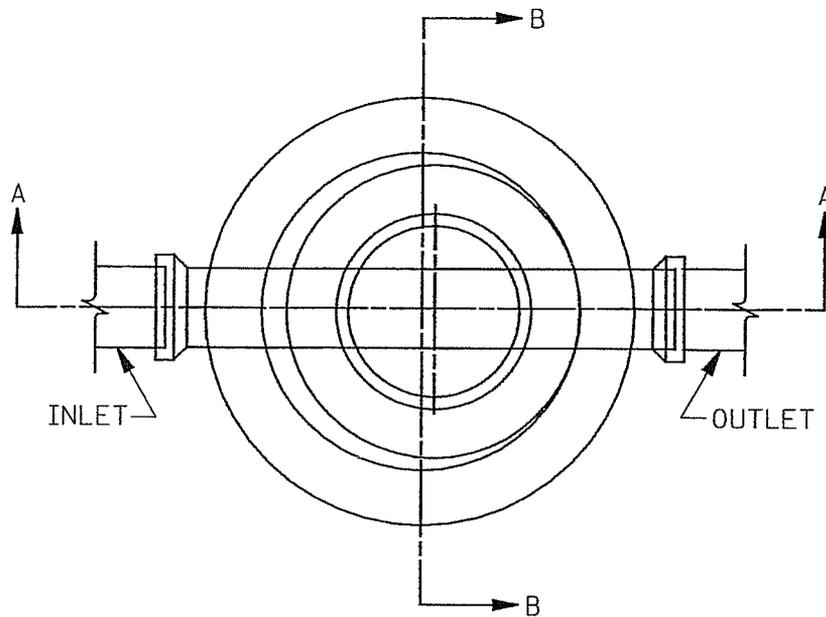
DETAIL

PROJECT NO.:
ENGR./ARCH.:
DRAWN BY:
DESIGN BY:
CHECKED BY:
CAD FILE:
DATE:



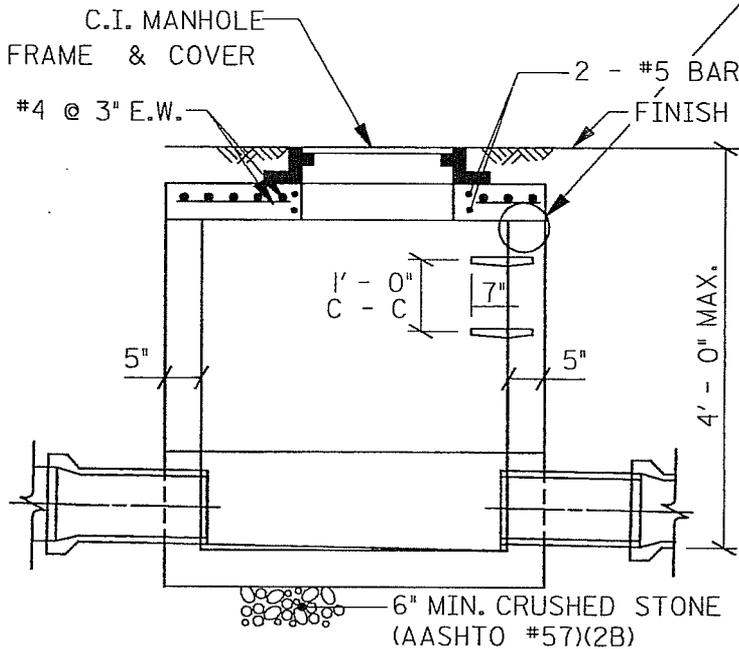
PRECAST MANHOLE BASE  
DETAIL

5100G
DRAWING NO.
SHEET OF

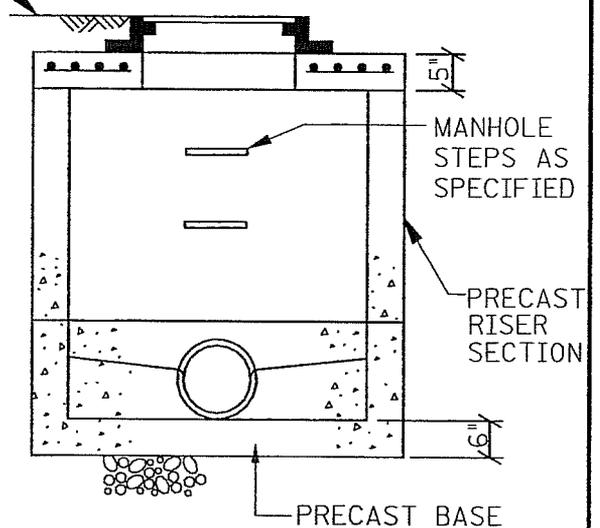


PLAN

IF PRECAST LID IS USED, JOINT  
JOINT BE COVERED W/ PREFORMED  
JOINT SEALANT COMPOUND PRIOR TO  
INSTALLATION OF CONCRETE COVER.



SECTION A - A



SECTION B - B

STANDARD SHALLOW PRECAST MANHOLE

PROJECT NO.:
ENGR./ARCH.:
DRAWN BY:
DESIGN BY:
CHECKED BY:
CAD FILE:
DATE:

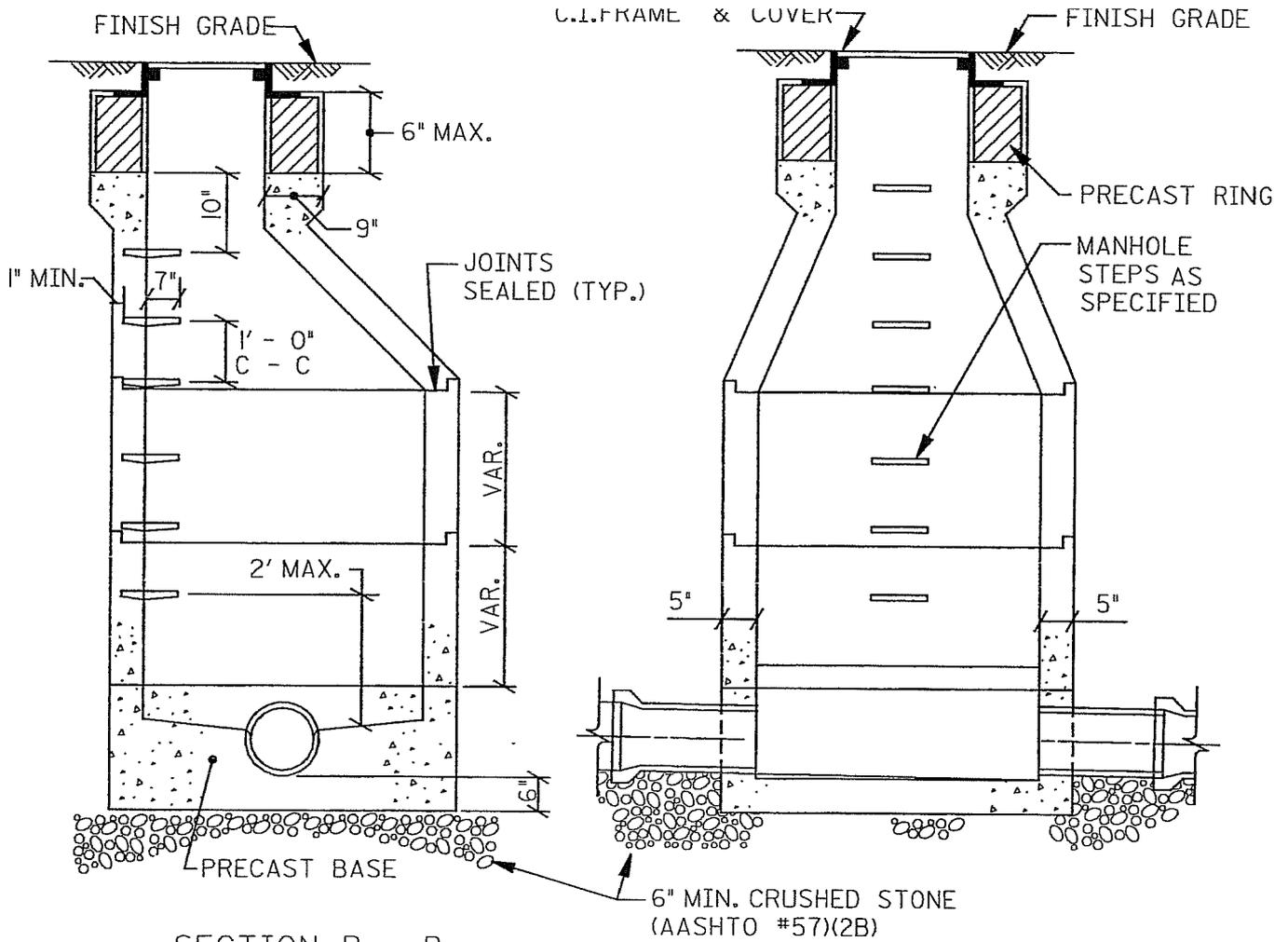


STANDARD SHALLOW  
PRECAST MANHOLE

51 06

DRAWING NO.

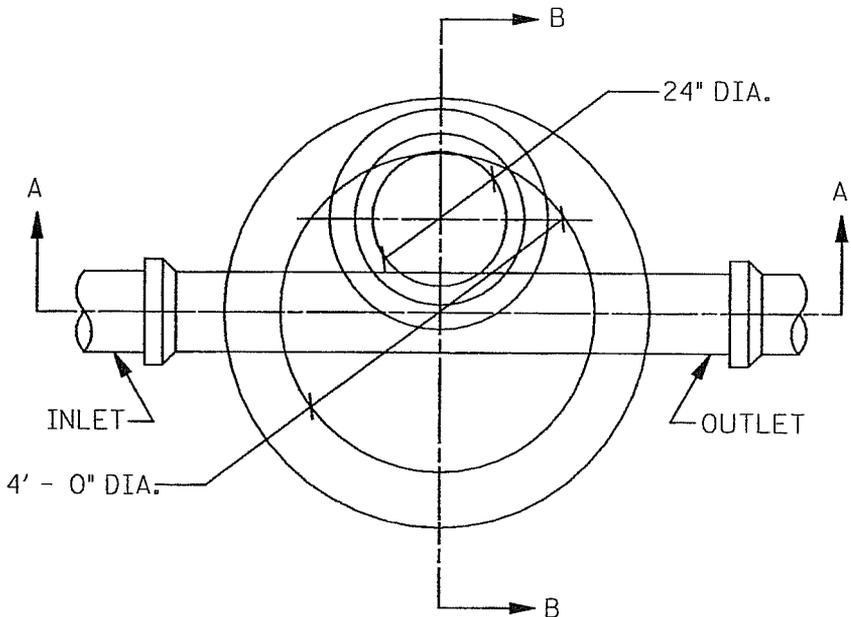
SHEET OF



SECTION B - B

SECTION A - A

DETAIL OF STANDARD DEEP PRECAST MANHOLE



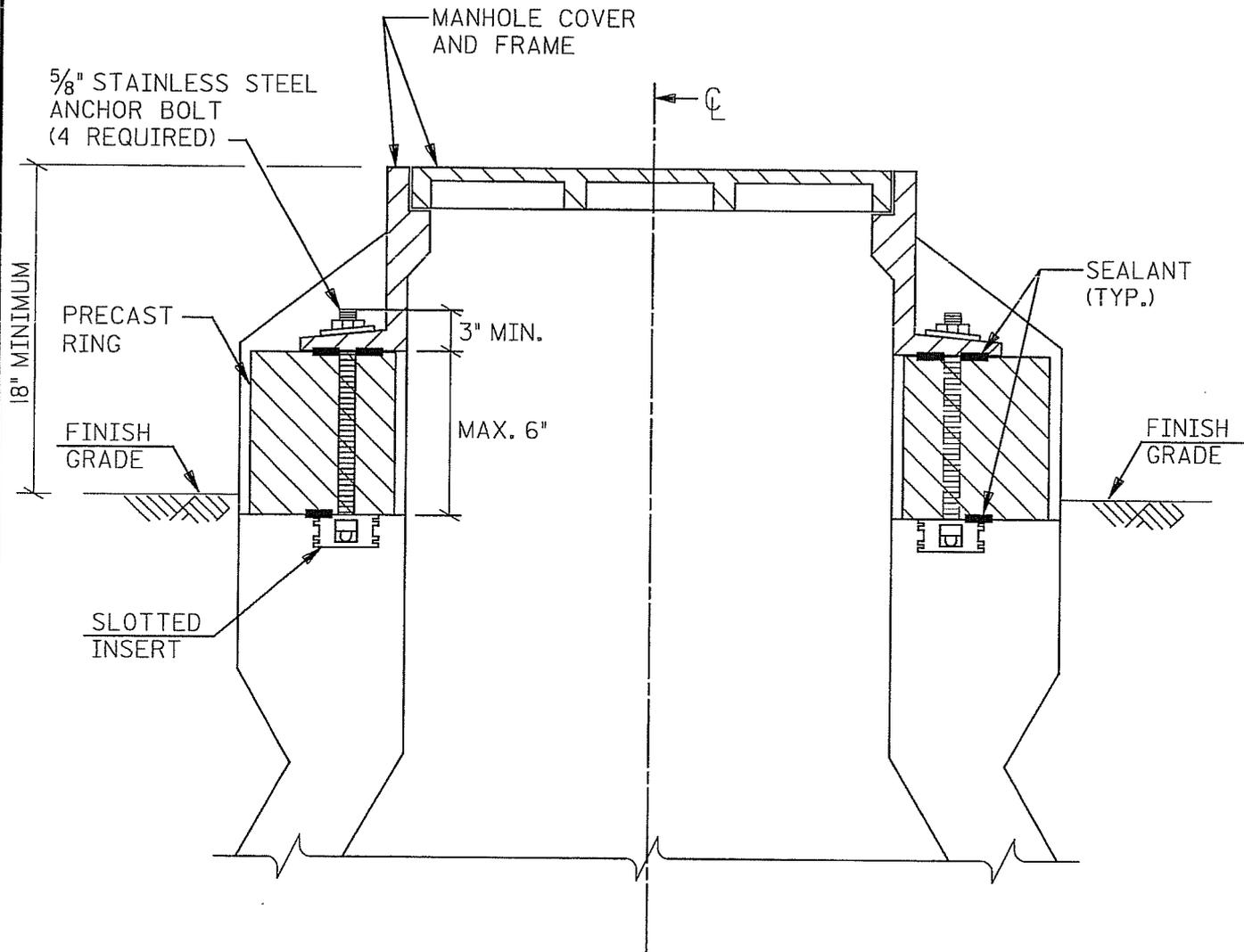
PLAN: PRECAST CONCRETE MANHOLE

PROJECT NO.:	
ENGR./ARCH.:	
DRAWN BY:	
DESIGN BY:	
CHECKED BY:	
CAD FILE:	
DATE:	



STANDARD DEEP  
PRECAST MANHOLE

5107
DRAWING NO.
SHEET OF



MANHOLE COVER WITH ANCHOR BOLT  
SCALE: NONE

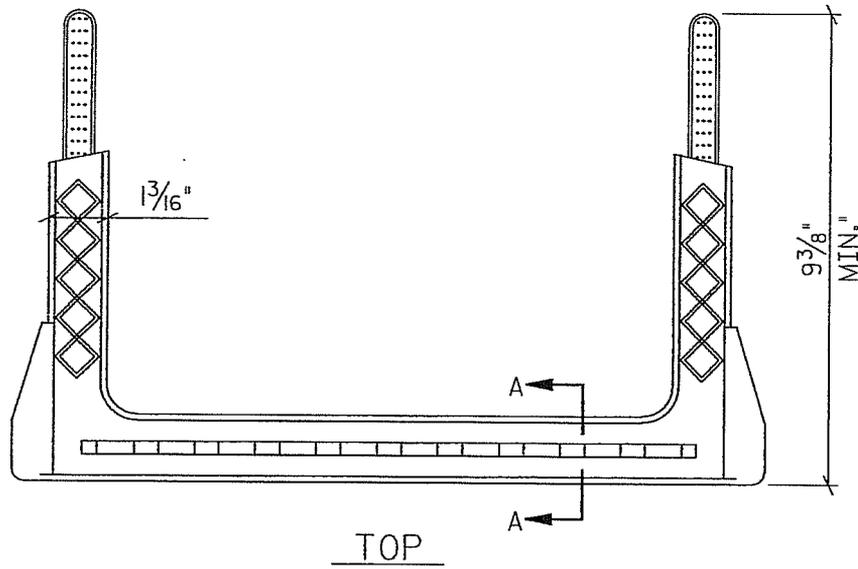
PROJECT NO.:
ENGR./ARCH.:
DRAWN BY:
DESIGN BY:
CHECKED BY:
CAD FILE:
DATE:



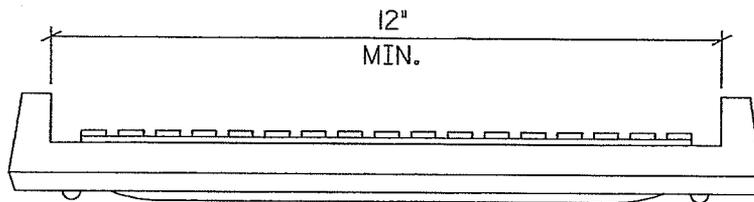
MANHOLE COVER WITH ANCHOR BOLT

5109A  
DRAWING NO.

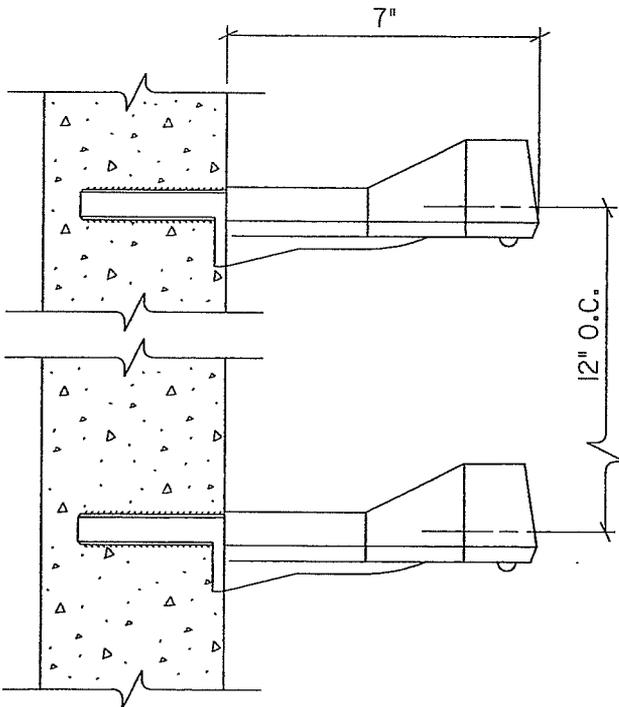
SHEET OF



TOP

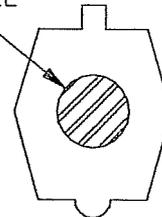


FRONT



ELEVATION

1/2" GRADE 60 STEEL REINFORCEMENT



SECTION A-A

NOTES:

MANHOLE STEPS TO BE COPOLYMER POLYPROPYLENE PLASTIC

DISTANCE FROM RIM OF MANHOLE TO TOP STEP SHALL NOT BE GREATER THAN 2 FT.

DISTANCE FROM BOTTOM STEP TO FLOOR OF MANHOLE SHALL NOT BE GREATER THAN 2 FT.

MANHOLE STEP DETAIL

PROJECT NO.:	
ENGR./ARCH.:	
DRAWN BY:	
DESIGN BY:	
CHECKED BY:	
CAD FILE:	
DATE:	



MANHOLE STEP DETAIL

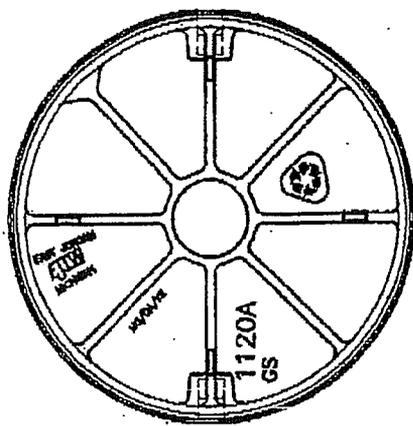
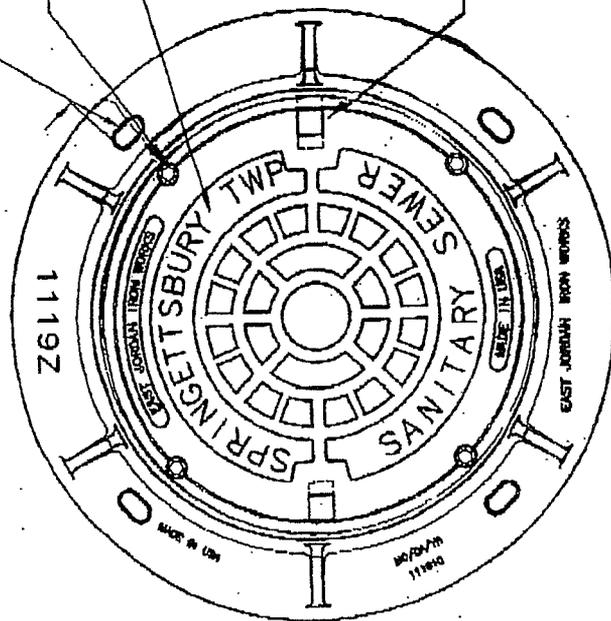
5110C

DRAWING NO.

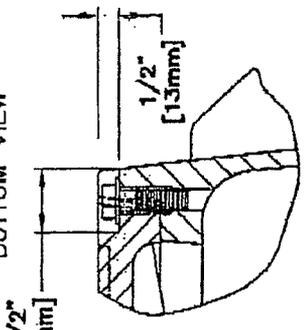
LOCATED IN NON-PAVED AREA, SEE DETAIL 5109A)

(4) 1" (25mm) X 2" (51mm) SLOTTED HOLES ON 29 3/8" (746mm) DIA BOLT CIRCLE. (WHEN LOCATED IN NON-PAVED AREA, SEE DETAIL 5109A)  
 (4) 1/2-13 X 1 3/4" HEX HD S.S. BOLTS W/ WASHERS  
 1 1/4" (32mm) LETTERING (RECESSED FLUSH)

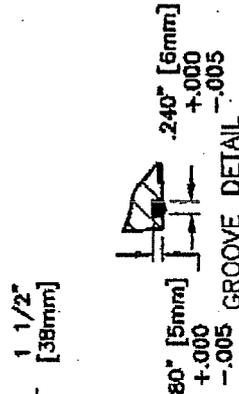
(2) CLOSED PICKHOLES (22mm) DIA HOLES SPACED ON (857mm) DIA B.C.



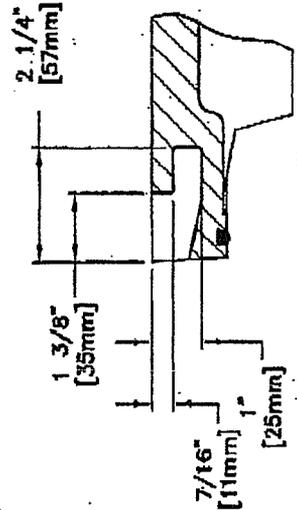
BOTTOM VIEW



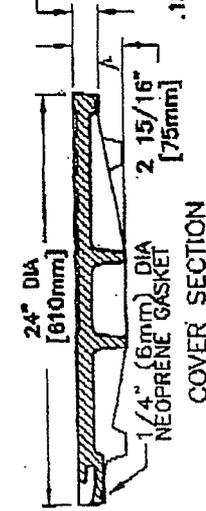
COUNTERBORE DETAIL



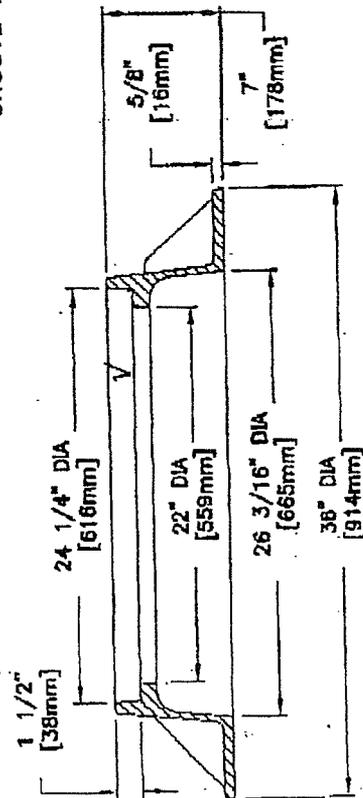
GROOVE DETAIL



PICKHOLE DETAIL



COVER SECTION



FRAME SECTION

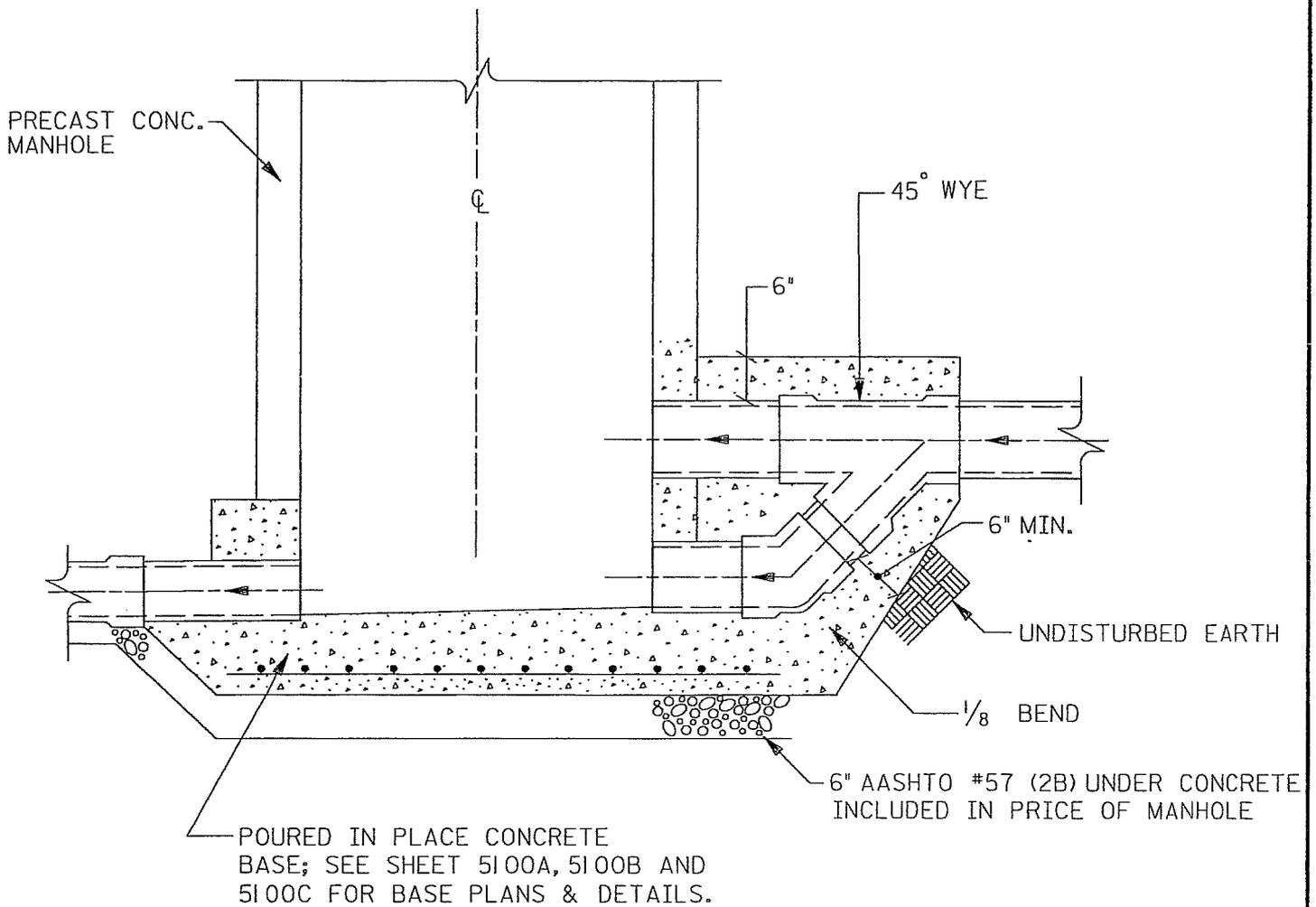
MACHINED SURFACE

PROJECT NO.:	
ENGR./ARCH.:	
DRAWN BY:	
DESIGN BY:	
CHECKED BY:	
CAD FILE:	
DATE:	



HEAVY DUTY WATERTIGHT  
 MANHOLE FRAME & COVER  
 W/ GASKET IN FRAME

5115  
 DRAWING NO.  
 SHEET OF



ELEVATION  
TYPE A DROP MANHOLE DETAILS

<u>SIZE OF SEWER</u>	<u>MIN. DROP</u>	<u>MAX. DROP</u>
8"	1' - 9"	2' - 8"
10"	2' - 0"	2' - 10"
12"	2' - 2"	3' - 3"
* 15"	3' - 2"	6' - 8"

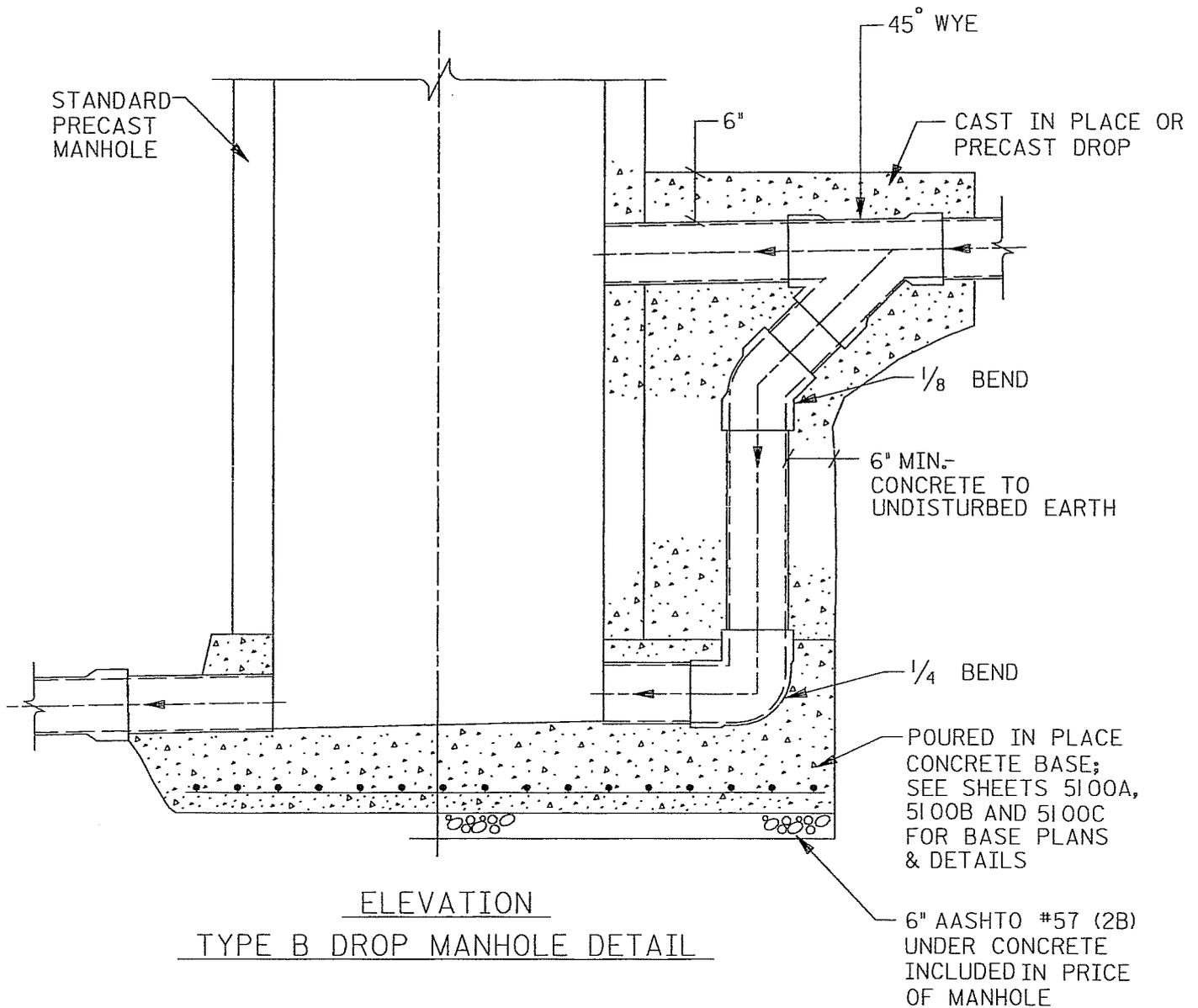
- NOTE:
1. CONCRETE INCLUDED IN UNIT PRICE BID FOR DROP MANHOLE CONNECTION.
  2. \* - INDICATES DIMENSIONS FROM FABRICATED FITTINGS.

PROJECT NO.:
ENGR./ARCH.:
DRAWN BY:
DESIGN BY:
CHECKED BY:
CAD FILE:
DATE:



P.V.C. PIPE  
TYPE A DROP  
MANHOLE DETAILS

5119A
DRAWING NO.
SHEET OF



<u>SIZE OF SEWER</u>	<u>MIN. DROP</u>
8"	2' - 8"
10"	2' - 10"
12"	3' - 3"
* 15"	6' - 8"

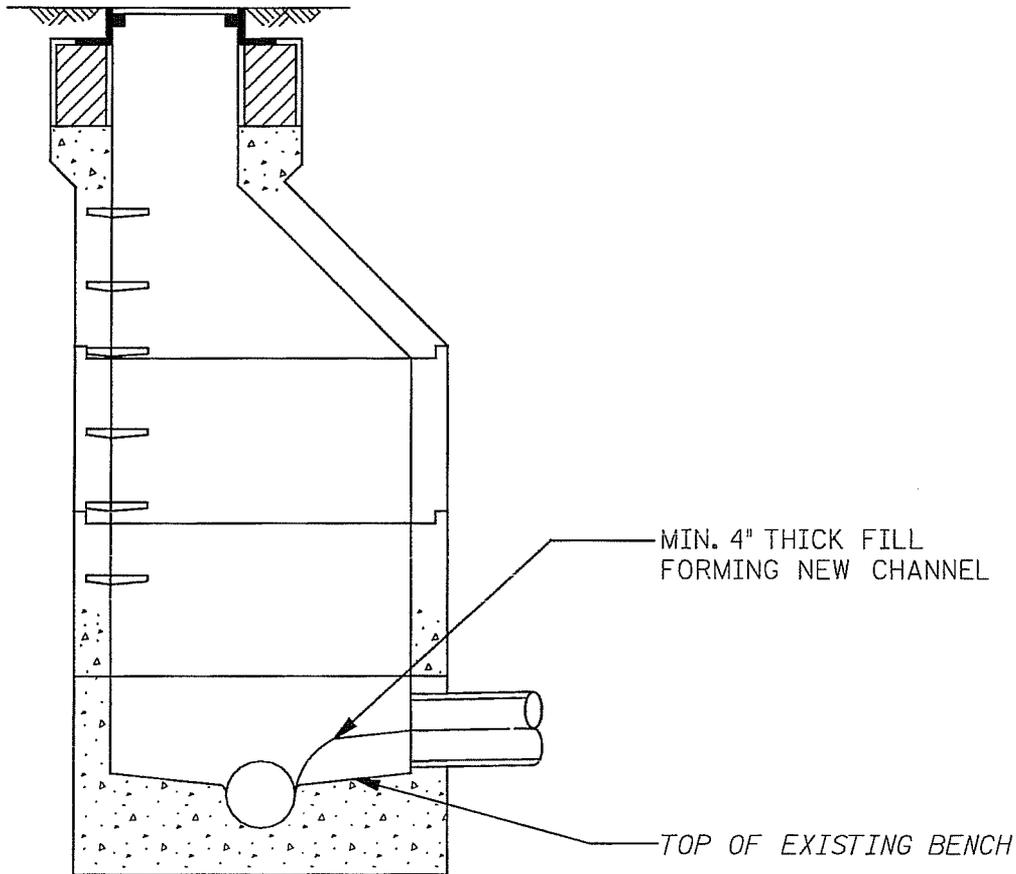
- NOTES:
1. CONCRETE INCLUDED IN UNIT PRICE BID FOR DROP MANHOLE CONSTRUCTION.
  2. \* - INDICATES DIMENSIONS FROM FABRICATED FITTINGS.

PROJECT NO.:
ENGR./ARCH.:
DRAWN BY:
DESIGN BY:
CHECKED BY:
CAD FILE:
DATE:

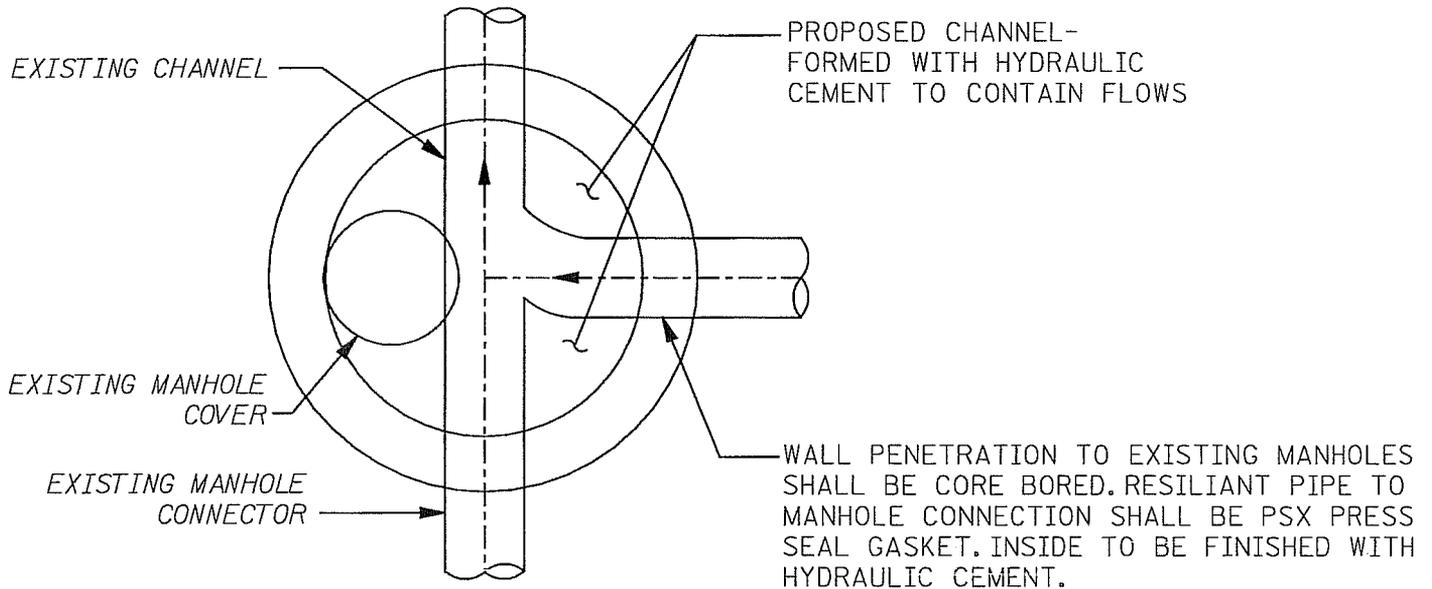


P.V.C. PIPE  
TYPE B DROP  
MANHOLE DETAILS

5120A
DRAWING NO.
SHEET OF



DETAIL OF STANDARD DEEP PRECAST MANHOLE



PLAN: PRECAST CONCRETE MANHOLE

PROJECT NO.:
ENGR./ARCH.:
DRAWN BY:
DESIGN BY:
CHECKED BY:
CAD FILE:
DATE:



MANHOLE CONNECTION DETAIL

5121

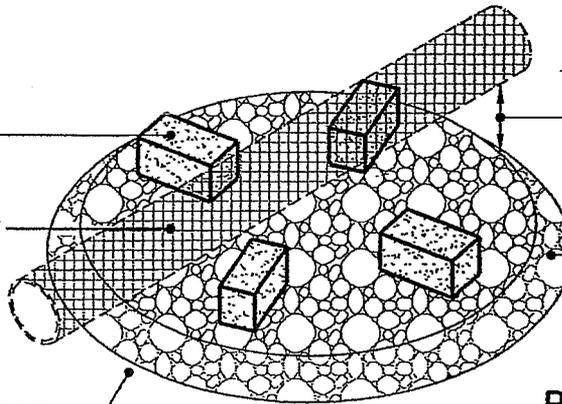
DRAWING NO.

SHEET OF

8x8x16 SOLID  
CONCRETE BLOCK  
CENTER W/RISER  
WALL (4 EACH)

EXISTING SANITARY  
SEWER PIPE

SEE SPECS FOR  
FOUNDATION  
IMPROVEMENT  
WHEN NEEDED



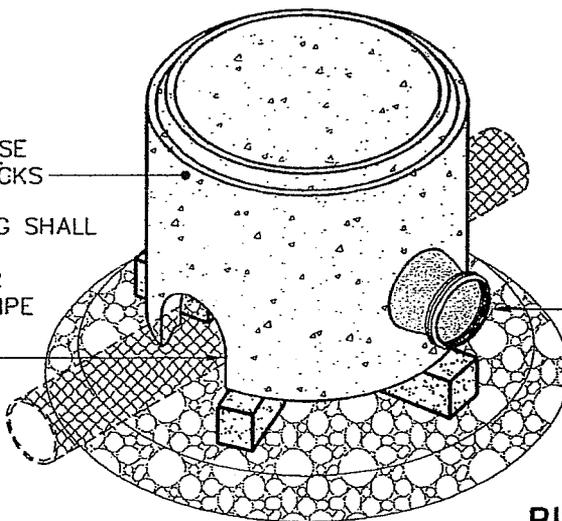
MIN. 8" CLEAR  
BETWEEN EXISTING  
PIPE AND PROPOSED  
STONE

12" THICK NO. 57 STONE(2B)  
ALLOW 1'-0" BEYOND RISER  
STRUCTURE DIMENSION FOR  
CONCRETE BASE

**BASE ISOMETRIC VIEW**

SET DOGHOUSE BASE  
ON CONCRETE BLOCKS

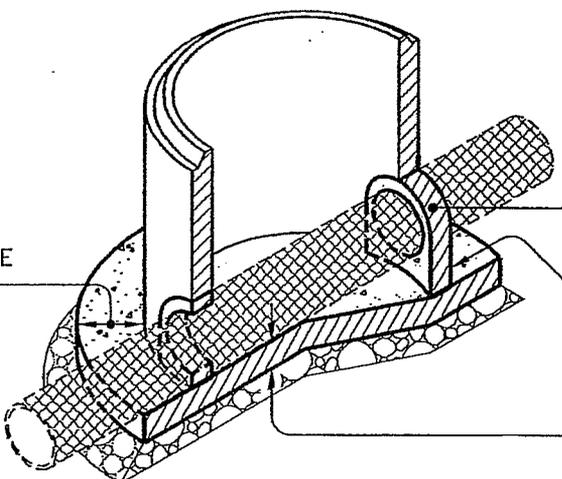
DOGHOUSE OPENING SHALL  
BE PREFORMED BY  
MANUFACTURER OR  
SAW CUT TO FIT PIPE  
OUTSIDE DIAMATER  
PLUS 6"



SEE PLANS FOR  
PROPOSED INVERT(S)  
LOCATION & ELEVATION

**RISER ISOMETRIC VIEW**

ALLOW CONCRETE  
TO FLOW A MIN.  
1'-0" BEYOND BASE  
OF STRUCTURE



FILL DOGHOUSE OPENING  
AROUND EXISTING PIPE  
WITH 3,000 PSI CONCRETE

CONTRACTOR TO APPLY  
WATER PROOFING  
SEALANT AT JOINT

8" MIN. CAST-IN  
PLACE BASE

**FOUNDATION SECTION VIEW**

PROJECT NO.:	
ENGR./ARCH.:	
DRAWN BY:	
DESIGN BY:	
CHECKED BY:	
CAD FILE:	
DATE:	

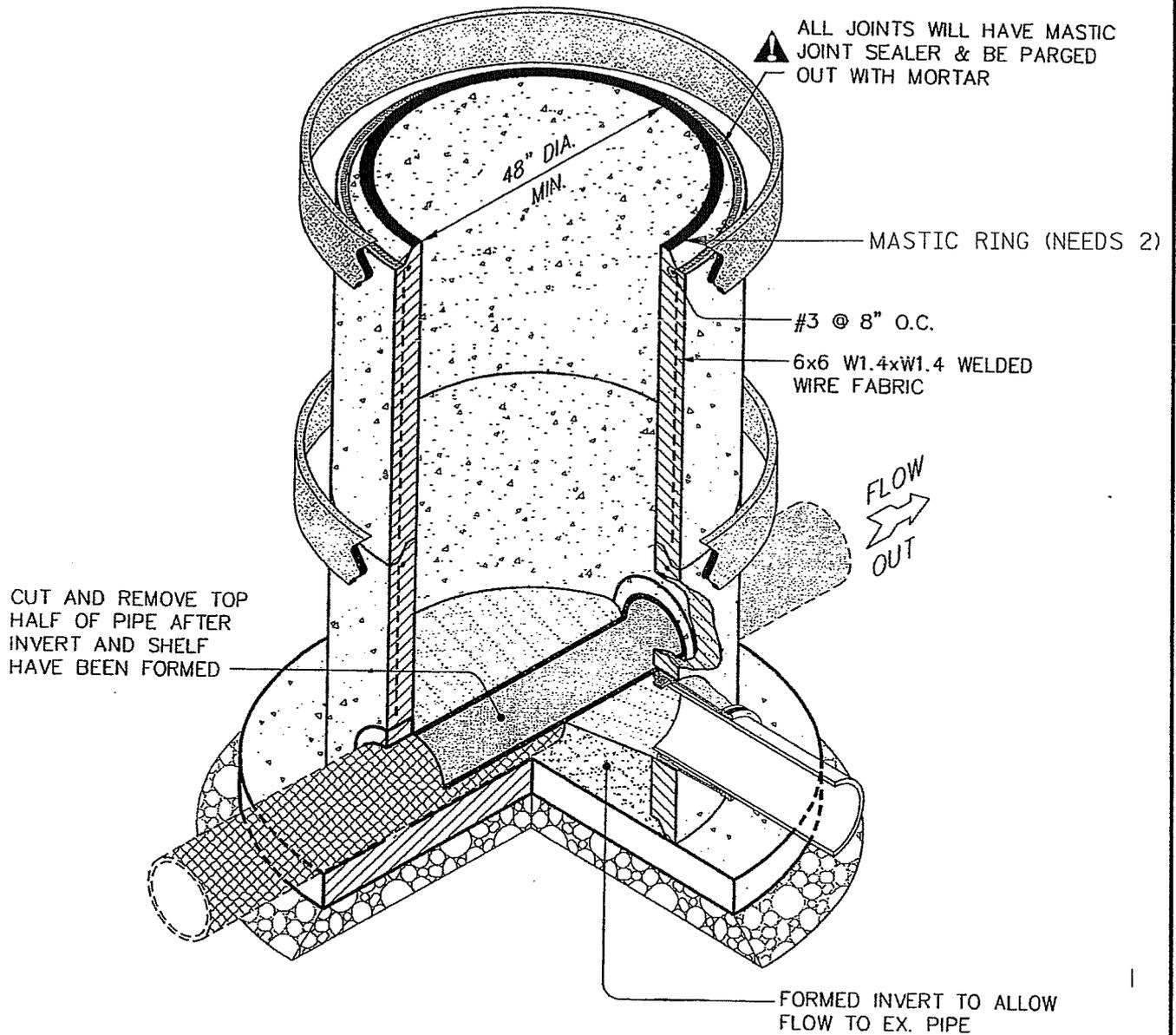


PRECAST CONCRETE  
DOGHOUSE MANHOLE

5122

DRAWING NO.

SHEET OF



**NOTES:**

1. All service laterals into manhole to be core drilled and booted.
2. PRECAST CONCRETE DOGHOUSE MANHOLE MUST BE APPROVED BY THE TOWNSHIP.

PROJECT NO.:	
ENGR./ARCH.:	
DRAWN BY:	
DESIGN BY:	
CHECKED BY:	
CAD FILE:	
DATE:	



PRECAST CONCRETE  
DOGHOUSE MANHOLE  
INVERT SECTION VIEW

5123

DRAWING NO.

SHEET OF

BACK  
FILL  
DEPTH  
IN FT.  
OVER  
TOP OF  
PIPE

REINFORCED CONCRETE PIPE  
NOMINAL DIAMETER (INCHES)

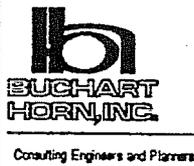
	15	18	21	24	27	30	33	36
6	CLASS II PIPE							
7	CLASS III PIPE							
8	CLASS III PIPE							
9	CLASS III PIPE							
10	CLASS III PIPE							
11	CLASS III PIPE							
12	CLASS III PIPE							
13	CLASS III PIPE							
14	CLASS III PIPE							
15	CLASS III PIPE							
16	CLASS III PIPE							
17	CLASS III PIPE							
18	CLASS III PIPE							
19	CLASS III PIPE							
20	CLASS III PIPE							
21	CLASS III PIPE							
22	CLASS III PIPE							
23	CLASS III PIPE							
24	CLASS III PIPE							
25	CLASS III PIPE							
26	CLASS III PIPE							
27	CLASS III PIPE							
28	CLASS III PIPE							
29	CLASS III PIPE							
30	CLASS III PIPE							
31	CLASS III PIPE							
32	CLASS III PIPE							
33	CLASS III PIPE							
34	CLASS III PIPE							
35	CLASS III PIPE							
36	CLASS III PIPE							
37	CLASS III PIPE							
38	CLASS III PIPE							
39	CLASS III PIPE							
40	CLASS III PIPE							

CLASS V  
PIPE

CLASS V PIPE

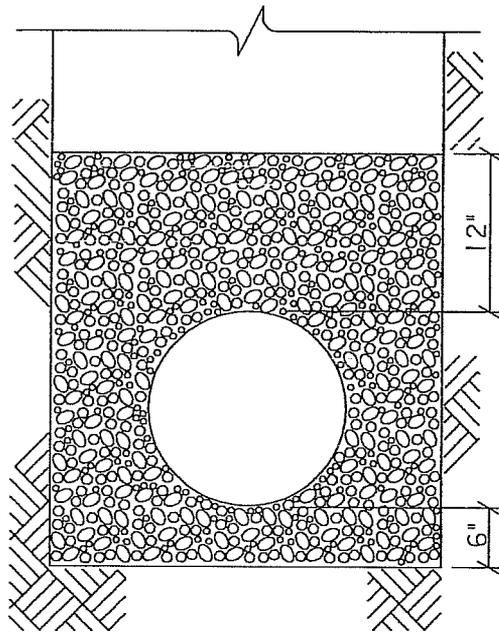
CLASS V PIPE

DRAWN BY *REF*  
DATE *5-10-94*  
CHECK BY *EM*  
DATE *6-2-94*



R.C.P. LOAD TABLE

APPROVED BY *llb*  
DATE APPROVED *6-3-94*  
DETAIL NO. **5176B**



TYPE IV BEDDING

NOTES:

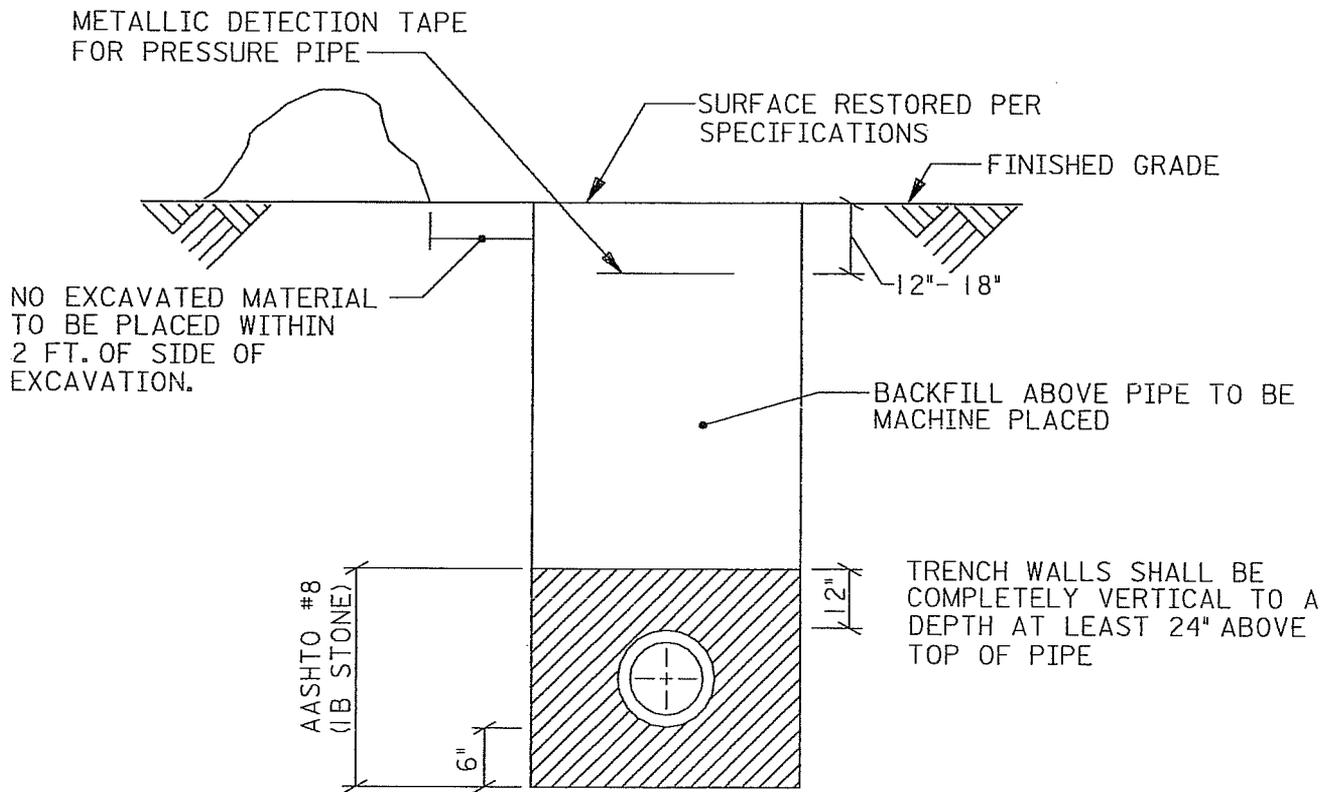
- TRENCH BOTTOM TO BE FREE OF WATER BEFORE PLACING BEDDING.
- SHAPE RECESSES FOR BELL OF PIPE BY HAND.
- BACKFILL ABOVE BEDDING WITH SPECIFIED BACKFILL MATERIAL.
- BACKFILL MATERIAL TO BE 1B STONE (AASHTO #8).

PROJECT NO.:	
ENGR./ARCH.:	
DRAWN BY:	
DESIGN BY:	
CHECKED BY:	
CAD FILE:	
DATE:	



PIPE BEDDING  
DETAIL

5177
DRAWING NO.
SHEET OF



SECTION

NOTES:

1. SHORING REQUIRED FOR ALL TRENCHES IN ACCORDANCE WITH OSHA AND APPLICABLE REGULATIONS LAWS & SAFETY CODES.
2. PLACE BACKFILL AROUND PIPE BY HAND AND COMPACT IN 6" LAYERS. BACKFILL AROUND PIPE: IB STONE

PROJECT NO.:
ENGR./ARCH.:
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CHECKED BY:
CAD FILE:
DATE:

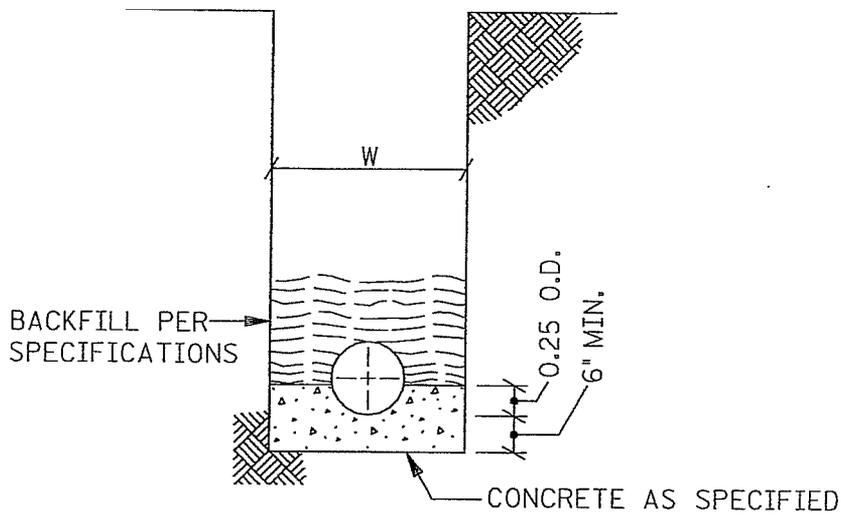


PIPE TRENCH DETAIL

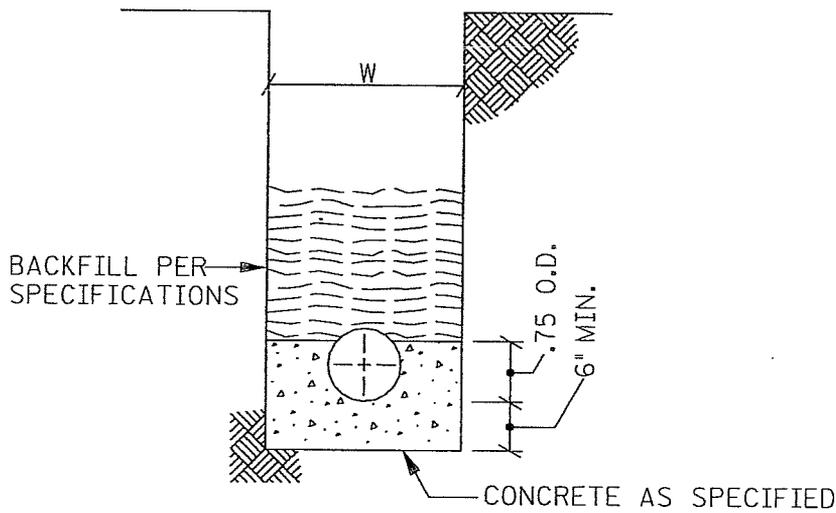
5178A

DRAWING NO.

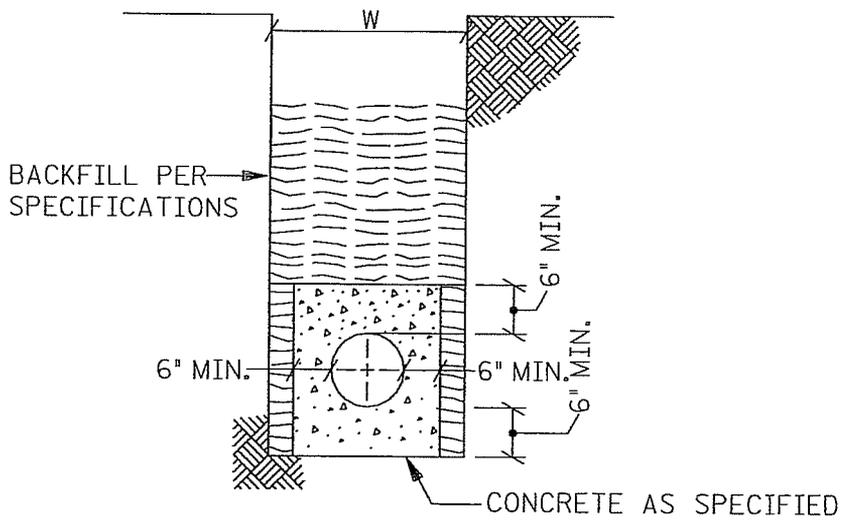
SHEET OF



LOW CONCRETE CRADLE



HIGH CONCRETE CRADLE



CONCRETE ENCASEMENT TYPE I

CONCRETE CRADLE AND ENCASEMENT DETAILS

PROJECT NO.:	
ENGR./ARCH.:	
DRAWN BY:	
DESIGN BY:	
CHECKED BY:	
CAD FILE:	
DATE:	

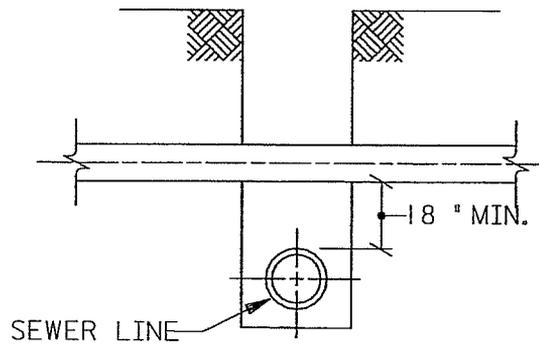


CONCRETE CRADLE AND ENCASEMENT DETAILS

5179

DRAWING NO.

SHEET OF



SECTION

VERTICAL WATER MAIN CLEARANCE

NOTES:

1. IF JOINT ON WATER MAIN IS WITHIN LIMITS OF SEWER TRENCH, INSTALL MECHANICAL BELL JOINT CLAMP.
2. IF CLEARANCE IS LESS THAN 18" ENCASE SEWER PIPE 10 FT. EACH SIDE OF WATER MAIN. TO BE PAID AT UNIT PRICE BID PER CUBIC YARD OF CONCRETE.
3. IN NO CASE SHALL THE SEWER PIPE CONTACT ANY WATER MAIN, SERVICE LINE OR APPURTENANCE.

PROJECT NO.:	
ENGR./ARCH.:	
DRAWN BY:	
DESIGN BY:	
CHECKED BY:	
CAD FILE:	
DATE:	

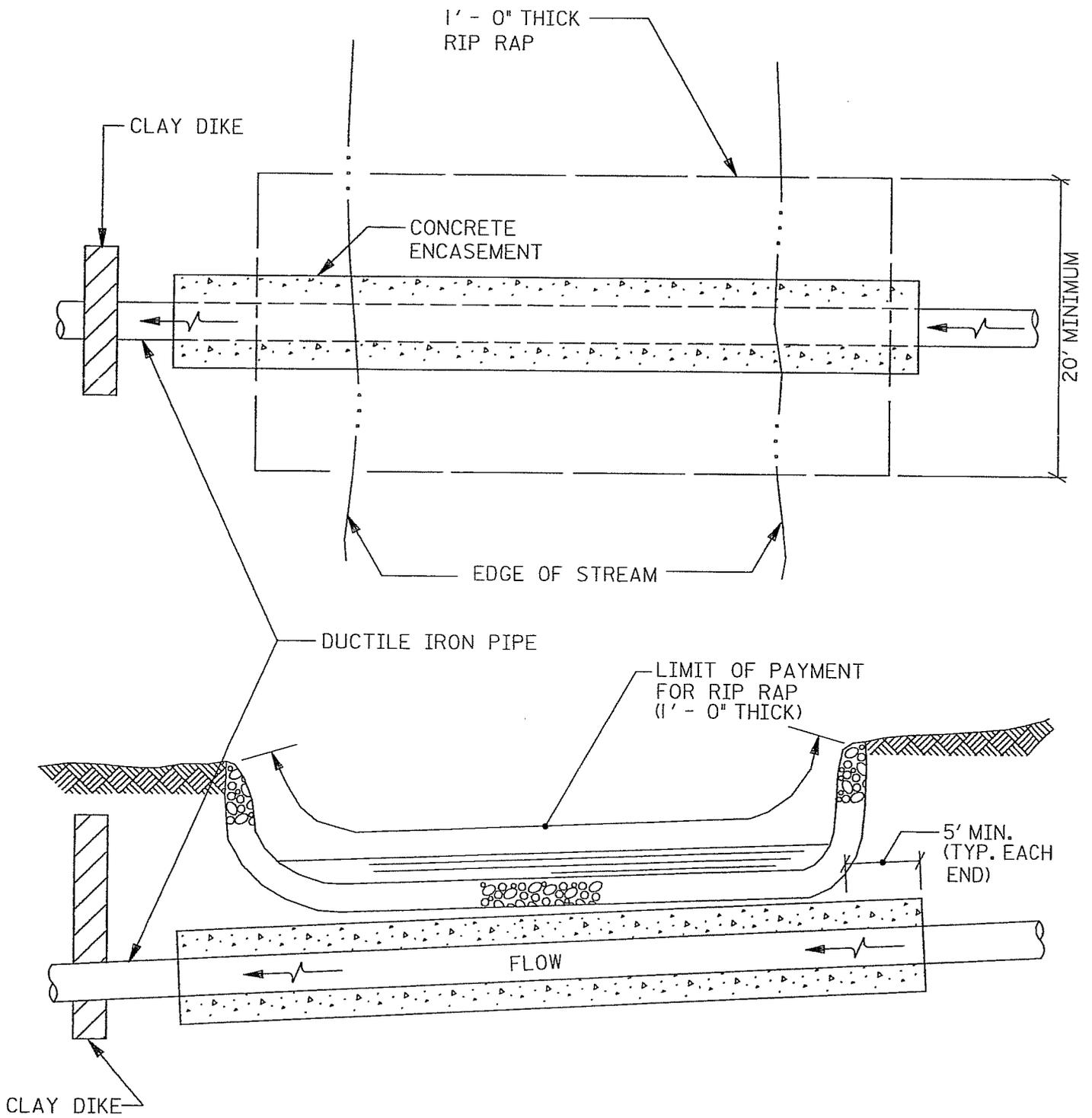


VERTICAL WATER  
MAIN CLEARANCE

5180

DRAWING NO.

SHEET OF



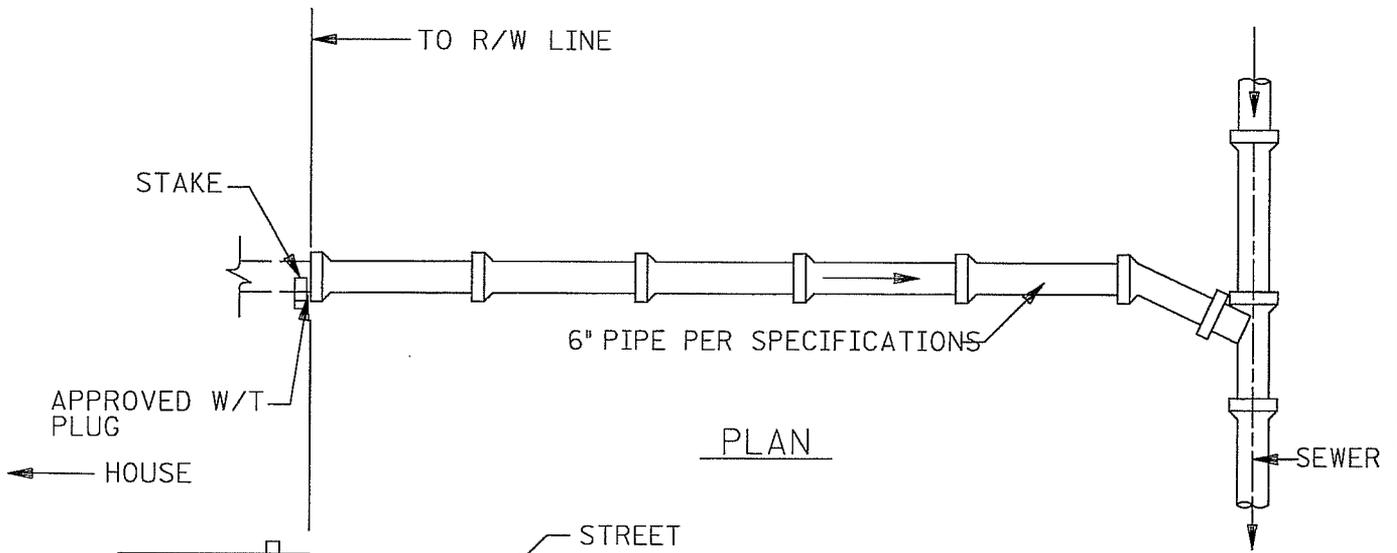
PROJECT NO.:
ENGR./ARCH.:
DRAWN BY:
DESIGN BY:
CHECKED BY:
CAD FILE:
DATE:



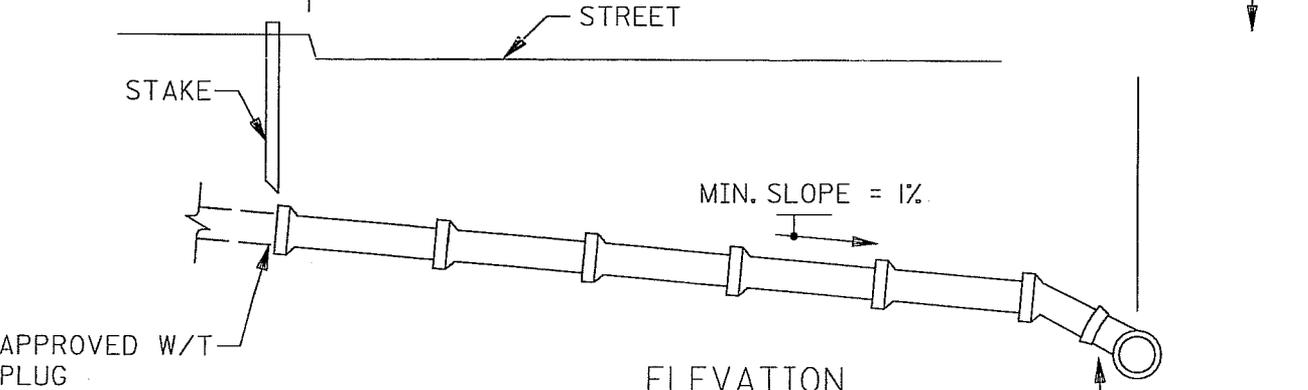
STREAM CROSSING  
DETAIL

5180A  
DRAWING NO.

SHEET OF

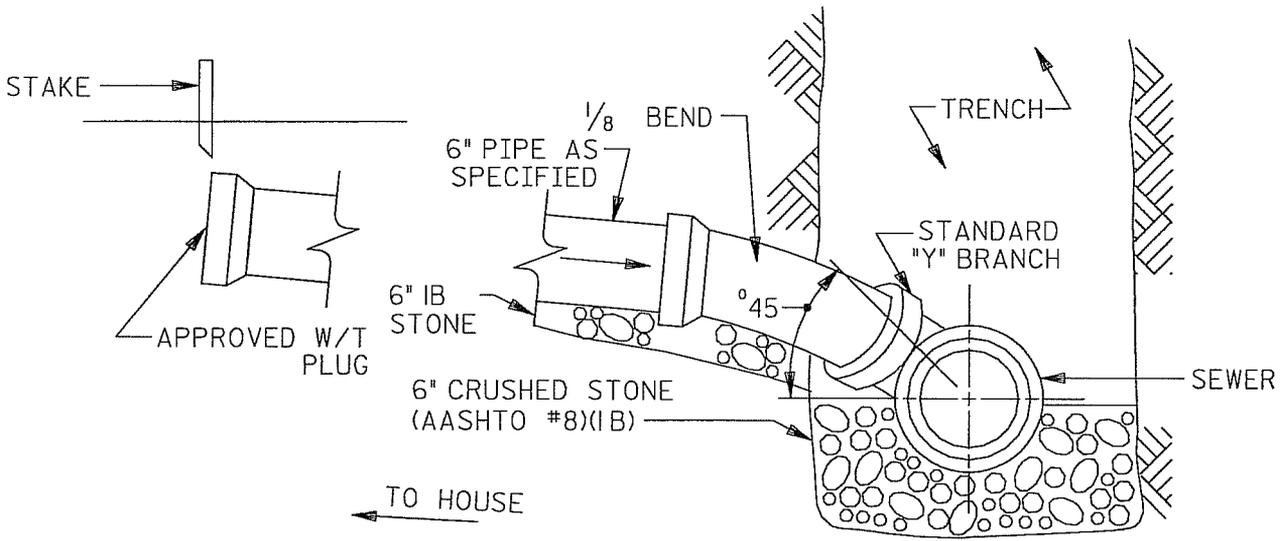


PLAN



ELEVATION  
TYPICAL LATERAL

SEE DETAIL BELOW



STANDARD LATERAL

W/T - WATERTIGHT

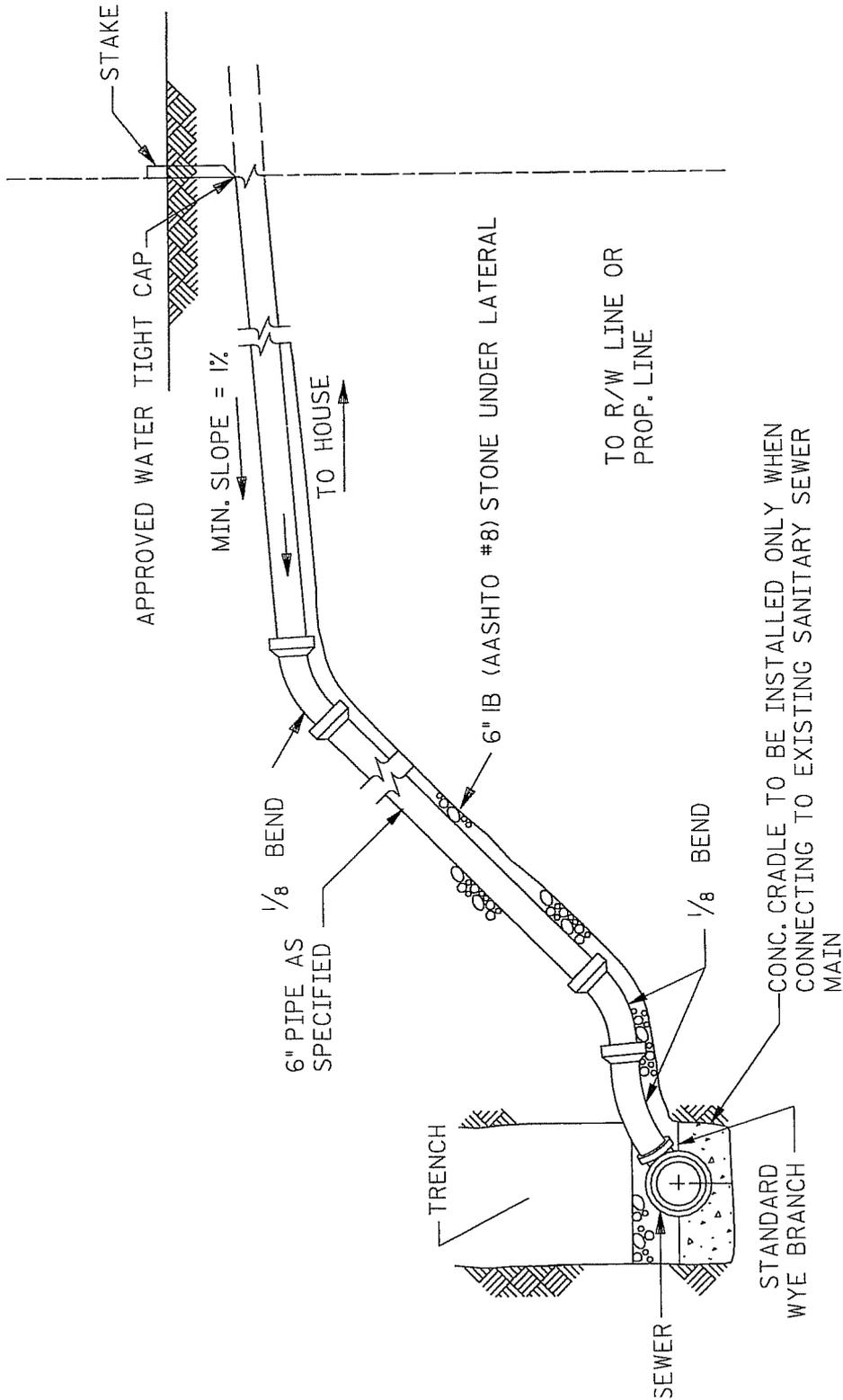
STANDARD HOUSE CONNECTION DETAILS

PROJECT NO.:	
ENGR./ARCH.:	
DRAWN BY:	
DESIGN BY:	
CHECKED BY:	
CAD FILE:	
DATE:	



LATERAL DETAIL

5187
DRAWING NO.
SHEET OF



NOTE: END OF LATERAL TO HAVE APPROVED WATER TIGHT CAP OR PLUG.

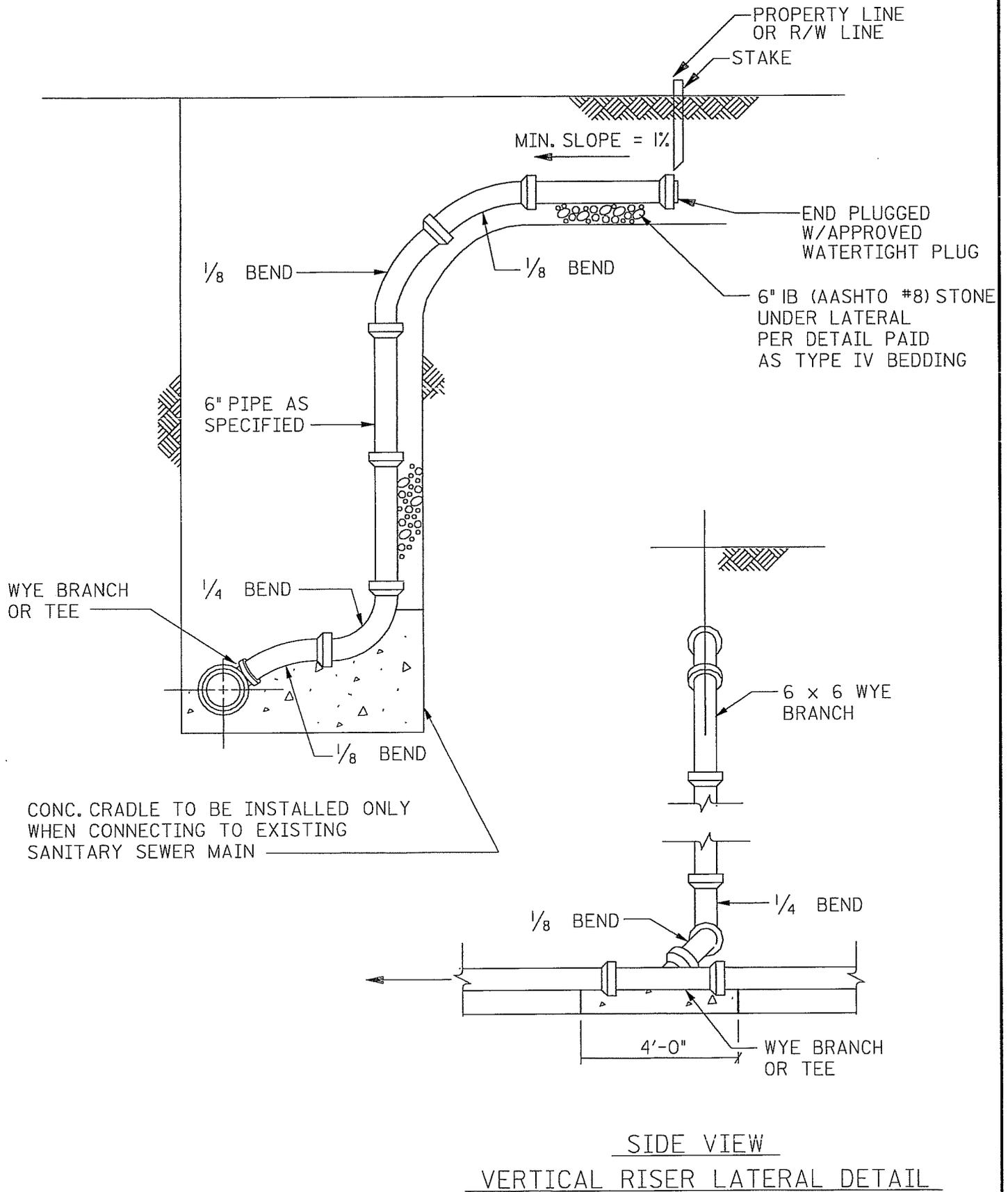
SLOPED RISER LATERAL DETAIL  
SCALE: NONE

PROJECT NO.:
ENGR./ARCH.:
DRAWN BY:
DESIGN BY:
CHECKED BY:
CAD FILE:



SLOPED RISER LATERAL DETAIL

5187A
DRAWING NO.
SHEET OF



PROJECT NO.:
ENGR./ARCH.:
DRAWN BY:
DESIGN BY:
CHECKED BY:
CAD FILE:
DATE:

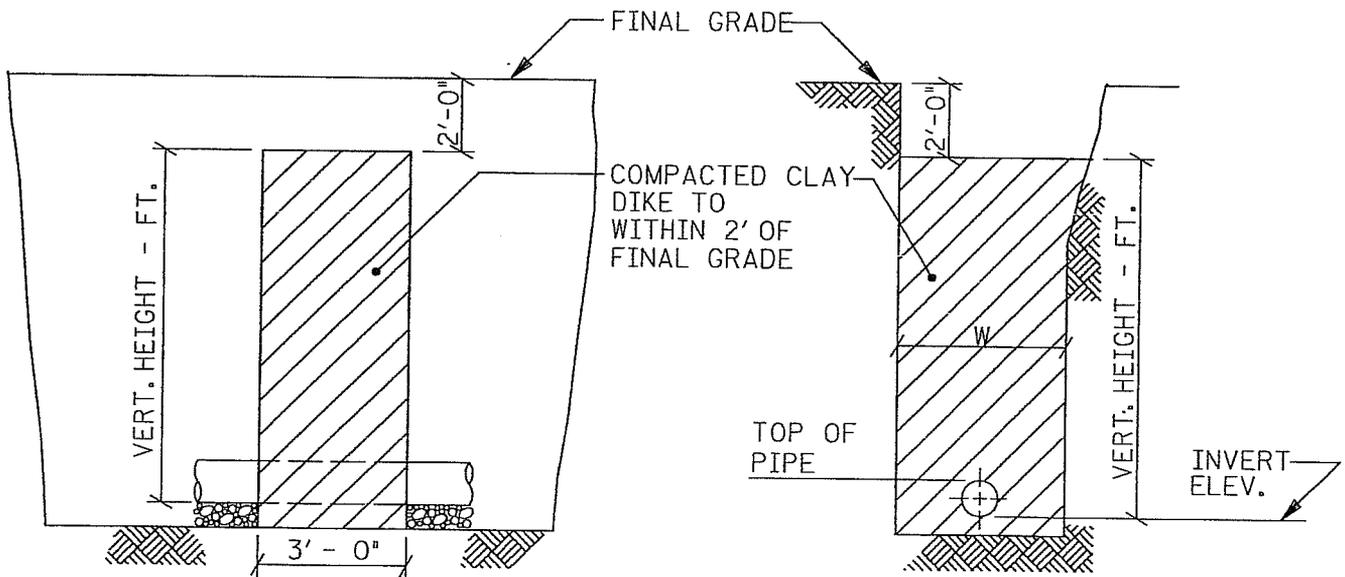


VERTICAL RISER  
LATERAL DETAIL

5187B

DRAWING NO.

SHEET OF



1. COMPACTED CLAY DIKES SHALL EXTEND VERTICALLY FROM UNDISTURBED GROUND AT BOTTOM OF TRENCH TO WITHIN TWO (2') FEET OF FINAL GRADE, AND FROM UNDISTURBED GROUND ON TRENCH SIDES FOR FULL WIDTH OF TRENCH.
2. EACH CLAY DIKE SHALL CONSIST OF CLAY CONTAINING NO MORE THAN 15% (BY VOLUME) STONE NOT LARGER THAN TWO (2") INCHES IN DIAMETER. CLAY SHALL BE PLACED IN SIX (6") INCH LIFTS AND COMPACTED BY MECHANICAL TAMPER TO NOT LESS THAN 95 PERCENT OF MAXIMUM DENSITY AT OPTIMUM MOISTURE CONTENT.

PROJECT NO.:
ENGR./ARCH.:
DRAWN BY:
DESIGN BY:
CHECKED BY:
CAD FILE:
DATE:

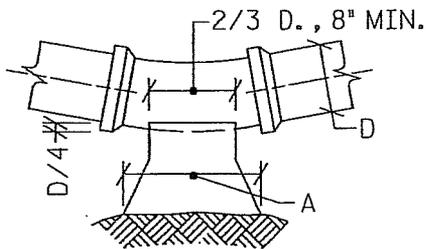


## CLAY DIKE DETAIL

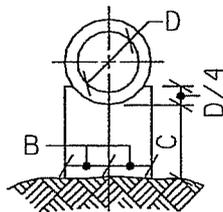
5190  
DRAWING NO.

SHEET OF

## BUTTRESS FOR VERTICAL BENDS

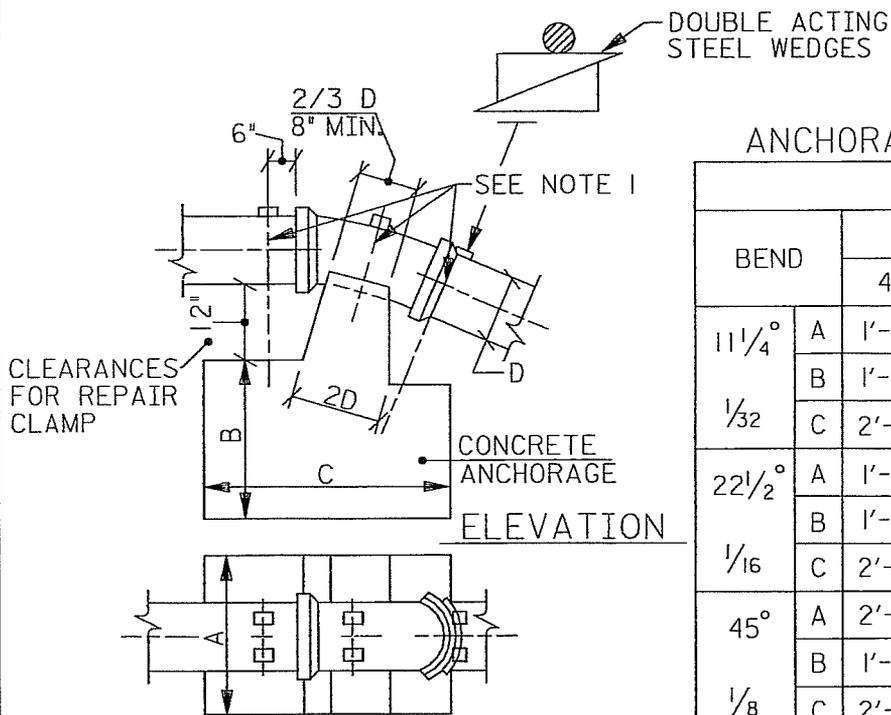


PLAN

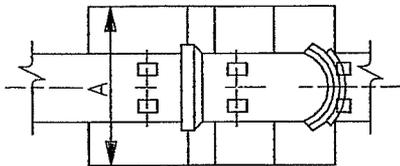


SECTION

BEND		BUTTRESS DIMENSIONS					
		SIZE					
		4"	6"	8"	10"	12"	16"
11 1/4°	A	4"	6"	8"	10"	1'-0"	1'-4"
	B	5"	7"	8"	9"	10"	1'-0"
1/32	C	5"	7"	7"	8"	8"	9"
22 1/2°	A	6"	9"	1'-0"	1'-6"	1'-9"	2'-3"
	B	6"	7"	7"	8"	10"	1'-0"
1/16	C	6"	7"	7"	8"	8"	9"
45°	A	10"	1'-3"	1'-8"	2'-1"	2'-6"	3'-4"
	B	7"	7"	8"	9"	11"	1'-3"
1/8	C	7"	7"	8"	10"	11"	1'-3"



ELEVATION



PLAN

## ANCHORAGE FOR VERTICAL BENDS

BEND		ANCHORAGE DIMENSIONS					
		SIZE					
		4"	6"	8"	10"	12"	16"
11 1/4°	A	1'-4"	1'-6"	1'-6"	2'-6"	3'-0"	4'-0"
	B	1'-0"	1'-6"	1'-9"	2'-0"	2'-6"	2'-6"
1/32	C	2'-0"	2'-0"	2'-6"	3'-0"	3'-0"	4'-0"
22 1/2°	A	1'-8"	2'-0"	3'-4"	3'-8"	4'-0"	4'-4"
	B	1'-6"	1'-9"	2'-3"	2'-3"	2'-3"	2'-6"
1/16	C	2'-0"	3'-0"	2'-8"	3'-10"	4'-0"	5'-9"
45°	A	2'-3"	2'-6"	3'-0"	4'-0"	4'-6"	5'-2"
	B	1'-9"	2'-6"	2'-9"	3'-0"	3'-6"	4'-0"
1/8	C	2'-6"	3'-0"	4'-0"	4'-6"	4'-9"	6'-6"

**NOTE:**

1. USE 3 #6 REINFORCING BARS AS SHOWN. IMBED 30 DIAMETERS IN CONCRETE AND PAINT EXPOSED SURFACE WITH 2 COATS OF APPROVED BITUMINOUS PAINT.
2. ALL CONCRETE TO BE CLASS AS SPECIFIED FOR MASS CONCRETE.
3. ALL BUTTRESSES TO BE CARRIED TO UNDISTURBED EARTH.
4. BUTTRESS DIMENSIONS SHOWN ARE MINIMUM. DIMENSIONS ARE BASED UPON SOIL BEARING PRESSURE OF 3,000 P.S.F. AND STATIC WATER PRESSURE OF 150 P.S.I. WHERE PRESSURE EXCEEDS 150 P.S.I. OR WHERE SOIL BEARING PRESSURE IS LESS THAN 3,000 P.S.F. SPECIAL BUTTRESS DESIGN IS REQUIRED.
5. USE DIMENSIONS SHOWN UNDER 4" PIPE FOR ALL PIPES LESS THAN 4" ø.

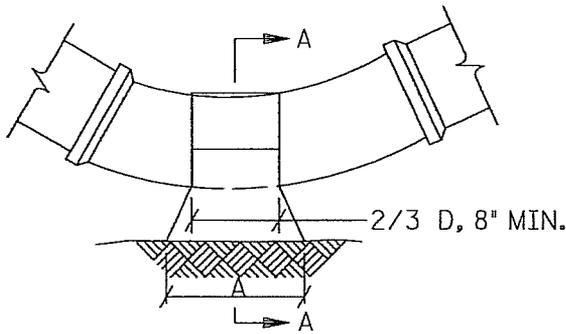
PROJECT NO.:	
ENGR./ARCH.:	
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DESIGN BY:	
CHECKED BY:	
CAD FILE:	
DATE:	



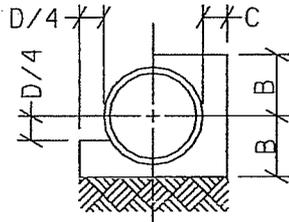
## THRUST BLOCK FOR VERTICAL BENDS

5195  
DRAWING NO.

SHEET OF

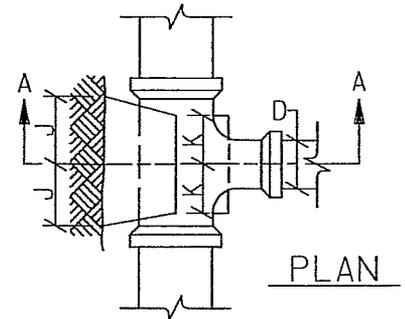


PLAN

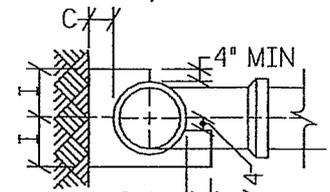


SECTION A-A

D = PIPE DIAMETER

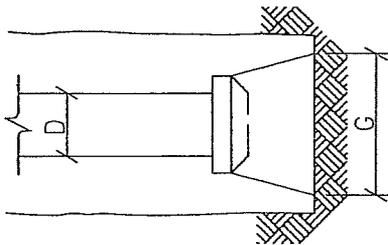


PLAN

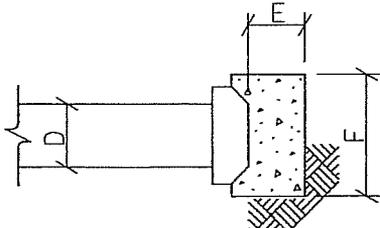


SECTION A-A

BUTTRESS FOR HORIZONTAL BENDS



PLAN



SECTION

BUTTRESS FOR CAPS

NOTE:

1. ALL BUTTRESSES TO BE CARRIED TO UNDISTURBED EARTH.
2. ALL CONCRETE TO BE AS SPECIFIED FOR MASS CONCRETE
3. BUTTRESS DIMENSIONS SHOWN ARE MINIMUM DIMENSIONS ARE BASED UPON SOIL BEARING PRESSURE OF 3,000 P.S.F. AND STATIC WATER PRESSURE OF 150 P.S.I. WHERE PRESSURE EXCEEDS 150 P.S.I. OR WHERE SOIL BEARING PRESSURE IS LESS THAN 3,000 P.S.F. SPECIAL BUTTRESS DESIGN IS REQUIRED.
4. USE DIMENSIONS SHOWN UNDER 4" PIPE FOR ALL PIPES LESS THAN 4"  $\phi$ .

BUTTRESS FOR TEES

BEND		SIZE OF BRANCH - D					
		4"	6"	8"	10"	12"	16"
11 1/4°	A	4"	6"	8"	10"	1'-0"	1'-4"
	B	5"	7"	8"	9"	10"	1'-0"
	C	5"	7"	7"	8"	8"	9"
22 1/2°	A	6"	9"	1'-0"	1'-6"	1'-9"	2'-3"
	B	6"	7"	8"	9"	10"	1'-0"
	C	6"	8"	9"	10"	11"	1'-2"
45°	A	10"	1'-3"	1'-8"	2'-1"	2'-6"	3'-4"
	B	7"	7"	8"	9"	11"	1'-3"
	C	7"	8"	9"	10"	11"	1'-2"
90°	A	1'-6"	2'-0"	2'-6"	3'-0"	3'-6"	5'-0"
	B	6"	6"	9"	1'-0"	1'-3"	1'-6"
	C	1'-6"	1'-10"	1'-9"	1'-8"	1'-7"	1'-5"
CAPS	E	6"	6"	8"	8"	10"	1'-0"
	F	9"	1'-0"	1'-4"	1'-8"	2'-0"	2'-9"
	G	11"	1'-5"	1'-11"	2'-5"	2'-10"	3'-9"
TEES	C	6"	8"	9"	10"	1'-0"	1'-2"
	H	6"	8"	9"	10"	1'-0"	1'-2"
	I	6"	9"	1'-0"	1'-3"	1'-5"	1'-11"
	J	4"	6"	8"	10"	1'-0"	1'-4"
	K	6"	6"	8"	8"	8"	10"

PROJECT NO.:
ENGR./ARCH.:
DRAWN BY:
DESIGN BY:
CHECKED BY:
CAD FILE:
DATE:

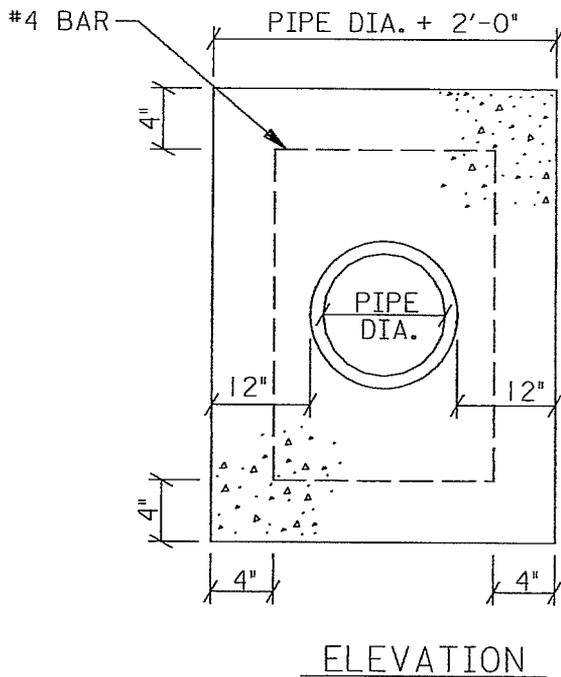
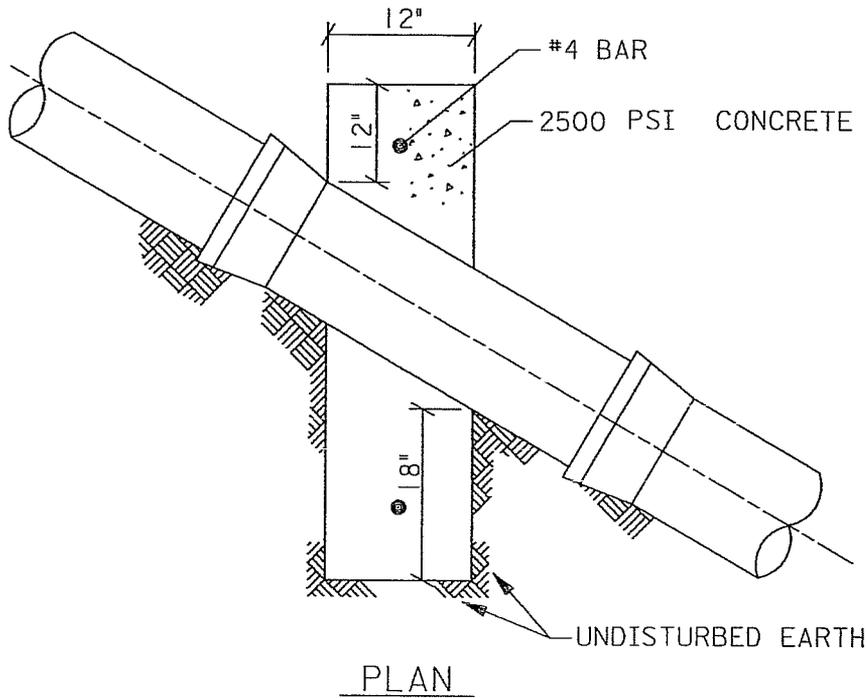


THRUST BLOCK FOR BENDS, TEES, & CAPS

5196

DRAWING NO.

SHEET OF



MAXIMUM SPACING  
 36' C.C. FOR 20% TO 35% SLOPES  
 24' C.C. FOR 35.1% TO 50% SLOPES  
 16' C.C. FOR 50.1% OR GREATER SLOPES

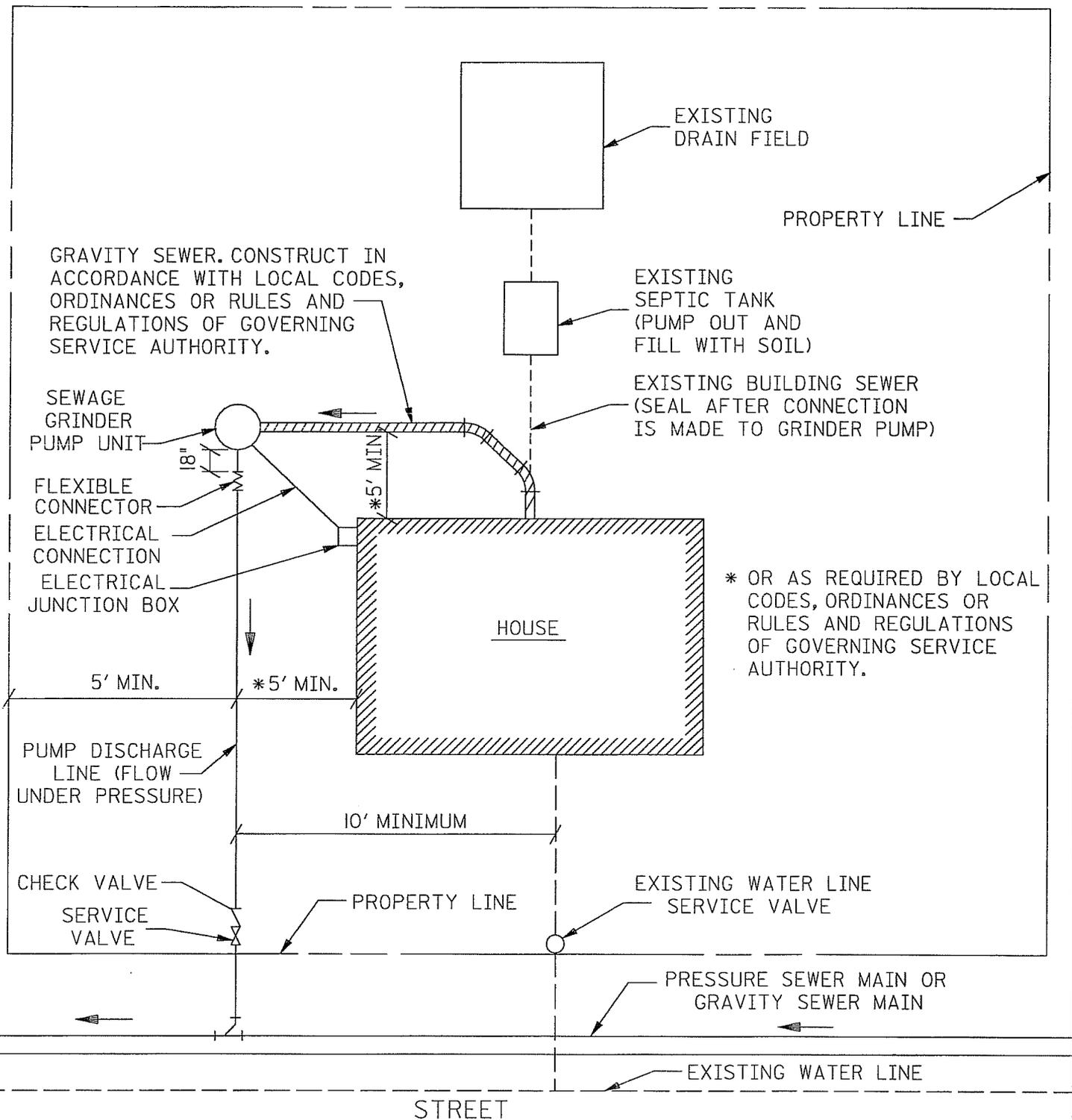
PROJECT NO.:
ENGR./ARCH.:
DRAWN BY:
DESIGN BY:
CHECKED BY:
CAD FILE:
DATE:



CONCRETE ANCHORS FOR  
STEEPLY SLOPED PIPES

5196A  
DRAWING NO.

SHEET OF



**LEGEND:**

- — — — — EXISTING WATER LINE
- — — — — EXISTING DRAIN LINE
- ////// BUILDING SEWER
- SGP DISCHARGE LINE
- SGP SEWAGE GRINDER PUMP

**NOTE:**

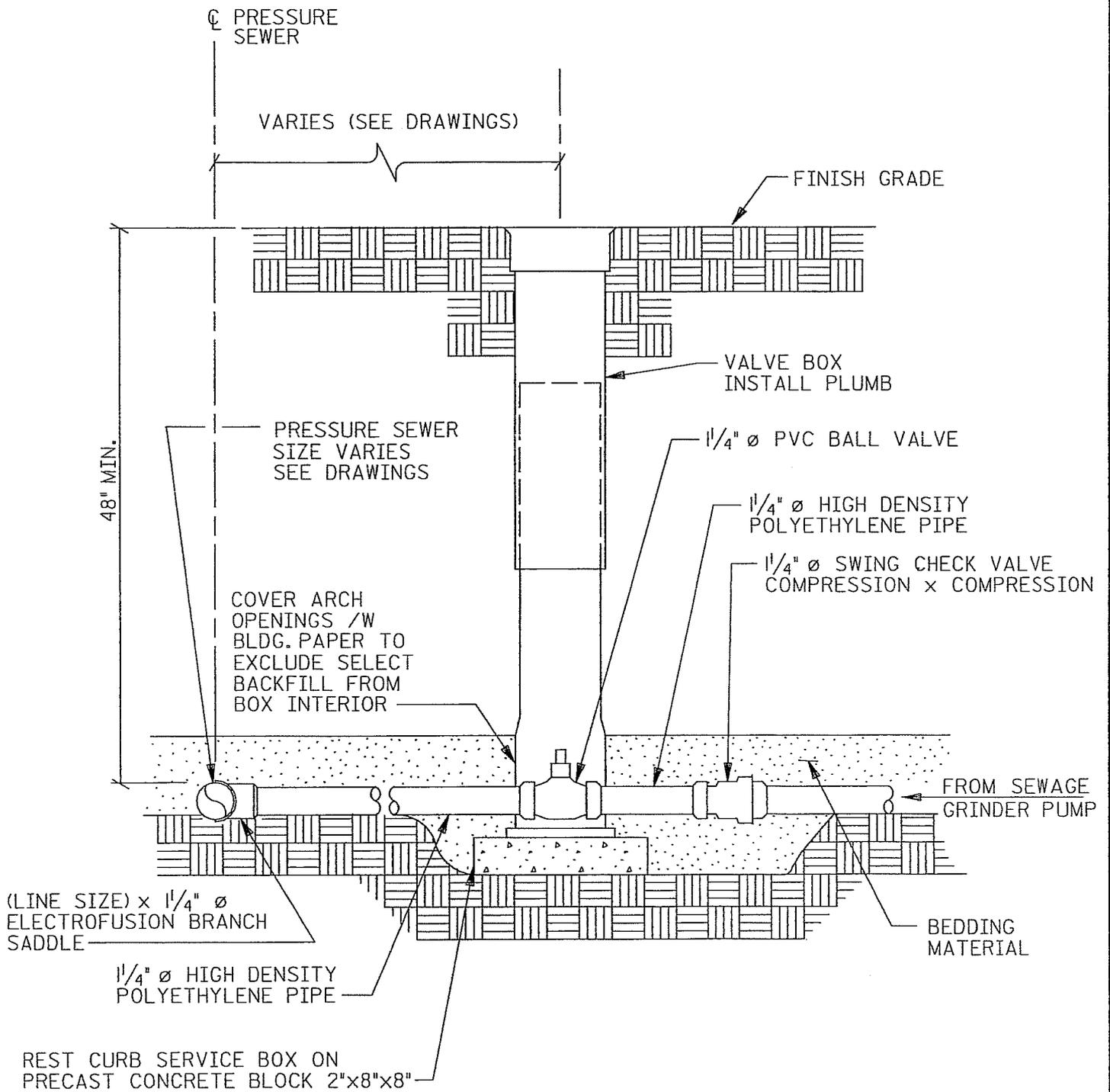
DISCHARGE LINE CHECK VALVE AND SERVICE VALVE NOT REQUIRED FOR CONNECTION TO GRAVITY SEWER MAIN

PROJECT NO.:	
ENGR./ARCH.:	
DRAWN BY:	
DESIGN BY:	
CHECKED BY:	
CAD FILE:	
DATE:	



RETROFIT OF EXISTING HOME  
PRESSURE SEWER  
SERVICE CONNECTION

5220
DRAWING NO.
SHEET OF



PROJECT NO.:
ENCR./ARCH.:
DRAWN BY:
DESIGN BY:
CHECKED BY:
CAO FILE:
DATE:



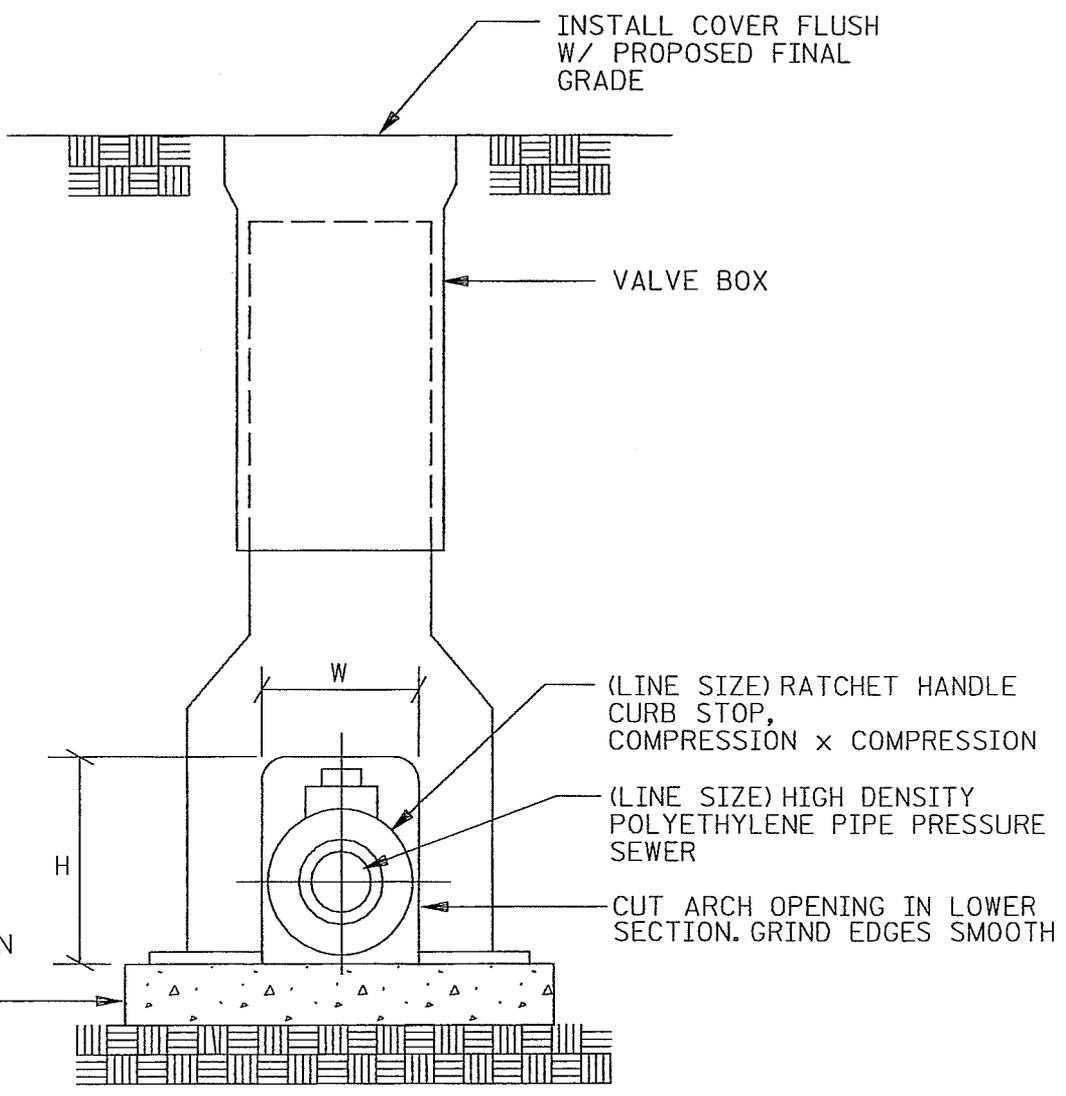
SERVICE VALVE  
ASSEMBLY

5223

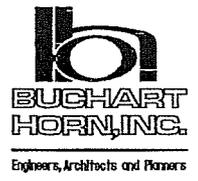
DRAWING NO.

SHEET OF

VALVE SIZE	H	W
1/4"	6"	4 1/2"
1/2"	6"	4 1/2"
2"	6"	4 1/2"
2 1/2"	6 1/2"	5 1/2"
3"	6 1/2"	6 1/2"

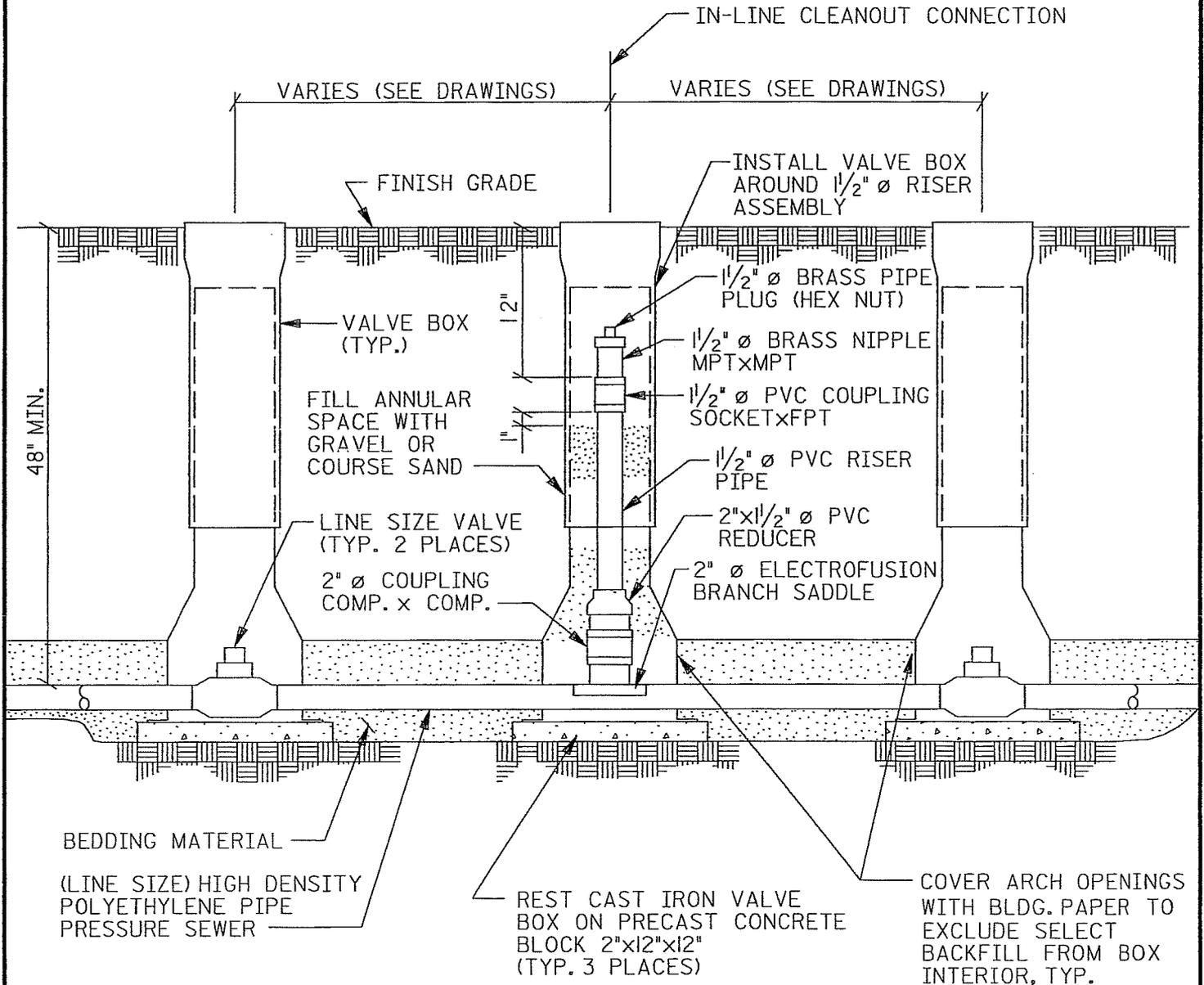


PROJECT NO.:
ENGR./ARCH.:
DRAWN BY:
DESIGN BY:
CHECKED BY:
CAD FILE:
DATE:



VALVE BOX DETAIL

5224
DRAWING NO.
SHEET OF



**NOTES:**

1. PRECAST CONCRETE BLOCKS TO REST ON UNDISTURBED EARTH OR FIRM SUBGRADE.

PROJECT NO.:
ENGR./ARCH.:
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DESIGN BY:
CHECKED BY:
CAD FILE:
DATE:

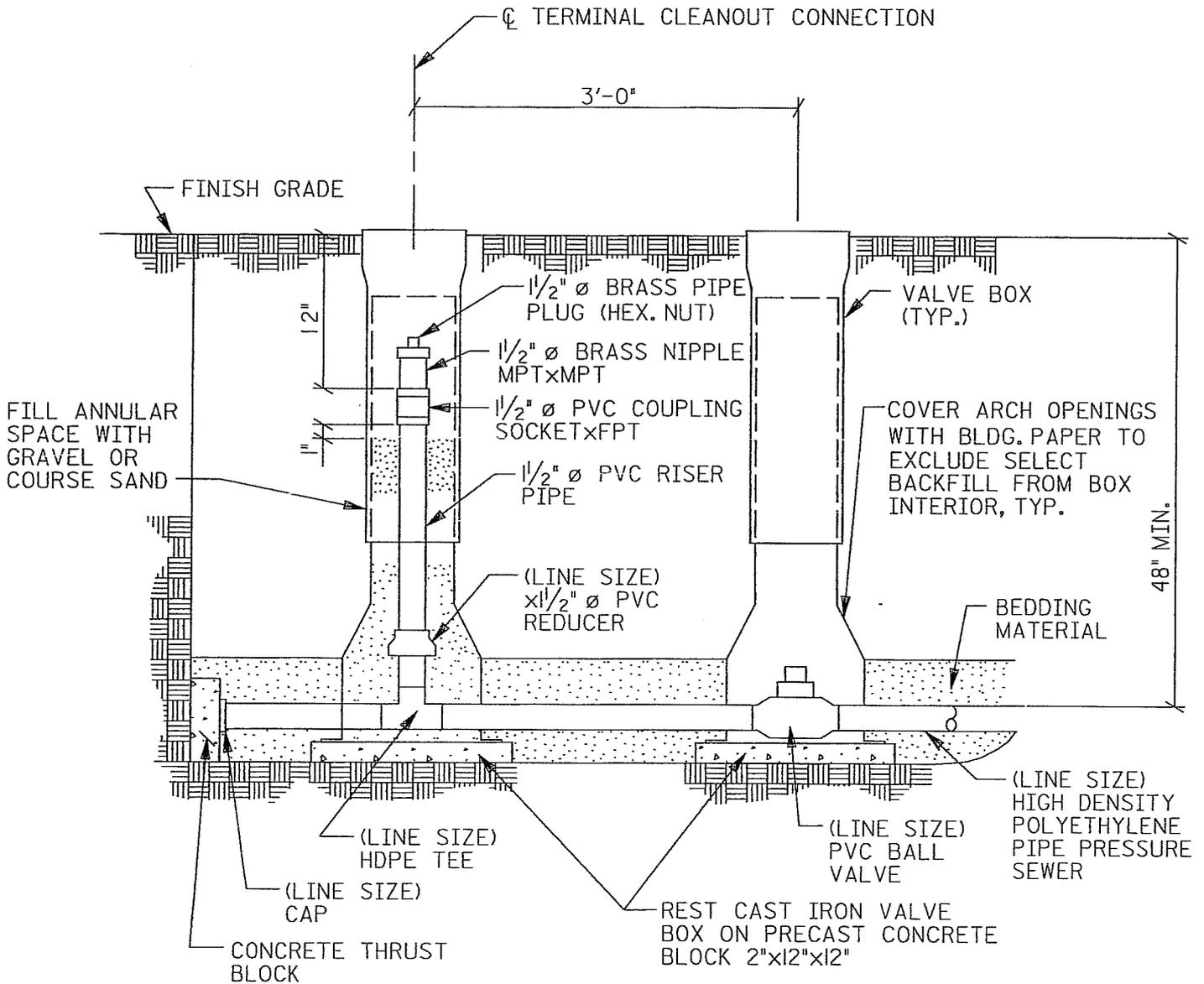


IN-LINE CLEANOUT  
CONNECTION

5225

DRAWING NO.

SHEET OF



**NOTES:**

1. PRECAST CONCRETE BLOCKS TO REST ON UNDISTURBED EARTH OR FIRM SUBGRADE.
2. THRUST BLOCK TO REST AGAINST UNDISTURBED EARTH.
3. ALL PVC CONNECTIONS SHALL BE SOLVENT WELD EXCEPT WHERE NOTED OTHERWISE.

PROJECT NO.:	
ENGR./ARCH.:	
DRAWN BY:	
DESIGN BY:	
CHECKED BY:	
CAD FILE:	
DATE:	



TERMINAL  
CLEANOUT CONNECTION

5226

DRAWING NO.

SHEET OF

**Prepared by:**  
**First Capital Engineering, Inc.**  
**And**  
**Buchart Horn, Inc.**  
**York, PA**