

# Standard Sanitary Sewer Specifications

For The

Township of Hillsborough  
Municipal Utilities Authority

Somerset County, New Jersey

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## **Section I: General Requirements**

### **A. Instruction**

1. All construction work and materials shall conform to this specification.
2. Modifications or changes to these specifications may be effected only with the knowledge and written consent of the Hillsborough Township Municipal Utilities Authority (or “Authority”) or their assigned agent.
3. The Developer and/or Contractor shall employ a Licensed Professional Engineer and/or Land Surveyor to perform all stake-out work for the sewers to be installed under this specification. Grade sheets shall be prepared by the professional performing the stake-out for use in construction of the sewers. Grade sheets are subject to review and approval by the Hillsborough Township Municipal Utilities Authority.
4. All construction details shall be in accordance with those shown on the detail plates attached hereto, and on file in the office of the Hillsborough Township Municipal Utilities Authority.
5. Drawings submitted to the Hillsborough Township Municipal Utilities Authority for approval shall include plans, profiles, cross-sections where applicable, and details of the proposed sewers and appurtenances.
6. All materials and shop drawings are subject to review and approval of the Authority Engineer.
7. All construction work shall be performed under the inspection of the Hillsborough Township Municipal Utilities Authority or their assigned agent.
8. The Developer/Contractor shall notify the Hillsborough Township Municipal Utilities Authority two (2) days in advance of the beginning of any construction work. If, for any reason construction work is suspended, the Developer/Contractor shall notify the Authority of the date of the resumption thereof.
9. Easements and Permits:
  - a. Prior to commencing work, the Developer/Contractor shall secure all easements, agreements, or permits required by applicable federal, state, and local codes.
  - b. The Authority shall not be held responsible for any agreements between the Developer/Contractor and private property owners.

## **B. Safety**

1. The Developer/Contractor shall install appropriate warning and protective measures to provide for the safety of workers, inspectors, and the general public prior to beginning any work. Protective measures shall be installed to protect persons, property, existing structures and utilities, and shall be in accordance with applicable standards.
2. Special care shall be exercised along roadways, pedestrian walkways and any other areas utilized by the general public.
3. All applicable OSHA requirements shall be employed to protect any persons, equipment and materials in the work area.
4. Any interruption of services, property damage or personal injuries shall be the responsibility of the Developer/Contractor.
5. Roadways, right-of-ways and/or easements shall be kept clean and free of debris and other foreign matter. Appropriate measures shall be taken to control dust and mud.
6. In sewerage facilities owned by the Hillsborough Township Municipal Utilities Authority, contractors shall provide certification of confined space entry training and provide proper safety equipment prior to entry, in accordance with applicable OSHA standards.
7. This specification in no way makes the Hillsborough Township Municipal Utilities Authority, its employees, consultants, etc. responsible for any damages, liability, any claims (including but not limited to safety and construction-related) due to the execution of the construction requirements contained herein.

## **C. Construction**

1. Prior to commencing any excavation, the Developer/Contractor shall provide for the location of all existing underground utilities and drains, and shall notify the New Jersey One Call System (1-800-272-1000) in accordance with the Underground Facilities Protection Act, N.J.S.A. 48:2-75 et seq.. Whenever work is in the vicinity of high voltage power lines, the Developer/Contractor shall operate in accordance with the High Voltage Proximity Act.
2. The Developer/Contractor shall make all necessary excavations and embankments, do all shaping and shoring of trenches or tunneling, furnish, lay and join all pipes, install fittings and couplings in place, construct all necessary structures, do all backfilling and tamping in a careful and workmanlike manner, repair trench settlement, correct the various services disturbed, restore affected

existing landscaping and vegetation and do all else necessary to complete the work as required on approved drawings.

3. The Developer/Contractor shall furnish all equipment, tools, labor and materials necessary to do the work and on completion shall leave the work in a neat and finished condition ready to perform its function.
4. Immediately upon completion of the Authority inspection of the installed sewers, the Developer/Contractor shall backfill the trench.
5. The Developer/Contractor shall be held entirely responsible for all damage to the sewer lines and appurtenances that may occur after they are constructed, until such time that the two-year maintenance bond expires.
6. The Developer/Contractor shall not operate equipment or store material outside the project limits on private property without first having obtained written consent of the owner thereof and providing same to the Authority.
7. Any access roadbed constructed by the Developer/Contractor through or over any site which has been obtained for construction purposes shall, upon completion of the work, be restored to a condition similar to that which existed prior to the start of the work and all evidence of the Developer's/Contractor's operations shall be removed.

**D. Work in Landscaped Areas**

1. The Developer/Contractor shall consult the Authority Engineer or his representative prior to removing or disturbing any tree, shrub, bush, fence, sidewalk, building, structure or improvement that may be encountered along the construction line. In locations where trees of a mature size exist, the extent of trimming or removal (if allowed) shall be at the discretion of the Authority Engineer. If during the construction work the Developer/Contractor damages trees or any part thereof, the treatment and restoration of the trees shall be accomplished under the direction of a qualified nurseryman. Before acceptance of the work, the Developer/Contractor shall furnish the Authority Engineer a certificate from the nurseryman stipulating that the trees have been properly cared for, treated, and restored under his direction.
2. Where tunneling is required to construct the utility line under trees, the opening shall be sheeted on top and sides and the sheeting in such cases shall be left in place.

3. Trees removed by order of the Authority Engineer which are not to be replaced shall become the property of the Developer/Contractor and shall be removed from the site. If the property owner desires the trees for firewood, the Developer/Contractor shall cut trees into 4-foot (+/-) logs and remove limbs. Brush may not be burned on lands without first obtaining a permit from the proper authorities.

**E. Work in Roadways**

1. All work in roadways shall be performed with minimal disturbance to normal traffic. Holes and settlements in the trenches shall be immediately filled to the original ground elevation with the specified materials.
2. Traffic control devices and placement shall be in accordance with USDOT - Part IV of the Manual on Uniform Traffic Control Devices (MUTCD).
3. Acquisition of permits and/or approvals from the appropriate agency (Township, County or State) shall be the responsibility of the Developer/ Contractor.

**F. Brooks and Water Courses**

1. The Developer/Contractor shall provide for all water courses interrupted or re-routed during the progress of the work and shall restore them to the original condition.
2. Acquisition of permits and/or approvals from the appropriate agency (Township, County or State) shall be the responsibility of the Developer/ Contractor.

**G. Utility Pipe/Conduit Crossing**

1. Where a storm sewer pipe or utility pipe/conduit crosses over a sanitary sewer pipe with less than twelve (12) inches of clearance, ductile iron pipe shall be used for the sanitary sewer pipe for a distance of ten (10) feet on each side of the crossing. In addition, concrete supports shall be placed on each side of the sanitary sewer. Should the clearance be six (6) inches or less, the ductile iron pipe shall be encased in concrete with concrete supports as stated above.

## Section II: Pipe Materials

### A. General

1. Material Tests - Any and all tests hereinafter specified or referred to may be omitted at the discretion of the Authority Engineer. The Authority Engineer may order any tests on materials he deems necessary, whether specified or not. All tests called for shall be made by a reputable manufacturer whose plant and laboratories are located in the United States, or by an independent laboratory approved by the Authority Engineer. Tests shall be made in the manufacturer's usual method or as directed by the Authority Engineer.
2. ASTM Requirements - All materials shall be as required on the plans and as described in these specifications. All materials shall meet or exceed applicable ASTM specifications, except where they have been modified by these specifications. All ASTM references shall be to the latest revision.

### B. Gravity Main Sewer Pipe

1. Polyvinyl Chloride Pipe (PVC)
  - a. All PVC pipe and fittings for gravity main sewers ranging in sizes from eight (8) inches to fifteen (15) inches in diameter shall be SDR 35 and shall conform to ASTM D-3034. The polyvinyl chloride compounds for the pipe shall have a cell classification of 12454-B or 13364-B (with minimum tensile modulus of 500,000 psi.) as defined in ASTM D-1784. Maximum lengths of pipe shall be thirteen (13) feet.
  - b. All PVC pipe and fittings for gravity sewer mains greater than eighteen (18) in diameter shall be either **solid wall type**, manufactured in accordance with ASTM F-679, entitled "Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings", or **closed profile type**, manufactured in accordance with ASTM F-794, entitled "Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings. The polyvinyl chloride compounds for the pipe shall have a cell classification of 12454-C.
  - c. Pipe joints shall be integral bell gasketed joints which form a positive seal when assembled. The joints shall be designed in accordance with ASTM D-3212, and the lubricant used for assembly shall be as provided or recommended by the pipe manufacturer and shall have no detrimental effect on the gasket or the pipe.
  - d. Elastomeric gaskets shall be manufactured in accordance with ASTM F-477.

- e. It is understood that all pipe materials will be produced by an established manufacturer and that handling of the materials and construction procedures will be in conformance with the manufacturer's recommendations and with accepted construction practices.
- f. All installation of PVC pipe and fittings shall meet or exceed the standard recommended practice for "Underground Installation of Flexible Thermoplastic Sewer Pipe" ANSI/ASTM 2321-74, except as these standard specifications has been modified herein.

## 2. Reinforced Concrete Pipe (RCP)

- a. The pipe shall be reinforced concrete pressure pipe, constructed with reinforced steel cages, or wire-wrapped steel cylinders, designed for non-pressure application. The interior of the pipe shall be lined with a corrosion-resistant material, to be specified at the time of submittal.
- b. The pipe, steel joint ring, and gasket shall be constructed in accordance with AWWA Specification C-302 entitled "Standard for Reinforced Concrete Pressure Pipe, Non-Cylinder Type, for Water and Other Liquids", or AWWA Specification C-301 entitled "Standard for Pre-Stressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids".
- c. Reinforcing (Non-Cylinder Type) - Concrete pipe shall be reinforced with a cage or cages formed of circumferential and longitudinal steel. Steel joint rings shall be located at its ends and shall be securely welded to the reinforcing steel. The steel structure shall be completely encased with dense concrete.
- d. Reinforcing (Steel Cylinder Type) - Pre-stressed concrete pipe shall be reinforced with a welded steel cylinder with steel joint rings welded to its ends. The steel cylinder shall be lined with concrete, and wrapped with a steel wire under tension and coated with a dense covering of cement mortar.
- e. Strength Requirements (Non-Cylinder Type) – The wall thickness, compressive strength of concrete and amount of circumferential reinforcement shall be as designated in ASTM C-76 entitled "Reinforced Concrete Culvert, Storm Drain and Sewer Pipe" for Class IV and V Pipe.
- f. Strength Requirements (Steel Cylinder Type) - Pre-stressed concrete steel cylinder type pipe shall be designed for the following design strength requirements:
  - 1. Class IV Pipe: (Equivalent to ASTM C-76 Class IV) A minimum load of 2000 pounds per linear foot per foot of inside diameter to produce .01 inch crack.



2. Class V Pipe: (Equivalent to ASTM C-76 Class V) A minimum load of 3000 pounds per linear foot per foot of inside diameter to produce .01 inch crack.
- g. Pipe Joints and Gaskets - Each joint shall be sealed by a rubber gasket so that the joint will remain tight under all conditions of service, including movement due to expansion, contraction and normal settlement. Each length of pipe shall be provided with bell and spigot ends formed by steel joint rings securely fastened in the pipe wall. The spigot ring shall be lined with concrete on its interior surface. Portions of the joint rings which will be exposed after the pipe is manufactured shall be protected from corrosion by an approved coating. The spigot ring shall have a groove for the purpose of receiving, holding, and protecting the gasket.
  - h. The joint surfaces shall be of such shape and dimensions that the joint will be self-centering when the pipes are laid so that the gasket will not be required to support the weight of the adjoining pipe.
  - i. The gasket sealing the joint shall be made of a special composition rubber having a texture to assure a watertight and permanent seal and shall be constructed as a continuous ring of suitable cross-section and of such size as to fill the groove on the spigot joint ring when the pipes are laid.
  - j. The rubber gasket shall be the sole element depended upon to make the joint watertight and shall have smooth surfaces free from pitting, blisters, porosity and other imperfections. Joint filler used to finish the joint shall not be depended upon for watertightness.
  - k. Joint Filler - Prior to assembly of all pipe joints, the surface of adjacent sections shall be cleaned, primed, and covered with pre-formed joint filler compound. After assembly, the excess filler squeezed out of the joints shall be trimmed off on the inside. Filler compound shall conform to Federal Specification SS-S00210 (GSA-FSS), entitled "Sealing Compound, Pre-formed Plastic, for Expansion Joints and Pipe Joints, Type I - Rope Form." Application and installation shall be performed in accordance with the manufacturer's recommendations.
  - l. Other approved methods of protecting both the inside and outside of the steel joint rings will be considered for use by the Engineer, at the request of the Developer/Contractor and recommendation of the pipe manufacturer.
  - m. Pipe Curing - All RC pipe shall be high-pressure steam-cured for at least sixteen (16) hours.

3. Vitriified Clay Pipe (VC) For repair of existing VC systems

- a. Vitriified clay sewer pipe shall only be used in situations where a specific discharge has detrimental effects on PVC and DI pipe, as determined by the Authority.
- b. All vitriified clay sewer pipe shall be the bell and spigot type and shall be shipped in unit pallets. Pipe and fittings shall be as approved by the Authority Engineer.
- c. Except where superseded by Clay Sewer Pipe Associates Standards, CSPA 1-63 for Standard Strength Pipe and CSPA 2-63 for Extra Strength Pipe, all vitriified clay sewer pipe shall be in accordance with ASTM C-200 for Extra Strength.
- d. Standard lengths and sizes - Laying lengths of eight (8) inch through thirty-six (36) inch diameter pipe shall be a nominal length of five (5) feet.
- e. Clay pipe compression joints - All vitriified clay sewer pipe shall have the compression-type joint conforming to the material and testing requirements of ASTM C-425. All joints shall have a removable rubber gasket which can be inspected in the field prior to installation.

4. Ductile Iron Pipe (DI)

- a. Ductile iron pipe shall be manufactured in accordance with ANSI A21.51 by an established manufacturer. Minimum wall thickness and thickness classification shall be in accordance with ANSI A21.51 Tables 51.1, 51.2, and 51.3 or Class 52, whichever is greater.
- b. The interior of the pipe shall be lined with Protecto 401 Ceramic Epoxy. The material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. Any request for substitution other than Protecto 401 must be approved by the Authority Engineer and the substitute material must be accompanied by a report certifying the following tests results:
  - A permeability rating of 0.00 when tested according to Method A of ASTM E-96, Procedure A with a test duration of 30 days.
  - ASTM B-117 Salt Spray (scribed panel) - Results to equal 0.0 undercutting after two years.
  - ASTM G-95 Cathodic Disbondment 1.5 volts @ 77°F. Results to equal no more than 0.5 mm undercutting after 30 days.

- Immersion testing rated using ASTM D-714.
    - 20% Sulfuric acid—No effect after two years.
    - 140°F 25% Sodium Hydroxide—No effect after two years.
    - 160°F Distilled Water—No effect after two years.
    - 120°F Tap Water (scribed panel)—0.0 undercutting after two years with no effect.
  - ASTM G-22 Standard practice for determining resistance of Synthetic Polymeric materials to bacteria. The test should determine the resistance to growth of Acidithiobacillus Bacteria and should be conducted at 30 degrees centigrade for a period of 7 days on a minimum of 4 panels. The growth must be limited only to trace amounts of bacteria.
  - An abrasion resistance of no more than 3 mils (.075 mm) loss after one million cycles using European Standard EN 598: Section 7.8 Abrasion Resistance.
  - a corrosion-resistant material, to be specified at the time of submittal. Fittings shall be manufactured in accordance with ANSI A21.10.
- c. Gravity sewer pipe shall be standard push-on joints with rubber gasket, as approved by the Authority Engineer. Joints shall be manufactured in accordance with ANSI A21.11.

### **C. Force Main Sewer Pipe**

#### 1. Polyvinyl Chloride Pipe (PVC)

- a. All PVC pipe for force main sewers shall be Class 150, DR 18 as per AWWA C-900 Standard, for sizes ranging from four (4) to twelve (12) inches in diameter.
- b. Pipes shall have integral bell gasketed joints which, when assembled, form a positive seal.
- c. It is understood that all pipe materials will be as produced by an established manufacturer and that handling of the materials and construction procedures will be in conformance with the manufacturer's recommendations and with accepted construction practices.
- d. All fittings and mechanical joints shall be made of Ductile Iron (DI).

#### 2. Ductile Iron Pipe (DI)

- a. All DI pipe used for force main sewers shall be the same as the DI pipe used for gravity sewer mains (see Paragraph B, 4 f this section). All pipe shall be designed for a minimum working pressure of 350 psi.

- b. Force main pipe shall be mechanical joint or push-on joint, as approved by the Authority Engineer.
- c. All fittings and mechanical joints shall be ductile iron, manufactured in accordance with ANSI A12.10, and all mechanical and push-on joint fittings shall conform to ANSI A21.11. All fittings shall be lined with a corrosion-resistant material, to be specified at the time of submittal.
- d. The interior of the pipe shall be lined with Protecto 401 Ceramic Epoxy. The material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. Any request for substitution other than Protecto 401 must be approved by the Authority Engineer and the substitute material must be accompanied by a report certifying the following tests results:
- A permeability rating of 0.00 when tested according to Method A of ASTM E-96, Procedure A with a test duration of 30 days.
  - ASTM B-117 Salt Spray (scribed panel) - Results to equal 0.0 undercutting after two years.
  - ASTM G-95 Cathodic Disbondment 1.5 volts @ 77°F. Results to equal no more than 0.5 mm undercutting after 30 days.
  - Immersion testing rated using ASTM D-714.
    - 20% Sulfuric acid—No effect after two years.
    - 140°F 25% Sodium Hydroxide—No effect after two years.
    - 160°F Distilled Water—No effect after two years.
    - 120°F Tap Water (scribed panel)—0.0 undercutting after two years with no effect.
  - ASTM G-22 Standard practice for determining resistance of Synthetic Polymeric materials to bacteria. The test should determine the resistance to growth of Acidithiobacillus Bacteria and should be conducted at 30 degrees centigrade for a period of 7 days on a minimum of 4 panels. The growth must be limited only to trace amounts of bacteria.
  - An abrasion resistance of no more than 3 mils (.075 mm) loss after one million cycles using European Standard EN 598: Section 7.8 Abrasion Resistance.
  - A corrosion-resistant material, to be specified at the time of submittal. Fittings shall be manufactured in accordance with ANSI A21.10.

#### **D. Gravity Lateral Sewer Pipe**

1. Polyvinyl Chloride Pipe (PVC)
  - a. All four (4) inch and six (6) inch diameter PVC pipe and fittings shall be Schedule 40, conforming to the ASTM D-1785.
  - b. Maximum laying lengths of four (4) inch and six (6) inch PVC Schedule 40 pipe shall not exceed ten (10) feet.
  - c. Adapters shall be provided for use with tees, wyes, tee-wyes or saddles to allow direct connection, with elastomeric gasketed PVC bell or solvent-weld type joints for plastic pipe Schedule 40 (see Paragraph F of this section).
  - d. Joints shall be either solvent-weld type joint conforming to ASTM D-2855 or integral elastomeric gasketed bell joints.
  - e. Fittings shall be manufactured in accordance with ASTM D-2466.
2. Ductile Iron Lateral Pipe (DI)
  - a. Four (4) inch and six (6) inch ductile iron pipe shall be used whenever a water main or storm sewer crosses over a lateral with less than twelve (12) inches of clearance between the pipes, for a distance of ten (10) feet on each side of the crossing.
  - b. Ductile iron pipe used for laterals shall be the same as used for gravity sewer mains, with the exception of the lining requirement (see Paragraph B, 4 of this section).
  - c. Adapter coupling from DI pipe to Schedule 40 PVC shall be a one-piece, gasketed repair coupling, as manufactured by Harco, P.O. Box 10335, Lynchburg, VA 24506, or approved equal.

#### **E. Low-Pressure Main and Lateral Sewer Pipe**

In general, the use of Low-Pressure Mains and individual grinder pumps shall not be permitted. However, the proposal for the use of such a system shall be reviewed by the Authority and may be permitted under certain conditions.

1. Polyvinyl Chloride Pipe (PVC)
  - a. All PVC pipe and fittings used for low-pressure main and lateral sewers shall be Schedule 40, 1 ½ inch diameter only.

- b. Pipes shall be either solvent-welded cement type conforming to ASTM D-2855 or integral elastomeric gasketed bell joints.
- c. Should the Authority approve the use of such a system, standard details for the systems apparatus shall be obtained from the Authority.

**F. Miscellaneous Fittings**

1. PVC Tees, Wyes, Tee-Wyes, Adapter Couplings & End Caps - shall be one piece all molded PVC, conforming to ASTM D-3034, with integral bell gasketed joints, conforming to ASTM F-477, as manufactured by Harco, or approved equal. All fittings shall be the same strength class as the section of pipe on which they are to be installed. Fittings shall be capped as soon as they are installed on the main.
2. PVC Repair Couplings - shall be one piece, all-molded PVC conforming to ASTM D-3034, with integral bell gasketed joints conforming to ASTM F-477, as manufactured by Harco, or equal. All fittings shall be the same strength class as the section of pipe on which they are to be installed.
3. Saddles - shall be the “Sealtite” sewer pipe saddle, as manufactured by the General Engineering Company, P.O. Box 609, Frederick, MD 21701, or approved equal. The saddle shall have a cast-iron body, integral “O”- ring flange gasket, stainless steel strap and shall match the contour of the size and type of pipe on which they are to be installed. Saddles shall only be used in a new connection to an existing sewer main (see detail plate #1).
4. Repair Clamps - shall be the “226 Full-Circle Repair Clamp”, as manufactured by the Smith-Blair Company, or approved equal. The clamp shall have stainless steel bolts and a rubber-lined stainless steel band. It shall be used to repair existing asbestos-cement (AC) pipe and for transitions from PVC or DI pipe to AC pipe. Repair clamps shall not be used in lieu of PVC repair couplings.
5. DI Fittings - shall be in manufactured in accordance with ANSI A12.10, and all mechanical and push-on joint fittings shall conform to ANSI A21.11. All fittings shall be lined with a corrosion-resistant material per section C.2.d., to be specified at the time of submittal.

## **Section III: Sewer Connections**

### **A. General**

1. All sewer connections shall consist of a gravity lateral from the sanitary sewer main up to and including the inspection riser with stub (see detail plates #2A & #2B), or, when authorized by the Authority Engineer, a low-pressure lateral from the low-pressure main sewer up to and including the valve box. No connections shall be permitted into a force main.
2. Whenever possible, sewer connections are to be made directly into the manholes.
3. ASTM Requirements - All materials shall be as required on the plans and as described in these specifications. All materials shall meet or exceed applicable ASTM specifications, except where the ASTM specifications have been modified by these specifications. All ASTM references shall be to the latest revision.

### **B. Materials**

1. All sewer connections shall be constructed of Schedule 40 PVC pipe. DI pipe shall be used in cases where a water main or storm sewer crosses over a gravity lateral with less than twelve (12) inches of clearance (see Section II, Paragraphs D & E). With clearances less than six (6) inches, the DI pipe shall be encased in concrete.
2. Fittings - PVC Tees, Wyes, Tee-Wyes, Adapter Couplings & End Caps - shall be one piece all molded PVC, conforming to ASTM D-3034, with integral bell gasketed joints, conforming to ASTM F-477, as manufactured by Harco, or approved equal. All fittings shall be the same strength class as the section of pipe on which they are to be installed. Fittings shall be capped as soon as they are installed.

### **C. Workmanship**

1. The sewer connections shall be installed in accordance with the requirements of the first section of these specifications. In general, each four (4) inch gravity lateral shall be installed at a minimum grade of one-quarter (1/4) inch per foot and not less than a minimum grade of one-eighth (1/8) inch per foot and each six (6) inch gravity lateral shall be installed at a minimum grade of one-eighth (1/8) inch per foot, unless otherwise directed by the Authority Engineer.
2. Inspection risers shall be installed straight and true and there with full sight of the bottom of the tee-wye.
3. Maximum lengths of four (4) inch and six (6) inch PVC Schedule 40 pipe shall be ten (10) feet.

#### **D. Inspection Risers**

1. The inspection riser shall consist of four (4) inch or six (6) inch Schedule 40 PVC tee-wye, pipe and female threaded adapter with screw plug (see detail plate #2A). DI pipe and fittings shall be permitted where applicable at the discretion of the Authority Engineer.
2. Construction of each inspection riser shall be as shown on the detail plate and as specified herein.
3. A schedule 40 PVC female threaded adapter conforming to ASTM D-1785 shall be provided on each riser. The female threaded adapter shall be threaded in accordance with ASTM D-2466 and shall accept a Schedule 40 PVC screw plug.
4. Female threaded adapters shall be joined to the riser pipe by means of solvent cement in accordance with the ASTM D-2855.
5. A minimum of one (1) foot stub with watertight plug or cap shall be installed in the back end of the tee-wye as shown on detail plate #2A.
6. Joints shall be either solvent cement type or elastomeric gasketed bell type as herein specified.
7. Inspection Riser Location - All inspection risers shall be located one (1) foot inside the right-of-way line, sanitary sewer easement, general utility easement, or as approved by the Authority Engineer.
8. Protective Casting in pavement or traveled ways - Inspection risers located in pavement or traveled ways shall be protected by use of a Campbell Foundry Casting #1000, or approved equal.
9. Protective Casting in lawn areas or non-traveled ways – Inspection risers in lawn and sidewalk areas shall be protected by use of a General Foundry Casting # 17101 (4”) or casting # 18111 (6”) or approved equal. See Plate #13

#### **E. Valve Box**

1. All sewer connections made using a low-pressure lateral sewer shall have a valve box in lieu of an inspection riser, the back edge of which shall be located one (1) foot inside of the right-of-way line, sanitary sewer easement, general utility easement, or as approved by the Authority Engineer.
2. Construction shall be as shown on detail plate #3 and as specified herein. Valve box and components shall be approved by the Authority Engineer.



3. The valve box shall be constructed of rectangular precast reinforced concrete vault sections with precast base and top slab sections. All sections shall be fully cured prior to shipping.
4. The joints of the vault sections shall be formed entirely of concrete, and shall be self-centering when assembled. The joints shall be sealed with a preformed gasket or a butyl rubber tape to form a watertight seal.
5. Access Hatch - The valve box shall have an aluminum hatch with a locking hasp and underside insulation, as per Bilco Co., New Haven, CT, 06505 or approved equal. Rain cap shall be piped to the outside of chamber and down to the stone foundation.
6. Pipe connections into valve boxes shall be "A-Lok X-Cel" as manufactured by A-Lok Products, Inc., P.O. Box 1647, Tullytown, PA 19007 or approved equal. Connectors shall be cast into manholes during manufacture.
7. Pipe connections shall assure a watertight seal while under a hydrostatic pressure of not less than fifteen (15) psi. and when deflected axially not more than ten (10) degrees in any direction.
8. Gasket materials shall meet or exceed the requirements established by ASTM C-923 entitled "Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes".
9. Pipe, Valves & Fittings - Each valve box shall contain two (2) ball valves, a check valve and a capped stub to provide access for line flushing. All pipe and fittings shall be constructed of Schedule 40 PVC. All fittings shall be rated to 1.5 times the maximum system operating pressure, or a minimum of 125 psi., whichever is greater. The ball valves shall have removable handles.
10. Sub-foundation - A solid, stabilized and level sub-foundation, consisting of a six (6) inch minimum depth of coarse aggregate No. 57 (¾-inch clean stone), shall be furnished for valve boxes.

**F. Vertical Riser Connections**

1. Vertical riser connections may be permitted when the main sewer is excessively deep, non-movable object interfere with the installation of the typical Gravity Lateral & Inspection Riser as shown on Plate #2 A and Plate #2B and only when ground conditions are favorable. They shall be used only with prior approval of the Authority Engineer. See Plate #14.

## **Section IV: Manholes**

### **A. General**

1. Manholes shall be installed immediately after pipe laying has reached the designated locations as indicated on the approved drawings.
2. Relocation of manholes shall only be allowed subject to written approval of the Authority Engineer.
3. Manholes shall be constructed as shown on the detail plates and shall conform to these specifications. No manhole components shall be installed until fully cured.
4. The material(s) and material supplier(s) shall be approved by the Authority Engineer before the work commences.
5. During all phases of manhole construction, the excavation shall be free of water.
6. Manholes shall in all cases be fully and completely built and fitted with their frames and covers as the sewer construction progresses.
7. ASTM Requirements - All materials shall be as required on the plans and as described in these specifications. All materials shall meet or exceed applicable ASTM specifications, except where the ASTM specifications have been modified by these specifications. All ASTM references shall be to the latest revision.

### **B. Standard Precast Manholes**

1. Standard precast manholes shall be made of reinforced concrete and consist of a base section, riser section(s), and an eccentric cone or flat slab top section (see detail plate #4).
2. Standard precast concrete manholes shall be four (4) feet in inside diameter up to a depth of ten (10) vertical feet, measured from invert to rim. Manholes that exceed ten (10) vertical feet shall be five (5) feet inside diameter at all depths.
3. Precast manhole sections shall be manufactured in accordance with ASTM C-478. The minimum compressive strength of the concrete for all sections shall be 4,000 psi. The maximum allowable absorption of the concrete shall not exceed eight (8) percent of the dry weight. All manhole sections shall be designed for H-20 loading.
4. Steel Reinforcement - The circumferential steel reinforcement for riser sections, cone sections and base walls shall be minimum of 0.12 square inches per linear foot in both directions, in accordance with ASTM C-76.

5. Exterior Coating - The exterior of all completely cured precast concrete manholes shall be protected with a two-coat application of a two-component catalyzed high build epoxy material. The dry film thickness shall not be less than ten (10) mils. The first coat shall be thinned in accordance with the manufacturer's requirements. The epoxy coating shall be "Tank-O-Lon" as manufactured by Con-Lux Coatings, Inc., Edison, N. J., 08818-0847, or equal.
6. Joints - Joints of the manhole sections shall be formed entirely of concrete and when assembled, shall be self-centering, providing a uniform watertight joint. The spaces between bells and spigots shall be so shaped as to accommodate preformed gasketing or butyl rubber tape. Sealing materials and methods shall be provided and installed in accordance with the manhole manufacturer's requirements, subject to approval by the Authority Engineer. Completed joints shall be watertight when subjected to the maximum possible internal or external hydrostatic pressures when in service.
7. Steps - Steps shall be the drop front step design, with a width not less than twelve (12) inches, legs of not less than ten (10) inches, and a drop not less than three (3) inches. They shall be fabricated of Copolymer Polypropylene Plastic as manufactured by M.A. Industries, Inc. or approved equal. See Plate #5
8. Sub-foundation - A solid, stabilized and level sub-foundation consisting of a six (6) inch minimum depth of coarse aggregate No. 57 (¾" clean stone) shall be furnished for precast manhole bases.
9. Lifting Holes - All lifting holes shall be fitted with rubber stoppers and shall be filled as much as possible with a waterproofing mortar mixture then covered with two (2) coats of the same waterproofing material as used by the manhole manufacturer. The Developer/Contractor shall re-coat surfaces damaged due to shipment or construction prior to backfilling.
10. Pipe Connections - Pipe connections into manholes shall be accomplished with a compression type elastomeric gasket designed, constructed and installed for use with the gravity sewer pipe to be installed. Pipe connections shall assure a watertight seal while under a hydrostatic pressure of not less than fifteen (15) psi. and when deflected axially not more than ten (10) degrees in any direction.
11. Gasket - Gasket materials shall meet or exceed the requirements established by ASTM C-923 entitled "Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes". Pipe connectors shall be "A-Lok X-Cel" as manufactured by A-Lok Products, Inc., P.O. Box 1647, Tullytown, PA 19007 or approved equal. Gaskets shall be cast into manholes during manufacturing.

12. The inverts of the holes for the influent and effluent pipes shall be at least four (4) inches above the inside floor of the precast section, prior to the casting of the channel.

### **C. Manhole Channels and Benches**

1. General - Manhole channels and benches shall be carefully formed to contain and direct the flow with a minimum of turbulence and creating smooth transitions between inlet and outlet pipes. The benches shall slope toward the channel. Sewer pipes shall extend into the manhole only as far as necessary to make a proper, watertight bond between pipe and manhole. The pipe shall be cut in a workmanlike manner and (if applicable) mortared smoothly.
2. Two general types of channels shall be permitted:
  - a. Precast Channels - Channels shall be semicircular in cross-section with vertical sides conforming to the diameter of the adjacent sewer pipes shown on the approved drawings. Sewer pipes shall extend into the manhole only as far as necessary to make proper, watertight connection between pipe and manhole. The pipe shall be cut in a workmanlike manner and mortared smoothly (see detail plate #6). The channels shall be manufactured by the manhole manufacturer and are subject to approval by the Authority Engineer.
  - b. Channels Built in Place - Channels shall be formed of concrete, shall be brick faced and shall be smooth, semicircular in shape with vertical sides and conforming to the size of the adjacent sewer pipes. Manhole channel brick shall comply to ASTM C-3258, Grade SA (see detail plate #7).

### **D. Polyvinyl Chloride (PVC) Liner**

1. All force main discharge manholes and those as indicated by the Authority Engineer shall include a PVC liner.
2. General - All interior manhole surfaces with the exception of channels and benches shall be covered by a PVC liner to be provided and installed by the manhole manufacturer. The completed lining system shall prevent corrosive materials present in the sewer line from causing concrete deterioration. Liner shall be "Dura-Plate 100", as manufactured by A-Lok Products, Inc., Tullytown, PA. 19007, or equal.
3. Design - The design of the liner shall be such that it will conform securely to the contour of the structure and form a permanent mechanical bond with the concrete through the use of pre-formed horizontal ribs. The liner will be formed in such a manner that the joints between the structure sections will be afforded protection through the use of a continuous PVC return extending into joints for a minimum of  $\frac{3}{4}$  of an inch. Provisions will be made to allow all pipe openings to be sealed.

4. Liner Materials - The liner shall be manufactured from polyvinyl chloride (PVC) resin and shall be white in color. The PVC compound shall result in a semi-rigid material suitable for thermoforming to the contour of the structure. All liner sections shall be free of cracks, pinholes or other defects adversely effecting the protective characteristics of the material and shall have a minimum thickness of sixty-five (65) mils.
5. Vertical Liner Connections - Liner sections may be fabricated in interconnecting panels with vertical joints secured and sealed by a pre-molded EPDM rubber seal in accordance with the manufacturer's requirements. Section joining methods shall be subject to approval by the Engineer.
6. Liner Installation - All liner sections shall be installed as an integral part of the process of casting the concrete base, riser and top slab components. Each PVC liner section shall be placed in the manhole manufacturer's forms to ensure that all liner attachment ribs are uniformly embedded in concrete.
7. The PVC liner shall extend to the floor of precast concrete base sections.
8. Joint Sealing - All joints between base, riser and top slab sections shall be sealed to prevent liquids or gases from entering the interior of joints.

**E. Manhole Grade Adjustment**

1. Adjustment of the manhole frames to meet finished grade shall be made using six (6) inch concrete barrel blocks, concrete bricks or concrete leveling rings, and shall not exceed +/- twelve (12) inches. If the required adjustment exceeds twelve (12) inches, then an additional manhole riser section shall be provided. Both the inside and outside surface of the raised section shall be coated with ½-inch thick mortar and troweled smooth.
2. Manhole Block - Manhole block shall be radial block with the inside and outside surfaces parallel. The radius shall be approximately two (2) feet and shall have a minimum length of twelve (12) inches, a width of not less than six (6) inches, and a maximum height of six (6) inches. Blocks shall meet the requirements of the New Jersey Department of Transportation and shall have a compressive strength of 3,000 psi. (28 day test).
3. Steps - Steps shall be built into the raised block section. Steps shall be provided in the manhole adjustment to insure a uniform distance between steps. The step rungs shall be as described in this section and as shown on Plate #5.

4. Mortar - Mortar for block manholes shall be composed of Portland cement and sand. The volume of sand shall not be less than two (2) times and not exceed three (3) times the volume of cement.
5. Cement - Cement shall be an American manufacturer of Portland Cement, Type II.
6. Sand - Sand shall pass through a No. 8 sieve, and shall be clean and free from deleterious material.
7. Water - All water used shall be potable water.

**F. Connections to Existing Manholes**

1. All connections to existing manholes shall be made by means of a flexible watertight connector inserted into a cored hole in the manhole wall. The size of the coring shall be as per the specifications of the connector manufacturer. Connections made by “breaking” through the manhole wall are not acceptable. The two (2) types of acceptable connectors are:
  - a. Mechanical Seals - Mechanical seals shall provide a watertight seal in the annular space between the cored hole and the outer surface of the pipe. The diameter of the cored hole shall be in accordance with the manufacturer’s specifications. The surface of the cored hole shall be smooth and free from ridges, burrs, etc.. The hole shall be cored and the seal installed in accordance with the manufacturer’s recommendations and procedures. The mechanical seal shall have 316 stainless steel hardware. The mechanical seal shall be the Link Seal, Model “O”, as manufactured by Pipe, Seal & Insulator, Inc., 6525 Goforth St., Houston, TX 77021, or equal.
  - b. PVC Sewer Manhole Adapter - PVC Manhole adapters shall fit over the spigot end of SDR-35 PVC gravity sewer pipe and be inserted in the cored wall opening. The adapter shall be centered in the annular space and cemented to form a watertight seal. The adapter shall have a granular material glued to the exterior of the adapter to provide a foundation for the cement bond. The adapter shall have an SDR-35 wall thickness and shall have an elastomeric gasket, in accordance with ASTM F-477. The adapter shall be as manufactured by Harco, P.O. Box 10335, Lynchburg, VA 24506, or equal.
2. The coring shall be either: a) through the bench of the existing manhole, thereby creating a channel, or b) on top of the bench, in which a channel shall be constructed on top of the bench.
3. The finished connection shall be watertight.

**G. Drop Manhole Connections**

1. All connections, where the invert of the incoming pipe is greater than two (2) feet above the invert of the outgoing pipe, shall connect by means of a drop connection. Drop connections can either be an “inside” or “outside” drop, which refers to the vertical piping being inside or outside of the manhole. All drop connections shall be the inside type, unless otherwise approved by the Authority Engineer.
2. Inside Drop Connection - The inside drop connection is comprised of a gasketed tee-wye connected to the incoming pipe and a vertical section of pipe with a 90-degree bend on the end. The top portion of the tee-wye is cut at a 45-degree angle to provide for access to the sewer main pipe. The piping assembly is secured the manhole wall with stainless steel straps and flush anchors. A brick trough-type channel shall be constructed on the bench to direct the flow into the main channel (see detail plate #8).
3. Outside Drop Connection - The outside drop connection is comprised of precast “U-shaped” collars stacked onto a standard manhole base with integrated drop. These components shall be as manufactured by and installed as per the manhole manufacturer. The annular space around the vertical pipe within the collars shall be filled with ¾” clean stone (see detail plate #9).

#### **H. Manhole Frames & Covers**

1. Manhole frames and covers shall be provided for each sanitary manhole installed. All manhole frames shall be set in a bed of one (1) inch thick mortar. A minimum of one-half (½) inch thick layer of cement shall be applied up around the outer edge of the frame, over the entire flange and trowled smooth. The interior frame to concrete joint shall be coated with one-half (½) inch thick mortar and trowled smooth.
2. All covers shall have a non-skid toe cope design and shall be capable of withstanding an AASHTO H-20 loading. All frames and covers shall be close-grained gray iron free from cracks, holes, swells and coal shuts, and shall conform to ASTM A-48 Class 30B. The quality shall be such that a blow from a hammer will produce an indentation on a rectangular edge of the casting without flaking the metal. All manhole castings shall be made accurately to the pattern, and to the dimensions specified, with a carefully mill-machined bearing surface. All covers shall have lettering as indicated in detail plate #10.
3. All pattern numbers referenced herein shall be as manufactured by the Campbell Foundry Company, 800 Bergen St., Harrison, N.J. 07029, or equal.
4. Standard Manhole Frame & Cover - The standard manhole frame and cover shall be pattern number 1202B. The covers shall have two (2) – 1” diameter vent holes spaced 180 degrees from each other (see detail plate #10).

5. Water-Resistant Manhole Cover - Water-resistant manhole covers shall be provided as directed by the Authority Engineer. The cover shall be the 1202B “Flow-Seal” used with the standard 1202B frame.
6. Locking Manhole Cover - Locking manhole covers shall be provided as directed by the Authority Engineer. The cover shall be the 1202B “Camlock” used with the standard 1202B frame.
7. Watertight Manhole Frame & Cover - The watertight manhole frame and cover shall be Campbell Casting pattern number 6544.

#### **I. Doghouse Manholes**

1. There are two types of doghouse manholes:
  - a. Traditional - This type incorporates the construction of a manhole around a live main sewer pipe. The manhole consists of a poured-in-place concrete base or precast reinforced concrete base slab set under the existing pipe, and a precast reinforced concrete base riser section with upside down “U”-shaped openings. The base riser section shall not have an interior or exterior coating. The remainder of the manhole shall be constructed as a standard type. Butyl rubber tape shall be placed in the joint between the precast base slab and the base riser section.
  - b. Sectioned Main - This type incorporates removing a section the main sewer pipe and installing a standard precast concrete manhole with short lengths of pipe to reconnect the sectioned main. The manhole shall be constructed in accordance with Paragraph B of this section. The existing main sewer pipe and the short lengths of pipe shall be of the same material, type and diameter. The new and existing pipes shall be joined with a rigid coupling.
2. The traditional doghouse manhole shall only be used where the pipe material is reinforced concrete (RC) or asbestos cement (AC), and shall be used only as authorized by the Authority Engineer.
3. Sub-Foundation - Base slabs shall be placed on a solid, stabilized and level sub-foundation, consisting of a minimum of six (6) inches of coarse aggregate no. 57 (¾-inch clean stone).
4. Pipe Grouting - The annular space between the existing pipe and the precast base riser section shall be grouted with a non-shrinking grout. Manhole construction and backfilling shall be completed prior to grouting the existing pipe in place. The pipe shall be grouted in such a way to ensure a watertight seal.



5. Bench - The bench shall be formed by placing concrete in the space between the existing pipe and the base riser section wall. The concrete shall be brought up from a level equal to  $\frac{3}{4}$  of the diameter of the pipe at the pipe, and equal to the diameter of the pipe at the manhole wall. The bench shall pitch toward the pipe and shall be trowl-finished. The newly connecting pipe(s) shall have channels either built into or on top of the bench of the doghouse manhole. The existing pipe shall be grouted in place prior to the bench construction.
6. Channel - The top of the existing pipe shall be cut or broken open only after construction, backfilling, pipe grouting and bench construction has been completed, all concrete and mortar is fully cured, and as authorized by the Authority Engineer. The existing pipe shall be opened in a careful and workmanlike manner. The edges of the opening shall be chipped or ground smooth, and shall be free from burrs, protruding reinforcing steel, etc.. There shall be no "lip" where the bench concrete meets the existing pipe (i.e. water shall flow freely on the bench into the existing pipe). All pipe fragments shall be removed from the existing pipe.
7. All doghouse manholes shall be watertight and are subject to testing (see Section VI).
8. In addition to these requirements, manhole construction shall be in accordance with Paragraph B of this section.

**J. Appurtenance Manholes**

1. The requirements for the below listed appurtenance manholes shall be comparable to those stipulated in Paragraphs B & H of this section. The inside diameter shall be five (5) feet, regardless of depth. Each manholes shall consist of a base slab with no bench and channel, riser section(s) and a flat top slab. No conical top sections shall be used. These manholes are subject to inspection, however, they are not subject to hydrostatic or vacuum testing. These manholes shall be constructed to ensure watertightness. Manhole frames and covers shall be provided as directed by the Authority Engineer.
2. Terminal Flush Manhole - A terminal flush manhole shall be located at the end of a low-pressure sanitary sewer main, as directed by the Authority Engineer. There shall be a single gasketed wall opening sized to accommodate the one and a half inch (1 1/2") inch Schedule 40 PVC low-pressure main. See Plate #15
3. In-Line Flushing Connection Manhole - An In-Line Flushing Connection Manhole shall be located along a low-pressure force main , as directed by the Authority Engineer. Two (2) gasketed wall openings sized to accommodate the force main pipe shall be provided. See Plate #16

**K. Foundation & Encasement Concrete**

1. As directed by the Authority Engineer, foundation concrete shall be provided.
2. The contractor shall furnish all labor and materials necessary for performing, placing, excavating and dewatering for, grading and rodding concrete as required for foundation, encasement and for any other purpose as directed by the Authority Engineer.
3. The trench shall be thoroughly dewatered prior to the placement of the foundation concrete.
4. Foundation concrete shall develop a twenty-eight (28) day compressive strength of 3000 psi. Slump tests and test cylinders shall be made as required by the Authority Engineer.

## **Section V: Sewer Construction**

### **A. Methods of Construction**

1. The Developer/Contractor shall make excavations in such a manner and to such widths that will provide suitable room for building the required structures or laying and joining pipe and shall furnish and place all sheeting, bracing and supports.
2. Pavement Cutting - Prior to any excavation, the Developer/Contractor shall cut all pavement to a neat line, as determined by the Authority Engineer and in accordance with applicable governmental agencies, by using pneumatic hammers or mechanical pavement cutters, saws or other approved methods or devices.
3. Prior to commencing any excavation, the Developer/Contractor shall provide for the location of all existing underground utilities and drains, and shall notify the New Jersey One Call System (1-800-272-1000) in accordance with the Underground Facilities Protection Act, N.J.S.A. 48:2-75 et seq.. Whenever work is in the vicinity of high voltage power lines, the Developer/Contractor shall operate in accordance with the High Voltage Proximity Act.
4. Trench - The trench in which the sewers and appurtenances are to be constructed shall be opened to a depth that is in accordance with the grades as shown on the approved plans. All excavations shall be cut from the surface, except where otherwise directed. The trench shall be excavated in accordance with OSHA 29 CFR Part 1926.650 Excavations. The trench elevation shall be carried to a depth of least six (6) inches below the pipe invert to provide a suitable bedding for the pipe.
5. Sheeting and Bracing - The contractor shall be responsible for properly supporting the sides of all excavations with timbers or other supports in accordance with OSHA 29 CFR 1926.650, Trenching & Shoring.
6. Drainage - The Developer/Contractor shall provide for sufficient dewatering of the trench at his own expense whenever needed during the progress of the work. No structures or sewers shall be laid in water. Water shall not be allowed to flow over or rise upon any concrete, masonry or pipe until the work has been inspected and the mortar or concrete has properly set. All water pumped or bailed from the trench or other excavation shall be conveyed in a proper manner to a suitable point of discharge.

7. Trench Dressing - The bottom of the trench shall be carefully dressed so that the pipe may be laid on a uniform six (6) inch depth of bedding material, free from any rocks, wood, block or large debris along its entire length. This part of the work shall be done manually by skilled workers after the trench bottom has been aligned and properly sub-graded.
8. Excavation for Foundation - If, in the opinion of the Authority Engineer, the material at or below the grade to which excavation would normally be carried is unsuitable for pipe foundation, it shall be removed to such depths and widths as he may direct and be replaced with the type of foundation material as ordered.
9. Foundation Material - Foundation material shall be installed only as directed by the Authority Engineer in areas where native material is unsuitable to support the pipe (see detail plate #11).
10. Bedding Material - Bedding material shall be installed to a minimum depth of six (6) inches below the pipe invert as specified (see detail plate #11).
11. Haunching Material - Haunching material shall be placed in accordance with the trench detail plate to the springline (or half-full point) of the pipe (see detail plate #11). Where saddles are used, the saddle shall be bedded in a minimum of six (6) inches of ¾" clean stone up to the springline of the adjoining pipe.
12. Extent of Open Excavation (in areas other than R.O.W.) - The extent of excavation opened or the area unrestored at any time will be dictated by specific site conditions, but shall always be confined to the limits prescribed by the Authority Engineer with regard to expeditious construction and to the safety and convenience of the public. Linear trenches shall not be kept open overnight.
13. Pipe Connection or Support at Structures - Pipe directly connected to or supported by rigid structures, such as manholes, foundation walls, footings and cradles, shall not have a length beyond the rigid support in excess of that shown in Table #1:

**Table 1:**

<b><u>Pipe Diameter</u></b>	<b><u>Allowable Length of Pipe</u></b>
8" to 24"	6'-6"
30" to 36"	13'-0"

**B. Foundation, Bedding and Haunching Material**

1. The materials used in the pipe trench shall be in accordance with detail plate #11 and the specifications contained herein.
2. Foundation Material - Foundation material shall be coarse aggregate No. 57 (¾-inch clean stone) or concrete, as directed by the Authority Engineer.
3. Bedding and Haunching Material - Bedding and haunching material shall be coarse aggregate No. 57 (¾-inch clean stone).

**C. Handling Materials**

1. Inspection - All pipe sections shall be carefully examined for dents, cracks and other defects, and no pipe known to be defective shall be laid. Pipe sections which do not meet the specifications shall be rejected within twenty-four (24) hours. If any pipe is found to be broken or defective after being laid, it shall be removed and replaced by sound pipe. Pipe shall be thoroughly cleaned and ample precautions shall be taken to prevent entrance of dirt and debris into the pipe after laying. Exposed ends of the sewer shall be provided with temporary plugs or covers.
2. Equipment - Proper tools and equipment satisfactory to the Authority Engineer shall be provided for the safe and efficient execution of the work. All pipes, fittings, and accessories shall be carefully lowered into the trench by means of machine, ropes, or other suitable equipment in such manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.
3. Pipe Jointing - All pipe ends shall be thoroughly cleaned prior to and kept clean during the joining operation. The pipe shall be carefully joined in conformity with the best practice and detailed instructions of the manufacturer to produce the required results of flexibility and water tightness.
4. Backfilling
  - a. General - No trench or other excavation shall be backfilled until the sewer or structure in it has been examined and approved except as otherwise provided herein. Following the Authority inspection of the laid pipe, the Developer/Contractor shall place initial and final backfill.
  - b. Backfilling Around Structures - As soon as practicable after the pipes and masonry been placed and concrete has acquired a suitable degree of hardness, and other necessary work has been done, backfilling shall begin and shall thereafter be done expeditiously. Select fill shall be used in the initial backfill within two (2) feet of the structure.

c. Open Trench Backfilling:

1. As soon as the pipe has been inspected, the Developer/Contractor will commence placing initial and final backfill until the trench is filled.
2. Initial Backfill - Initial backfill to a point two (2) feet above the crown of the pipe shall be placed in six (6) inch layers and compacted by hand. The material shall be select fill in accordance with detail plate #11. Prior to compaction, the initial backfill shall be deposited to a depth of two (2) feet above the crown of the pipe. Backfilling shall be carried up both sides of the pipe for the full width of the trench. Care shall be taken not to displace or disturb the pipe. Compaction equipment shall not be used directly over the pipe until sufficient backfill has been placed to prevent damage.
3. Final Backfill - Final Backfill from two (2) feet above the crown of the pipe to the top of the trench shall be deposited in lifts not to exceed six (6) inches and shall be thoroughly compacted as follows:
  - a. Easement Areas (unimproved) - Where sewers are located under areas where no paving or structures are to be constructed, all final backfill materials shall be compacted to a minimize settlement. If, in the opinion of the Authority Engineer, the native material excavated from the trench is not suitable for use as backfill, the Developer/Contractor will provide select fill material. The Developer/Contractor shall notify the Authority Engineer when unsuitable soil conditions are suspected and obtain approval prior to the installation of any select fill on the job. No stone or rock fragment weighing in excess of approximately fifty (50) pounds shall be backfilled into the trench nor shall large masses of backfill be dropped, as from a grab bucket, into the trench in such a manner as to endanger the sewer. All trenches located in easements shall be compacted in such a matter to obtain an eighty-five (85) percent modified proctor density to control settling.
  - b. Paved Areas (improved) - When sewers are located under existing roadways or in any paved areas, including driveways and parking lots, all final backfill material shall be select fill placed in accordance with the Authority Engineer or the applicable governmental agency. All trenches located in paved areas shall be compacted in such a manner as to obtain ninety-five (95) percent of modified proctor density to control settling.

## **Section IV: Final Acceptance**

### **A. General**

1. All tests shall be performed under the supervision of the Hillsborough Township Municipal Utilities Authority. The Developer/Contractor shall furnish all labor, equipment and materials to perform the tests contained herein.
2. Prior to final acceptance of the work done under these specifications, the Developer/Contractor shall flush and clean all sewer lines, manholes and appurtenances in preparation for inspection. If it is found the lines have not been properly cleaned, the inspection will be terminated and not resumed until the cleaning has been completed.
3. All sewer lines shall be laid to true line and grade between manholes.
4. If, in the opinion of the Authority Engineer, the work performed in the construction is not acceptable for reasons such as improper pipe alignment, deviation in grade, obvious leaks, cracks or defects in pipes or manholes, excessive infiltration, obstructions or deposits in pipes or any other condition which may affect the proper functions of the sewer, the Developer/Contractor shall replace, repair or clean the defective section or sections and appurtenances at his own expense.

### **B. Testing**

1. Testing for final acceptance shall include, but are not limited to the following:
  - a. Gravity Sewer Water Infiltration Tests - Weirs shall be installed at various locations in the line to measure infiltration. The tests shall be conducted during wet and dry weather. Maximum allowable infiltration shall be fifty (50) gallons per inch diameter per mile of pipe per twenty-four (24) hour period. Infiltration tests will be permitted only when sufficient ground water exists (a minimum of five (5) feet above the top of the pipe, throughout the 24 hour testing period or above the groundwater level, (at the highest point of the line being tested).
  - b. Gravity Sewer Water Exfiltration Tests - Water exfiltration tests shall be required if it cannot be demonstrated that ground water exists at least five (5) feet above the outside top of the pipe. When exfiltration tests are conducted,

exfiltration observed will be considered to be equal to infiltration and the above maximum allowable infiltration rate shall apply. Manholes may be included in exfiltration tests or tested separately. The water level shall be at least five (5) feet above the top of the pipe whichever is higher, at the highest point of the line being tested.

- c. Manhole Exfiltration Tests - The manhole shall be completely plugged and then filled with water to the manhole rim and allowed to stand for two (2) hours prior to the start of readings. The test shall normally be a two (2) hour duration. The maximum allowable exfiltration shall be one-half (½) gallon.
- d. Manhole Vacuum Tests - Vacuum testing of manholes can be employed in lieu of exfiltration testing. The Developer/Contractor shall furnish the equipment needed to perform this type of testing. The vacuum testing apparatus shall be used in accordance with the manufacturer’s procedures. The maximum vacuum test pressure shall be ten (10) inches of mercury (Hg). Pressures in excess of ten inches mercury may damage the manhole. The Developer/Contractor shall be entirely responsible for protecting the manhole from damage. In accordance with ASTM C-924, the figures contained in Table 1 correlate to the holding duration of vacuum pressure for a given manhole depth and diameter:

**Table #1**

**Required Duration for Holding 10”Hg Vacuum Pressure in Precast Concrete Manholes of 48” to 72” Inside Diameter (seconds)**

<b><u>Manhole Depth</u></b> (feet)	<b><u>Duration for 48” Dia.</u></b>	<b><u>Duration for 60” Dia.</u></b>	<b><u>Duration for 72” Dia.</u></b>
4	10	13	16
8	20	26	32
12	30	39	48
16	40	52	64
20	50	65	80
24	60	78	96

**Note: Add the following times for every additional two (2) feet of depth**

2 ft. increments	5	6.5	8
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- d. Gravity Sewer Low Pressure Air Exfiltration Tests - During the low-pressure air exfiltration test, the maximum allowable air pressure drop in the pipe between two consecutive manholes shall not exceed 0.5 psi from 5.0 to 4.5



psi. over a five (5) minute duration. Adjustments shall be made to accommodate whatever water table exists .

- e. Gravity Sewer Deflection (Mandrel) Tests - All PVC sewers shall be mandrel tested. The maximum allowable deflection (reduction in vertical inside diameter) is five (5) percent. The mandrels provided for testing purposes shall conform to the dimension indicated on detail plate #12.
- f. TV Inspection - Closed circuit TV inspection of all sanitary sewer lines shall be performed. A videotape record of all TV inspection shall be provided to the Authority.
- g. Force Main/Low-Pressure Main and Lateral Sewer Hydrostatic Pressure and Leakage Tests - The test pressure should be 150% of the operating pressure at the lowest elevation of the system, or the class designation of the pipe plus fifty (50) psi., whichever is lower. The duration of the test should be two hours unless otherwise specified. The leakage rate must not exceed that which is specified in Table 2:

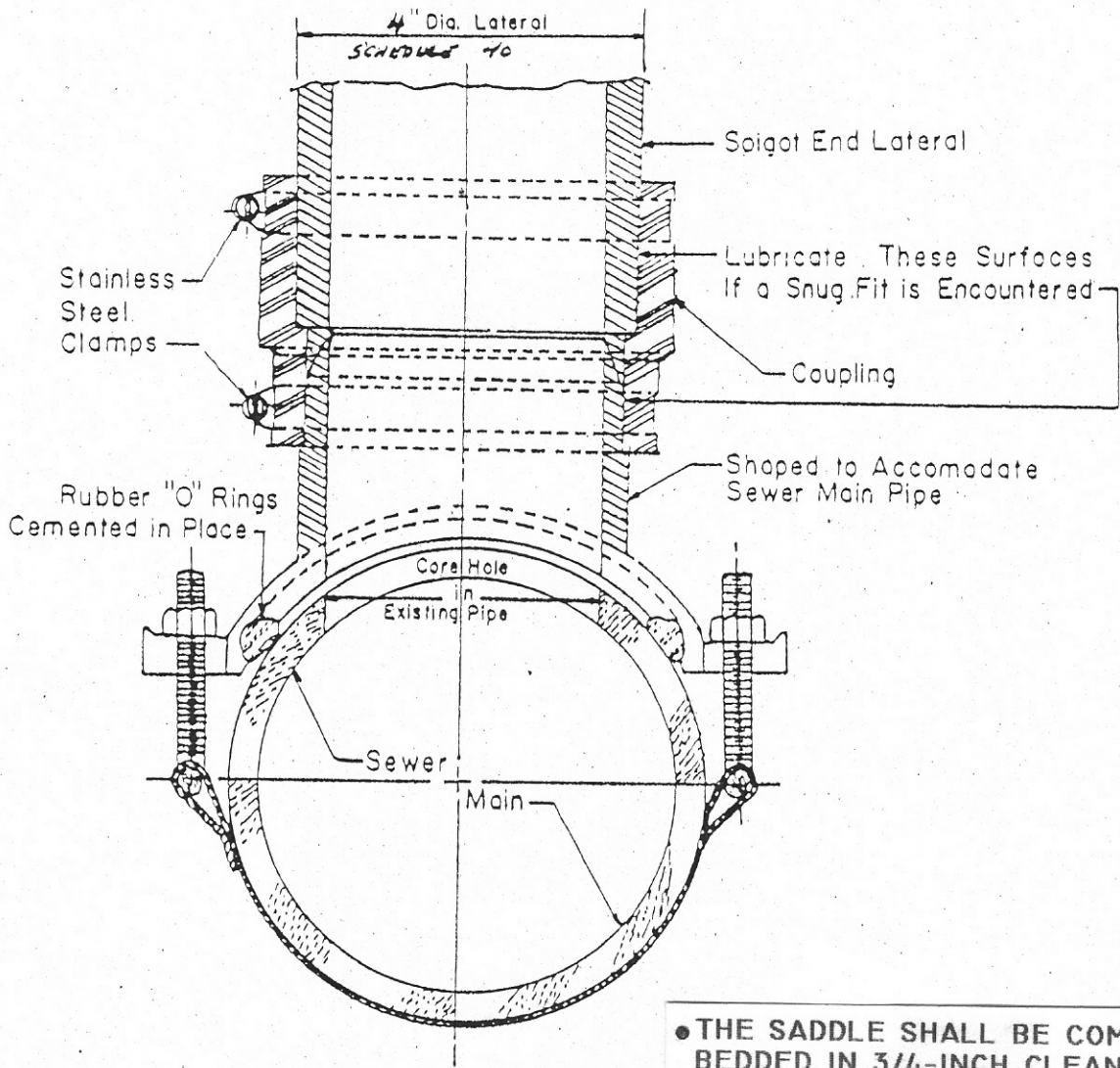
**Table #2**

**Allowable Leakage for PVC Sanitary Force Main Pipe with Elastomeric Joints in Gallons per Hour per 1000 Feet of Pipe or 50 Joints**

<b><u>Pipe Size</u></b>	<b>Test Pressure at Lowest Point in Line (psi)</b>				
	<b><u>50</u></b>	<b><u>100</u></b>	<b><u>150</u></b>	<b><u>200</u></b>	<b><u>250</u></b>
4"	.19	.27	.33	.38	.43
6"	.29	.41	.50	.57	.64
8"	.38	.54	.66	.76	.85
10"	.48	.68	.83	.96	1.07
12"	.57	.81	.99	1.15	1.28
15"	.72	1.02	1.25	1.44	1.61

## **Section VII: Detail Plates**

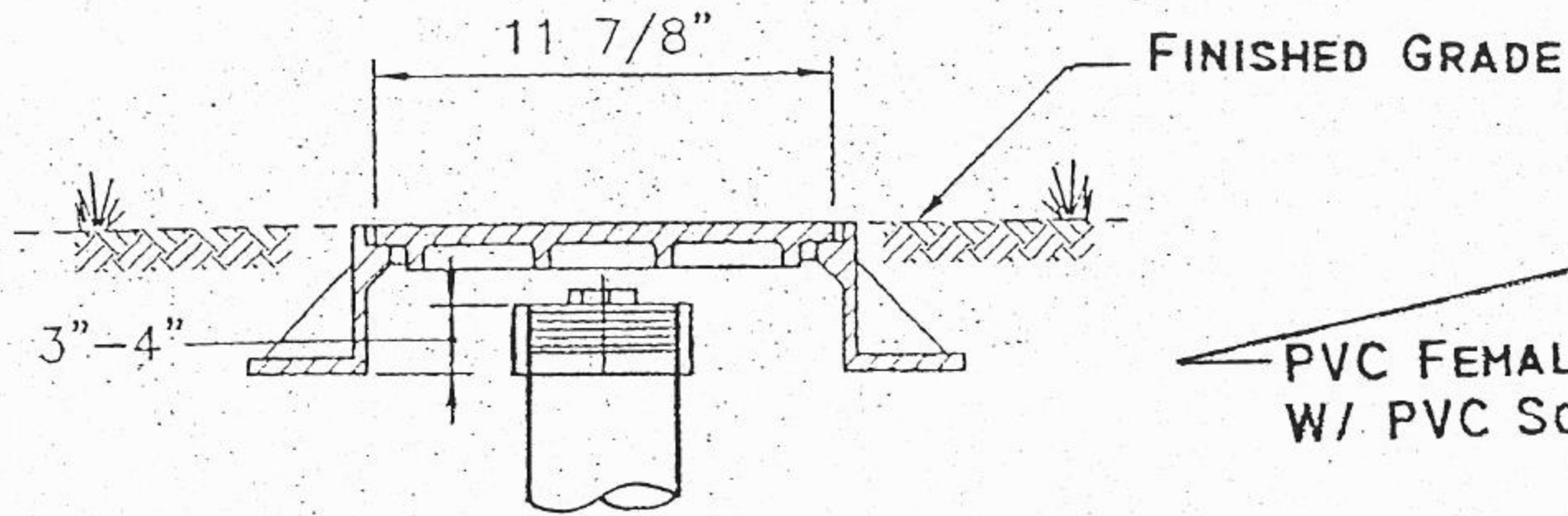
The following pages are detail plates as referenced herein.



## SANITARY SADDLE

"S" SADDLE by GENECO or  
APPROVED EQUAL

GRAVITY



PVC FEMALE THREADED ADAPTER  
W/ PVC SCREW PLUG

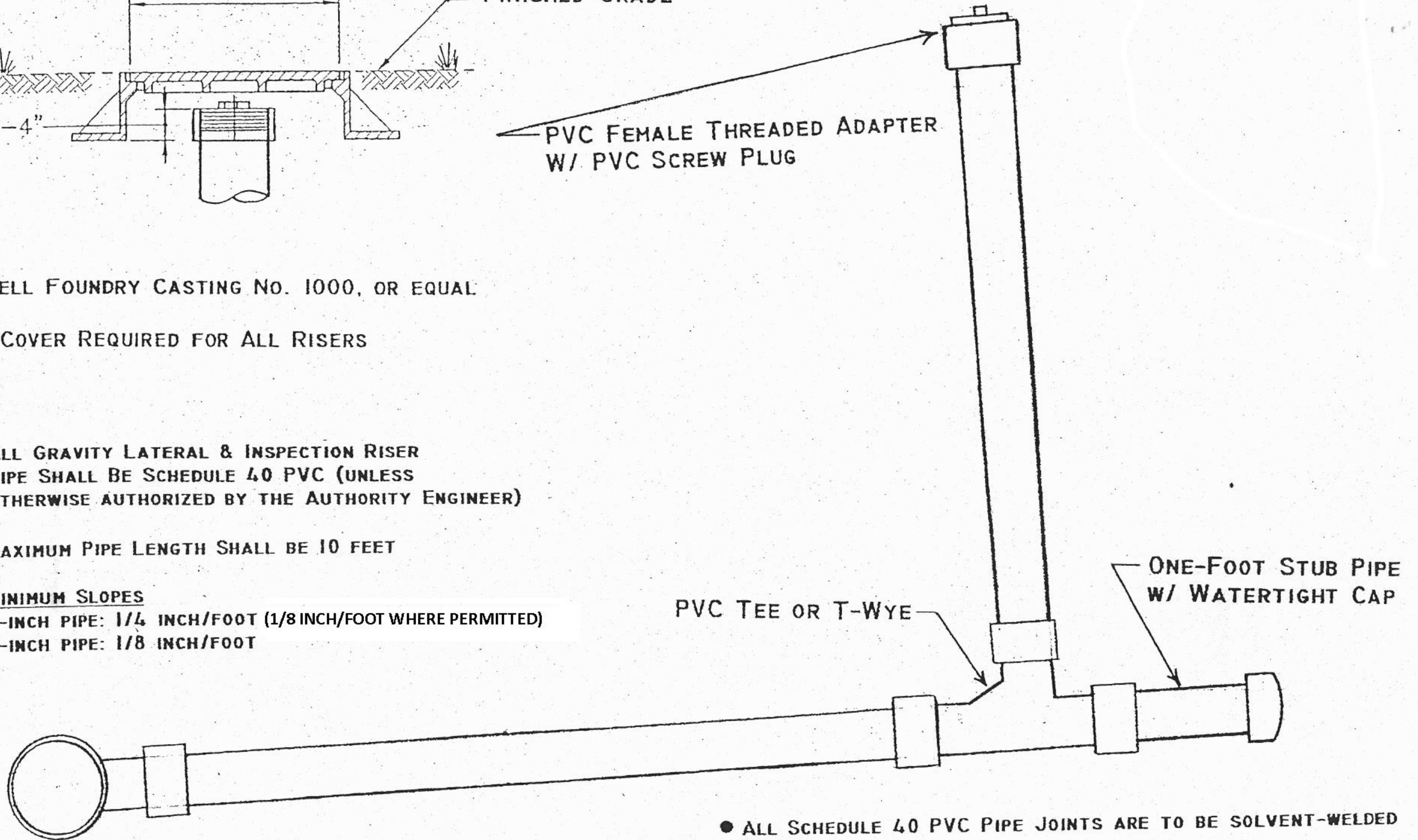
● CAMPBELL FOUNDRY CASTING NO. 1000, OR EQUAL

● RISER COVER REQUIRED FOR ALL RISERS

● ALL GRAVITY LATERAL & INSPECTION RISER  
PIPE SHALL BE SCHEDULE 40 PVC (UNLESS  
OTHERWISE AUTHORIZED BY THE AUTHORITY ENGINEER)

● MAXIMUM PIPE LENGTH SHALL BE 10 FEET

● MINIMUM SLOPES  
4-INCH PIPE: 1/4 INCH/FOOT (1/8 INCH/FOOT WHERE PERMITTED)  
6-INCH PIPE: 1/8 INCH/FOOT



● ALL SCHEDULE 40 PVC PIPE JOINTS ARE TO BE SOLVENT-WELDED

**GRAVITY LATERAL & INSPECTION RISER DETAIL (PROFILE)**  
(N.T.S.)

● ALL GRAVITY LATERAL & INSPECTION RISER PIPE SHALL BE SCHEDULE 40 PVC (UNLESS OTHERWISE AUTHORIZED BY THE AUTHORITY ENGINEER)

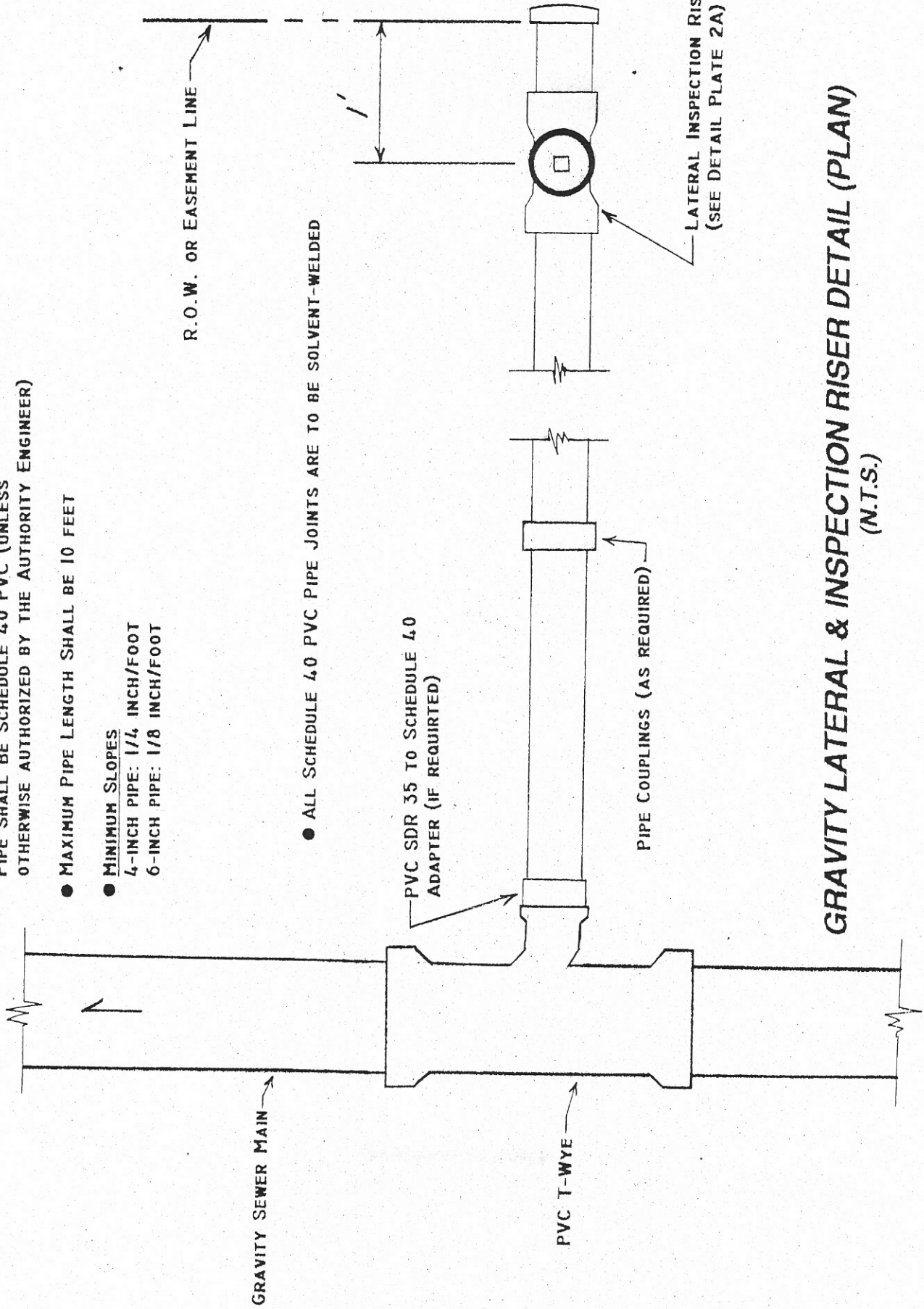
● MAXIMUM PIPE LENGTH SHALL BE 10 FEET

● MINIMUM SLOPES

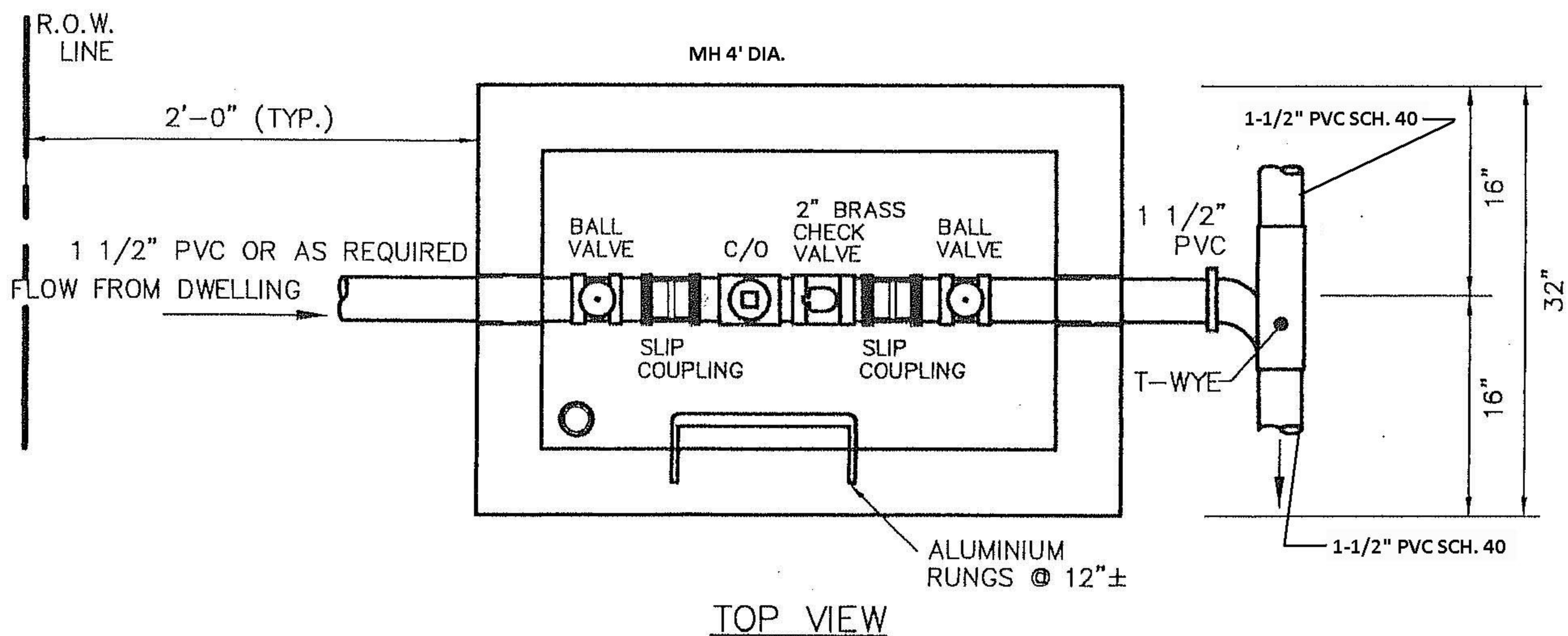
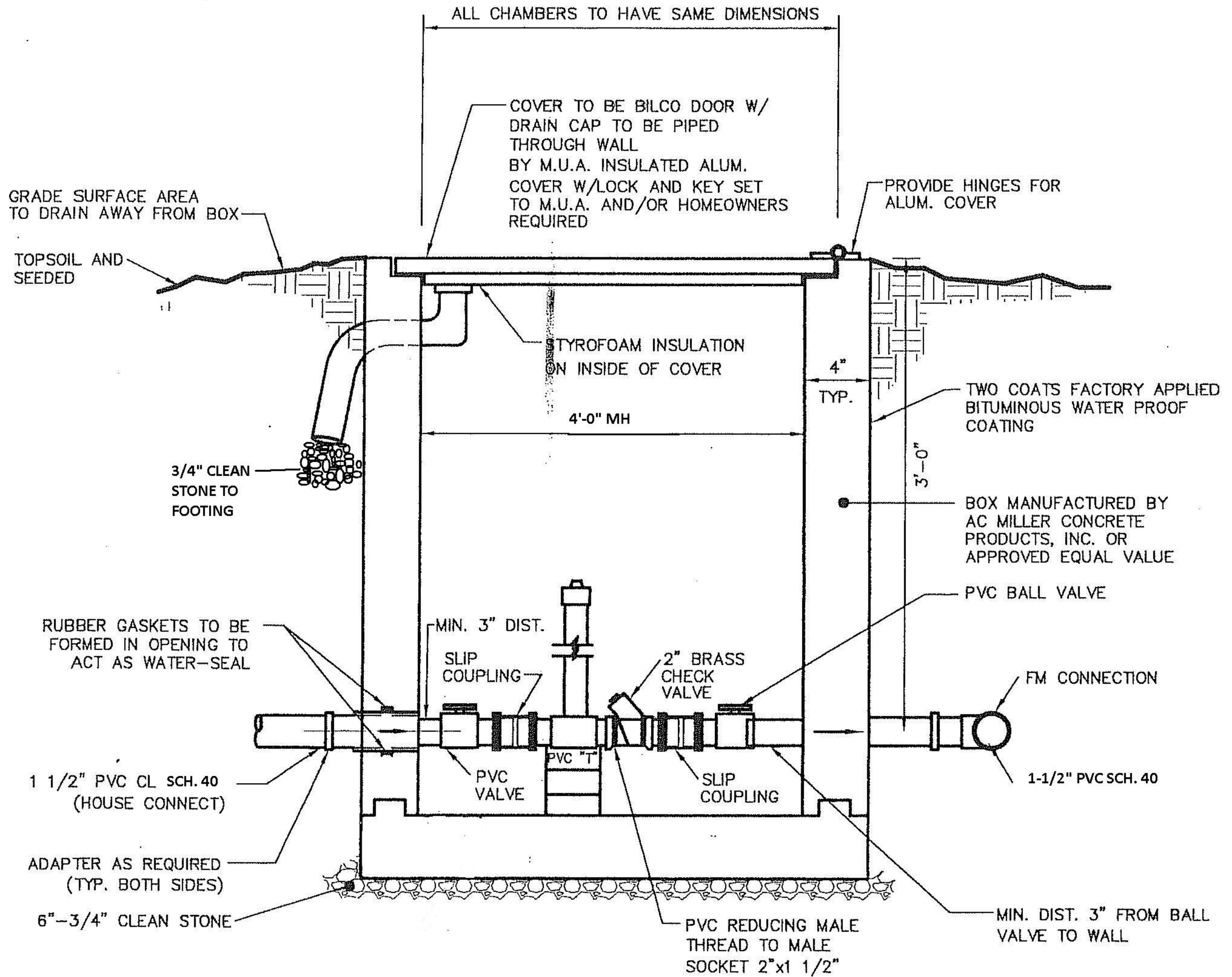
4-INCH PIPE: 1/4 INCH/FOOT

6-INCH PIPE: 1/8 INCH/FOOT

● ALL SCHEDULE 40 PVC PIPE JOINTS ARE TO BE SOLVENT-WELDED



**GRAVITY LATERAL & INSPECTION RISER DETAIL (PLAN)**  
(N.T.S.)

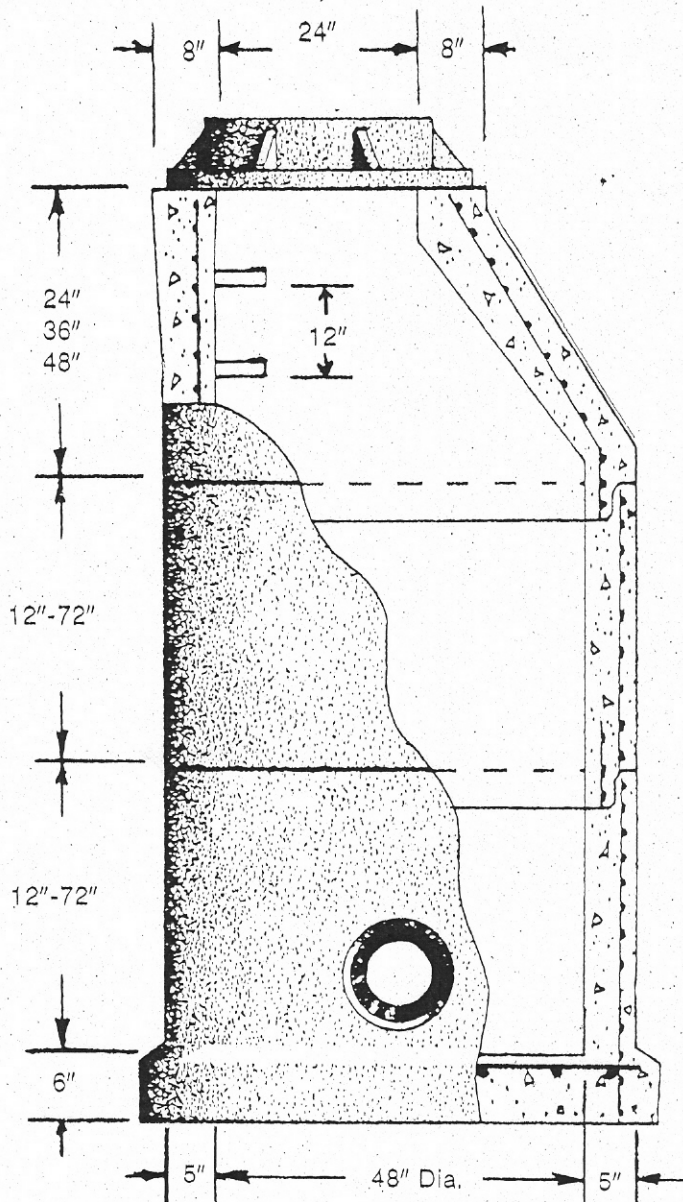


TOP VIEW

**LOW-PRESSURE FORCE MAIN VALVE BOX DETAIL**

N.T.S.

DETAIL PLATE #4



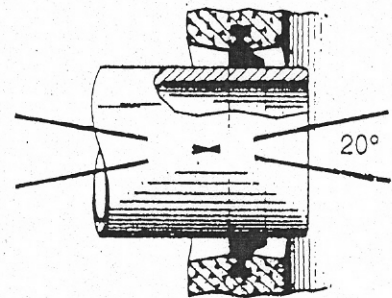
Joints can be sealed using butyl rubber Fed. Spec. SS-S-210-A or D-LOK rubber gasket ASTM C-443, OR EQUAL

Reinforcing ASTM A-185  
Area 0.12 in.<sup>2</sup> /vert. ft.

Concrete Compressive  
Strength 4000 psi

Exterior coating

ALUMINUM STEP RUNGS



**MANHOLE DESIGN**

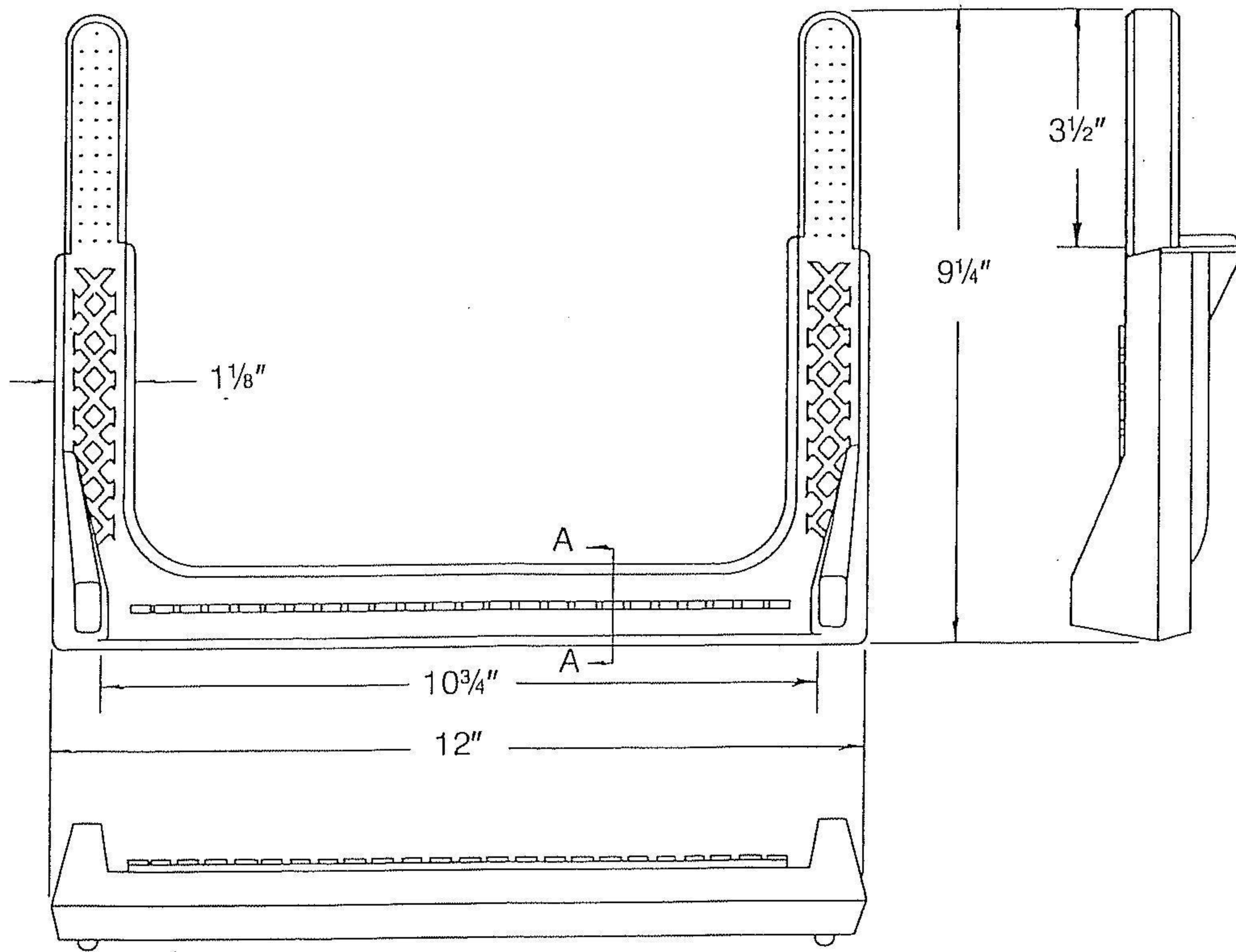
Manhole design specifications conforms to "Precast Reinforced Concrete Manhole Sections" ASTM C478, Latest Revision.

PIPE TO MANHOLE SEAL

A-LOK gasket per A.S.T.M. rubber gasket specs C923, cast integrally in manhole wall and located as required, OR EQUAL.

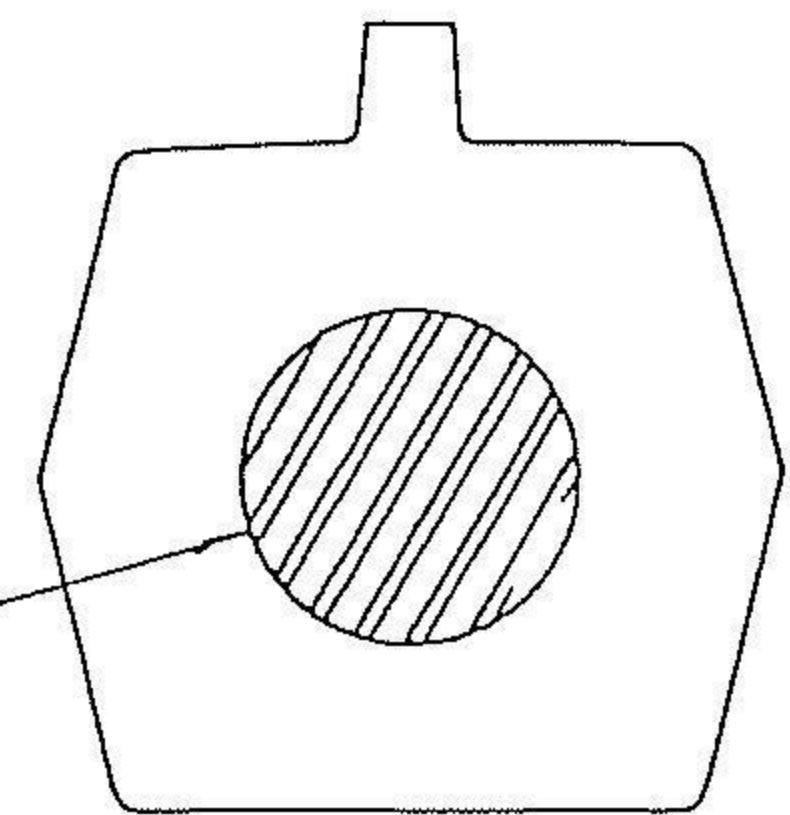
Joint allows 10° omni-directional deflection

**STANDARD 48-INCH DIAMETER PRECAST  
CONCRETE MANHOLE  
(N.T.S.)**

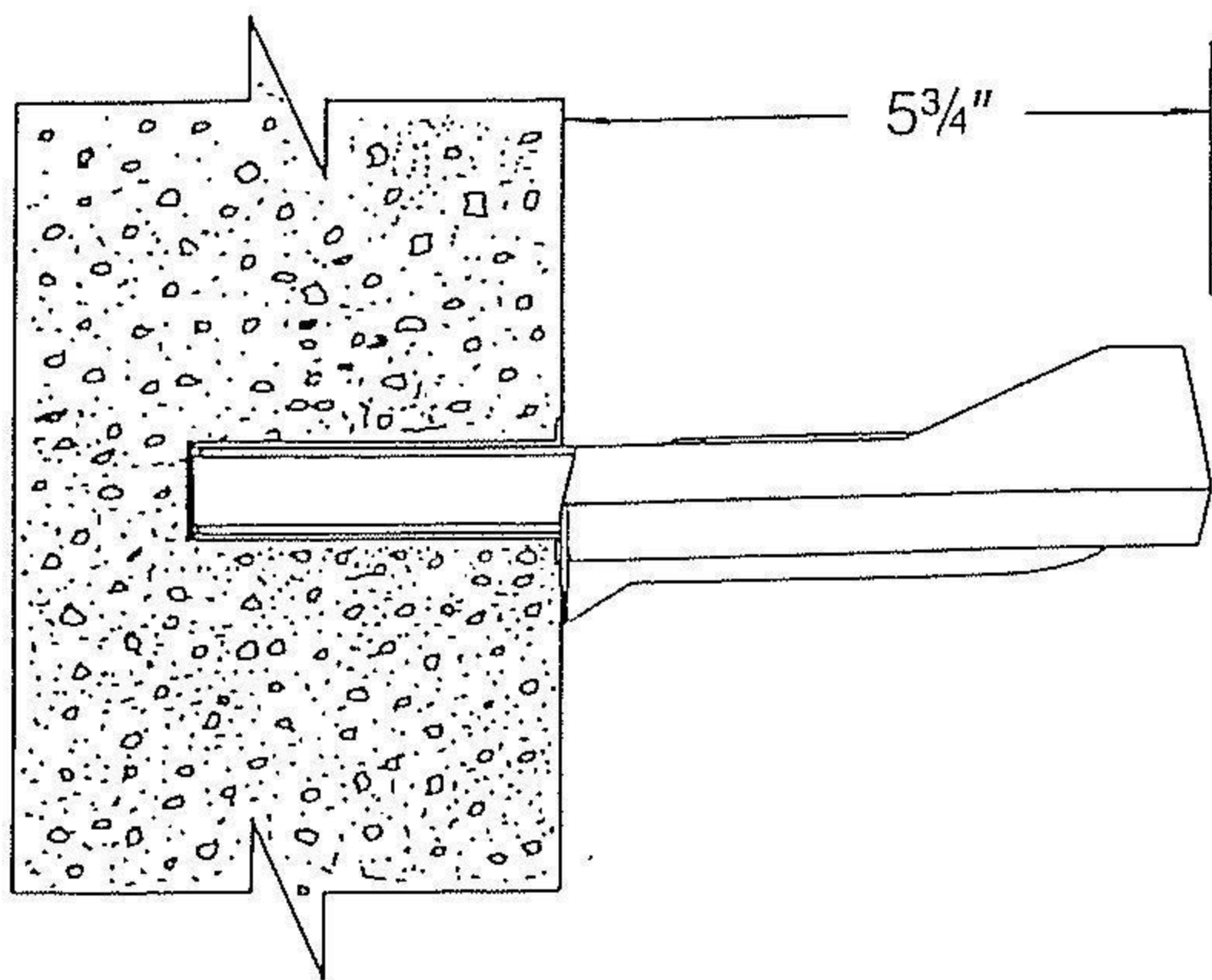


**Copolymer Polypropylene Plastic**

$\frac{1}{2}$ " GRADE 60 STEEL REINFORCEMENT

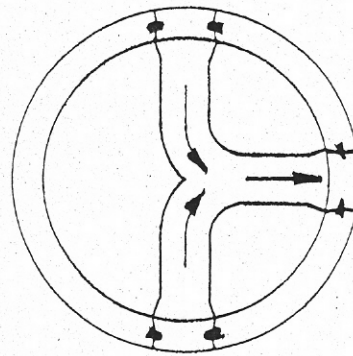
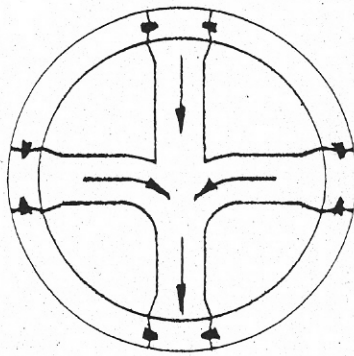
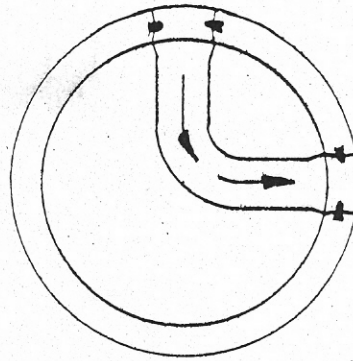
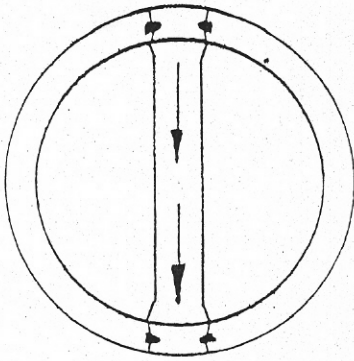


**SECTION A**

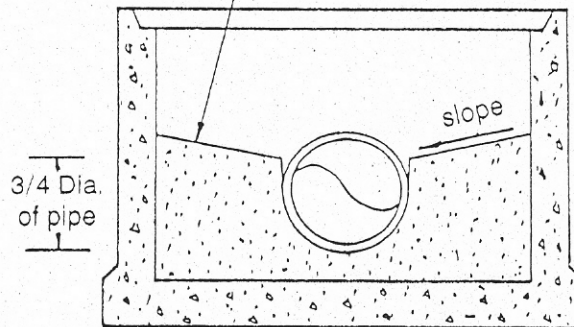


Manufactured by  
M.A. Industries Inc.  
Kelley and Dividend Dr.  
Peachtree City, GA





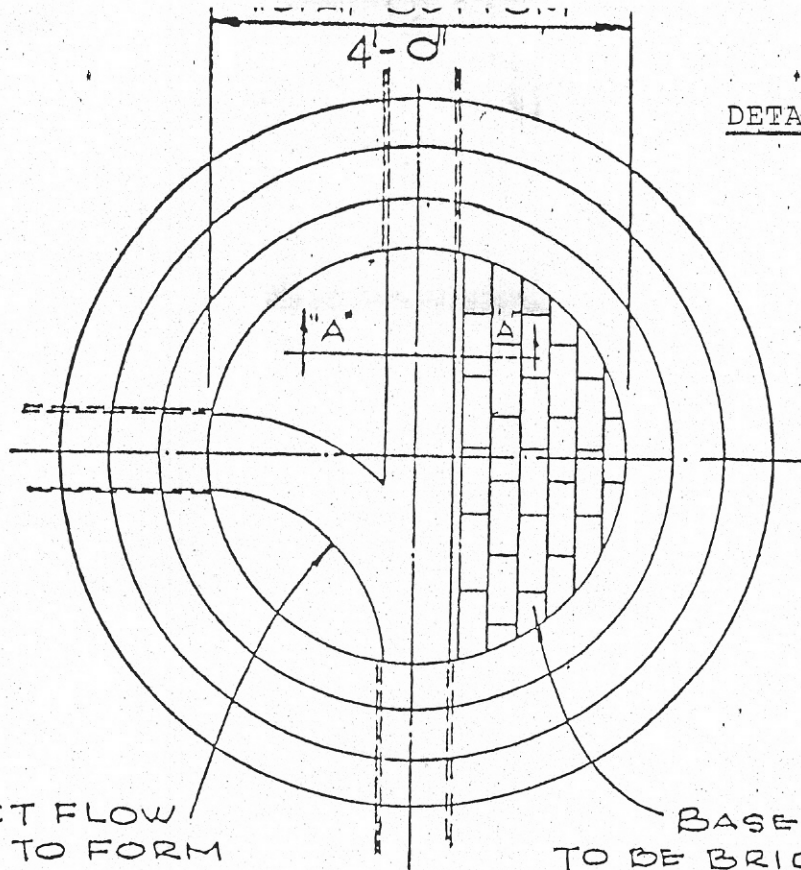
Non Skid Surface  
for personnel safety



Available for  
4"-24" dia. pipe

TYPICAL CROSS SECTION

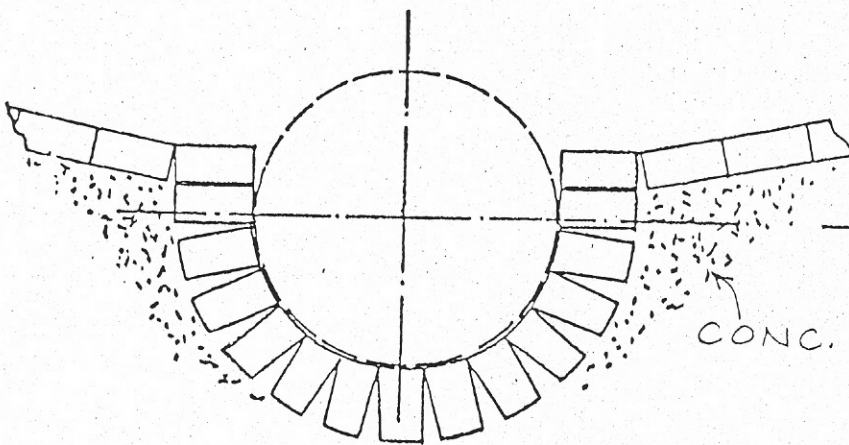
**PRECAST CONCRETE MANHOLE CHANNELS**  
(N.T.S.)



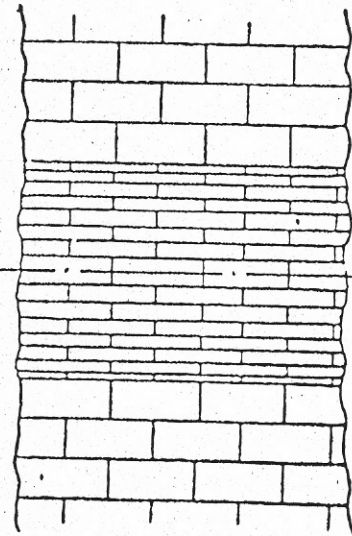
CONSTRUCT FLOW THROUGH TO FORM EASY FLOW CURVES

BASE OF MANHOLES TO BE BRICK FACED

PLAN VIEW

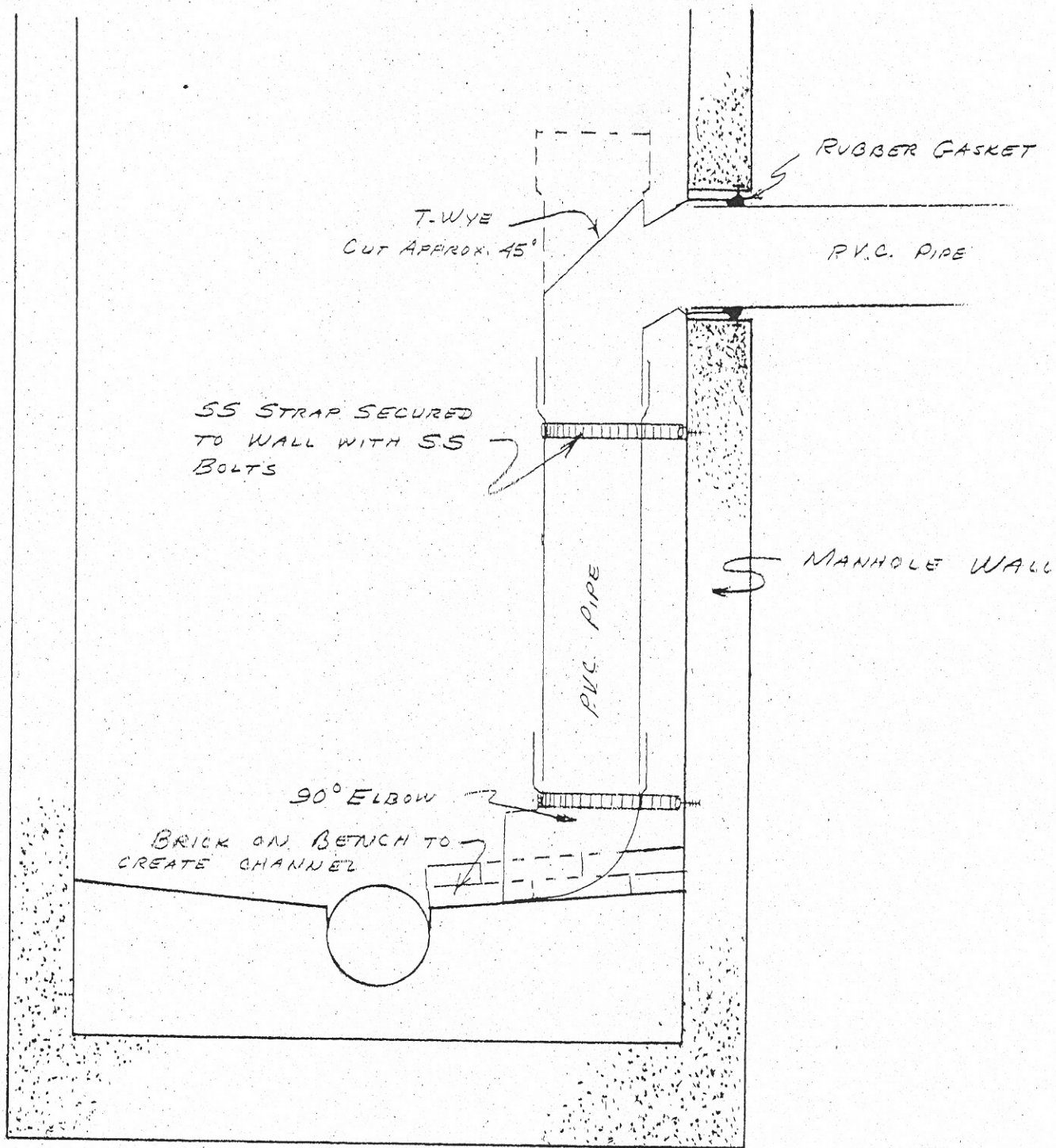


SECTION "A-A"  
SECTION THROUGH M.H.

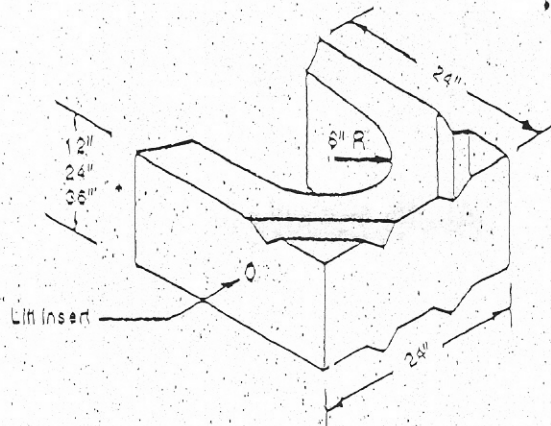


PLAN

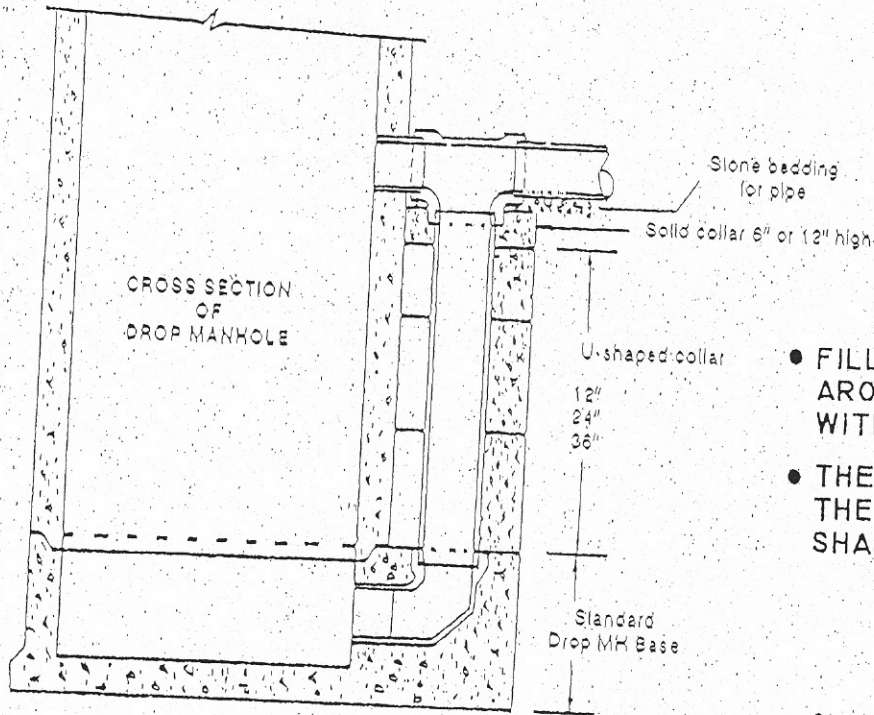
**MANHOLE CHANNELS BUILT IN PLACE**  
(N.T.S.)



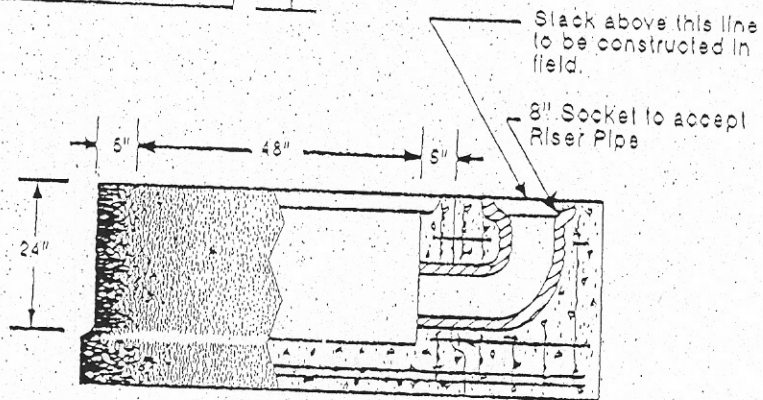
**MANHOLE INSIDE DROP CONNECTION**  
(N.T.S.)



U-SHAPED COLLAR



- FILL THE ANNULAR SPACE AROUND THE DROP PIPE WITH 3/4-INCH CLEAN STONE
- THE MAIN SEWER PIPE AND THE DROP PIPE & FITTINGS SHALL BE COMPATABLE



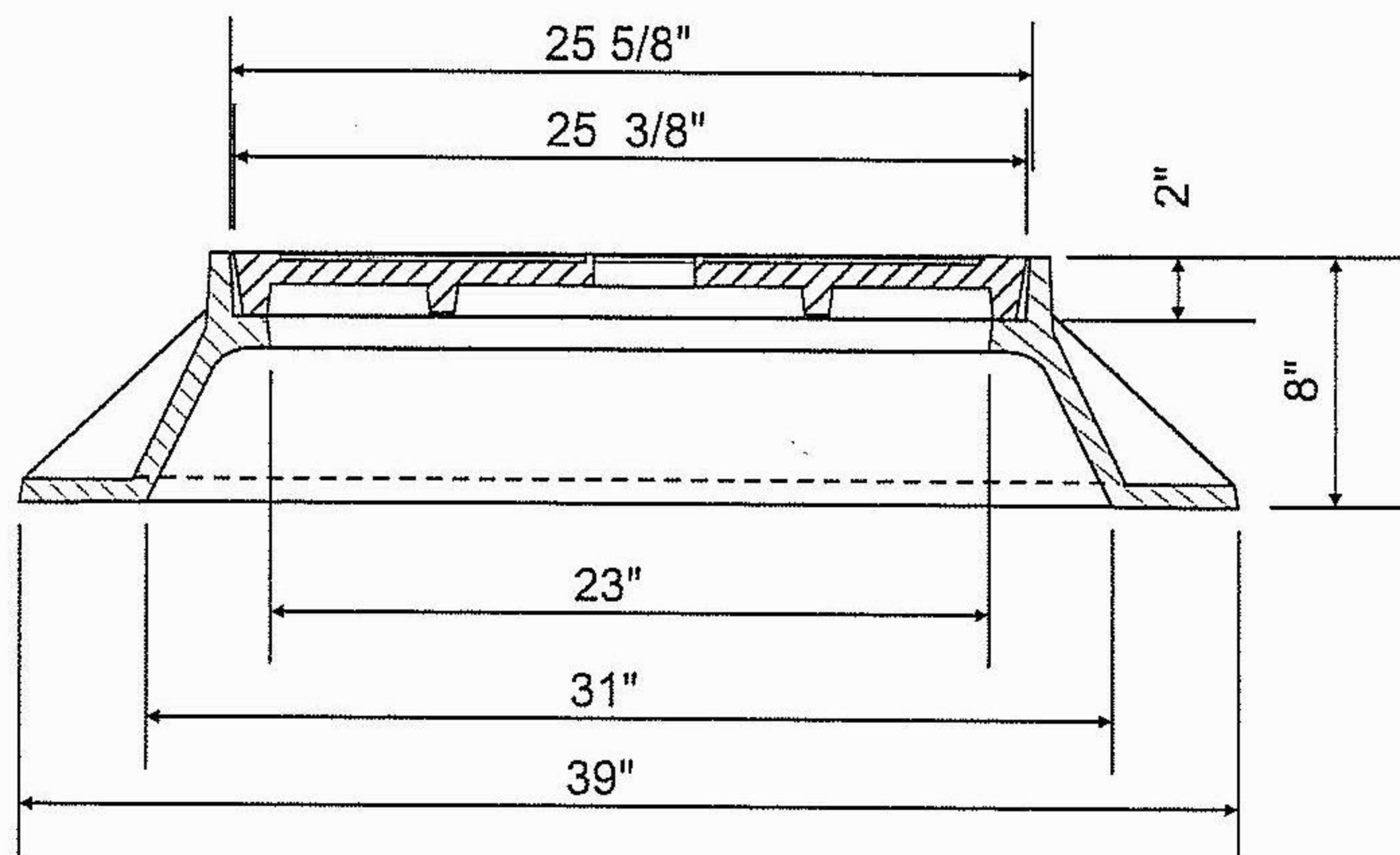
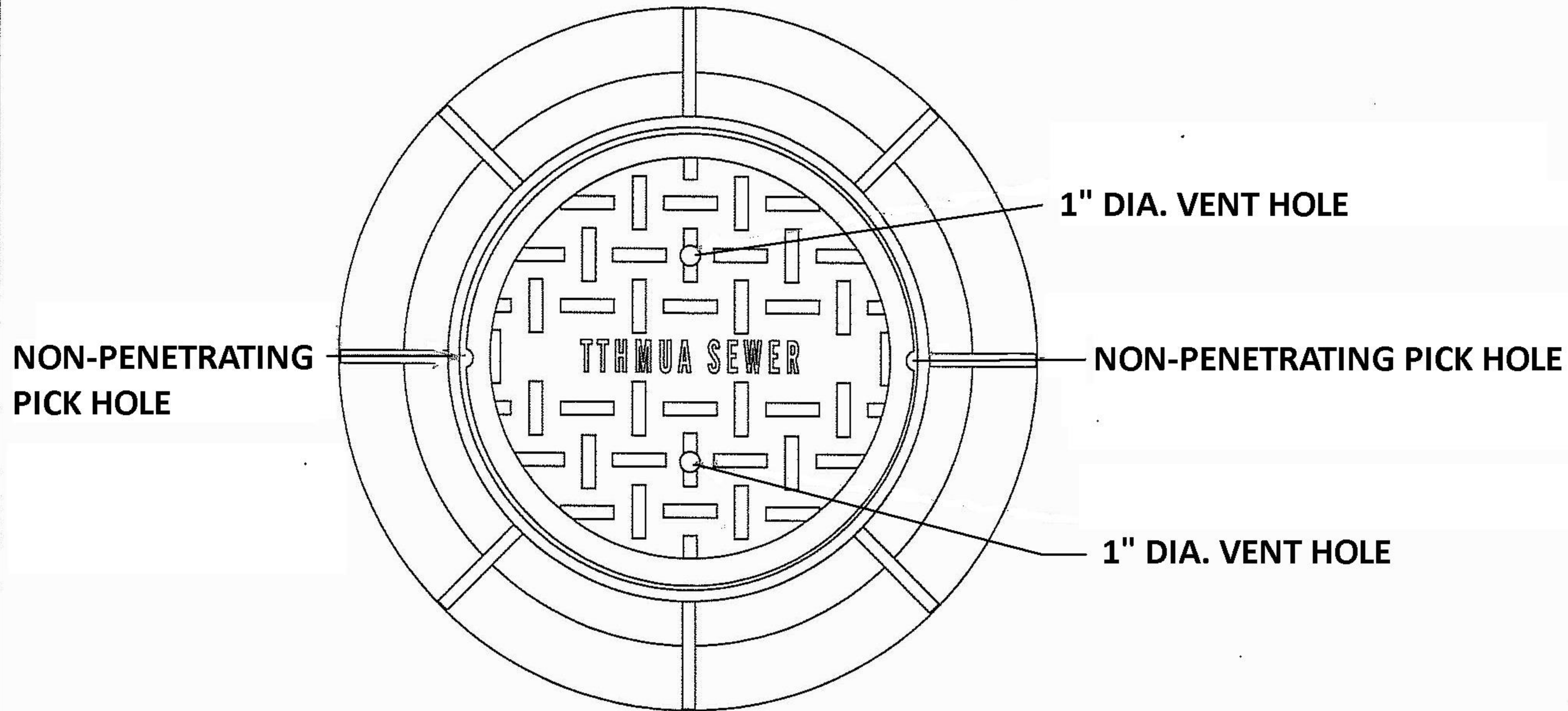
MANHOLE BASE WITH PRECAST DROP

**MANHOLE OUTSIDE DROP CONNECTION**  
(N.T.S.)

1202 B

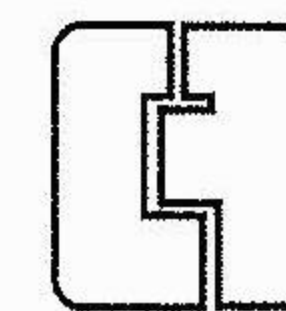
Heavy Duty Manhole Frame & Vented Cover

The Township of Hillsborough MUA  
 P.O. Box 5909  
 Hillsborough, NJ 08844



Notes:

1. Material: Gray Cast Iron, ASTM A48-83, Class 30B.
2. AASHTO HS20-44 Highway Loading;
3. Bearing surface at seat of cover and frame shall be machined for uniform fit;
- \* 4. Cover shall have two non-penetrating pick holes and two 1" diameter vent holes;
5. Castings supplied without surface coating.



**CAMPBELL FOUNDRY COMPANY**

Harrison, N.J. 07029

Phone: 973-483-5480

FAX: 973-483-1843

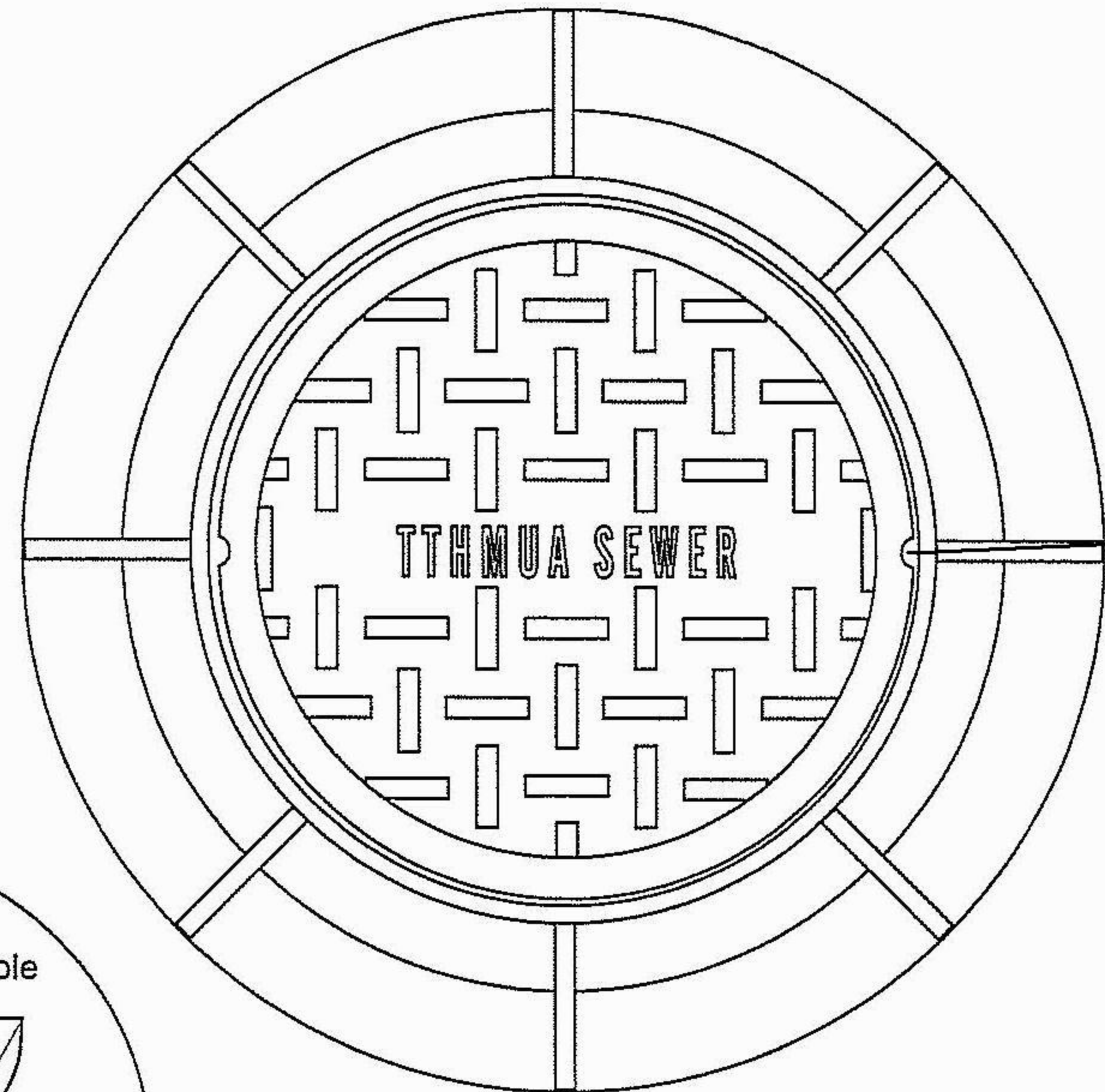
SCALE:	APPROVED BY:	DRAWN BY: D.L.
DATE: 11/26/09		REV:

Heavy Duty Manhole Frame & Vented Cover

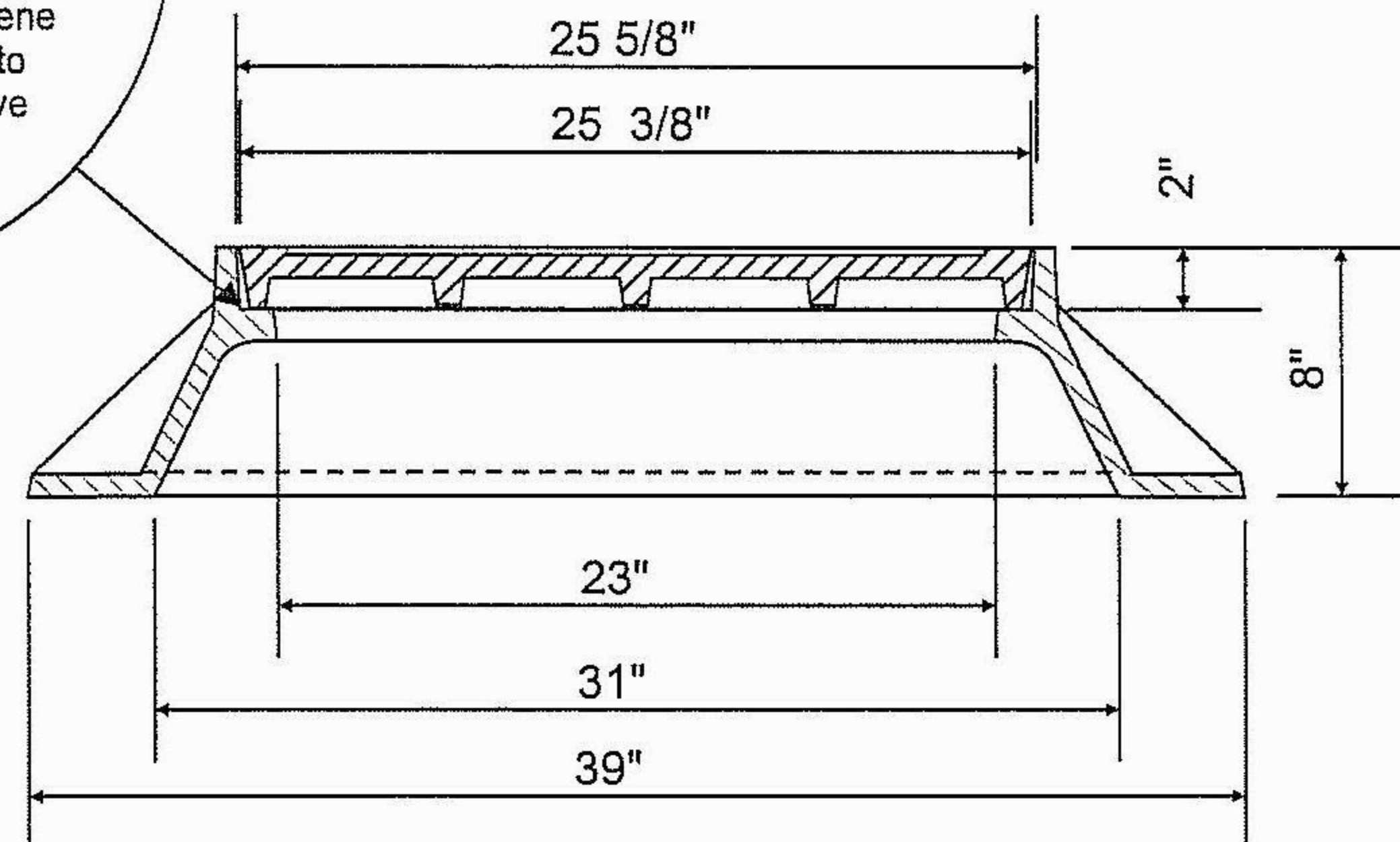
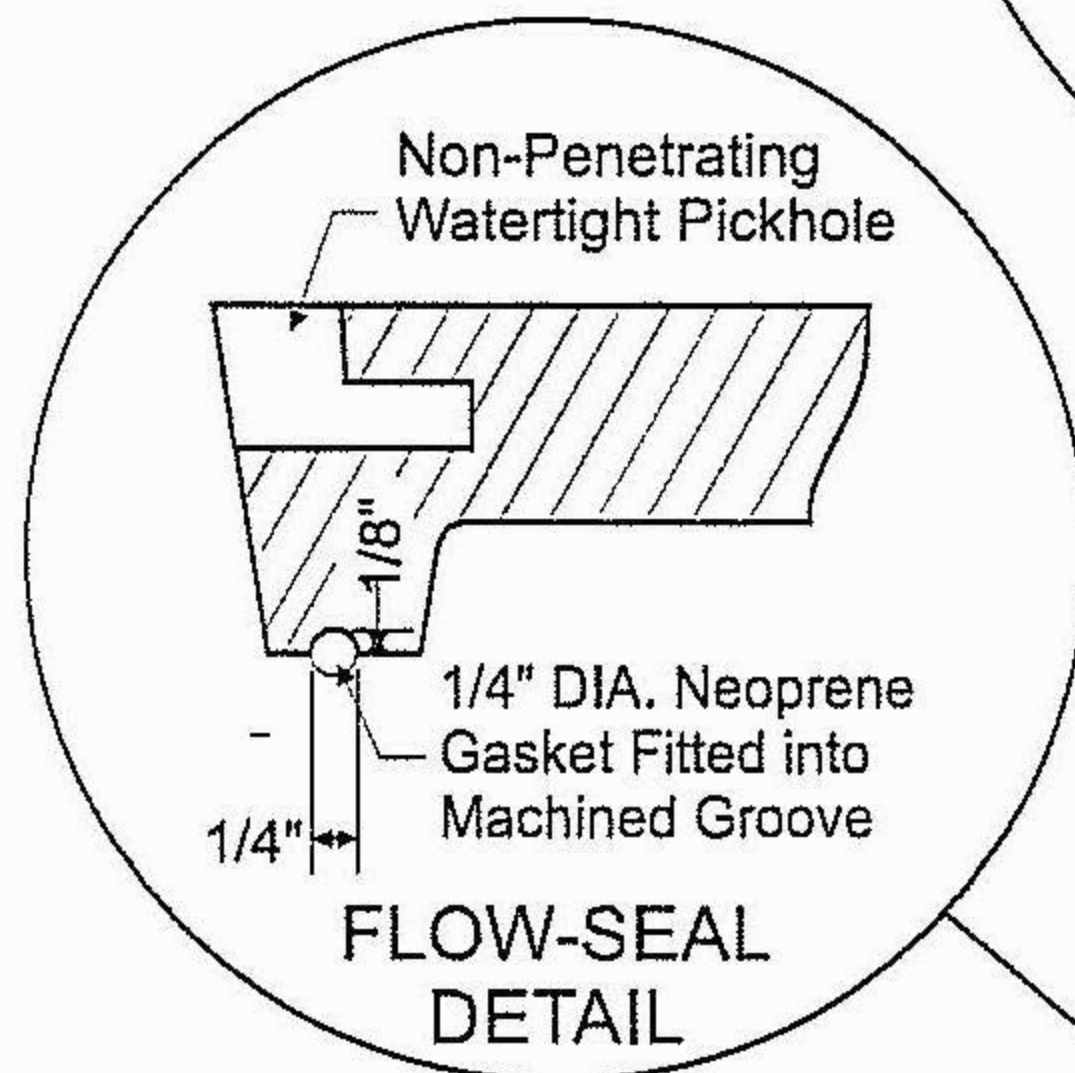
Pattern Number: 1202 B

Heavy Duty Manhole Frame and Flow-Seal Cover

The Township of Hillsborough MUA  
 P.O. Box 5909  
 Hillsborough, NJ 08844



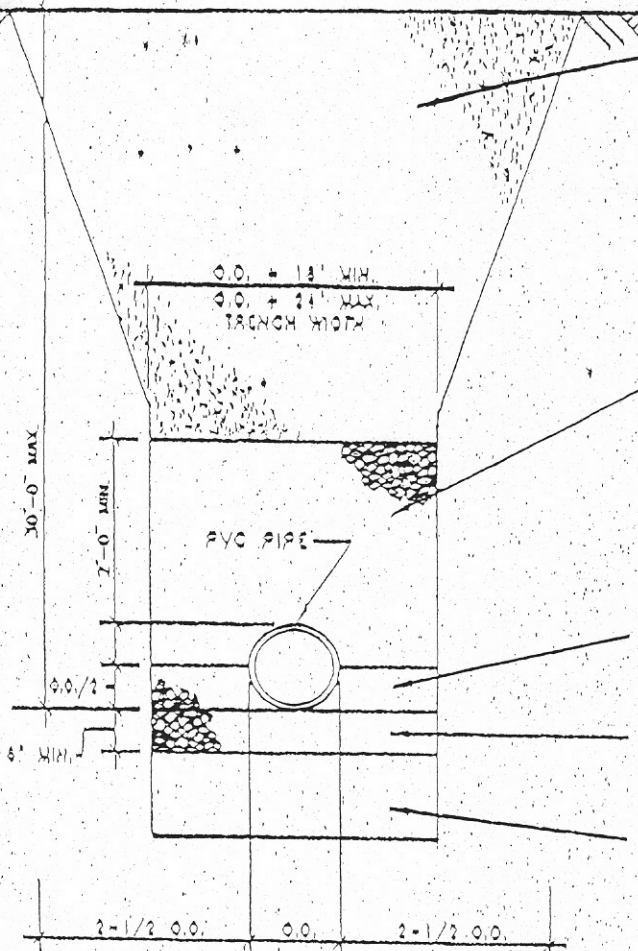
NON-PENETRATING PICK HOLE



Notes:

1. Material: Gray Cast Iron, ASTM A48-83, Class 30B;
2. AASHTO HS20-44 Highway Loading;
3. Bearing surface at seat of cover and frame shall be machined for uniform fit;
4. Cover shall be fitted with 1/4" dia. neoprene 'FLOW SEAL' gasket and have two non-penetrating pickholes for reduced inflow;
5. Castings supplied without surface coating.

 <b>CAMPBELL FOUNDRY COMPANY</b> Harrison, N.J. 07029 Phone: 973-483-5480 FAX: 973-483-1843		
DATE: 11/26/09		REV.:
Heavy Duty Manhole Frame and Flow-Seal Cover		
Pattern Number: 1202 B		



HORIZONTAL LIMITS OF COMPACTION REQUIRED FOR HAUNCHING AND BEDDING MATERIALS

FINAL BACKFILL

EASEMENTS - SUITABLE NATIVE MATERIAL OR NJDOT SOIL AGGREGATE, TYPE I-5 WHEN AUTHORIZED BY THE ENGINEER (COMPACT TO MINIMIZE SETTLEMENT)

PAVED AREAS - NJDOT SOIL AGGREGATE, TYPE I-5 (3/4-INCH ROAD STONE) (COMPACTION 95%)

INITIAL BACKFILL (HAND-PLACED)

HTMUA EASEMENTS - NJDOT SOIL AGGREGATE, TYPE I-5 (3/4-INCH ROAD STONE) OR NJDOT COARSE AGGREGATE NO. 57 (3/4-INCH CLEAN STONE)

PAVED AREAS - NJDOT SOIL AGGREGATE, TYPE I-5 (3/4-INCH ROAD STONE) OR NJDOT COARSE AGGREGATE NO. 57 (3/4-INCH CLEAN STONE)

HAUNCHING MATERIAL

NJDOT COARSE AGGREGATE NO. 57 (3/4-INCH CLEAN STONE)

BEDDING MATERIAL

NJDOT COARSE AGGREGATE NO. 57 (3/4-INCH CLEAN STONE)

FOUNDATION MATERIAL

NJDOT COARSE AGGREGATE NO. 57 (3/4-INCH CLEAN STONE) WHEN AUTHORIZED BY THE ENGINEER

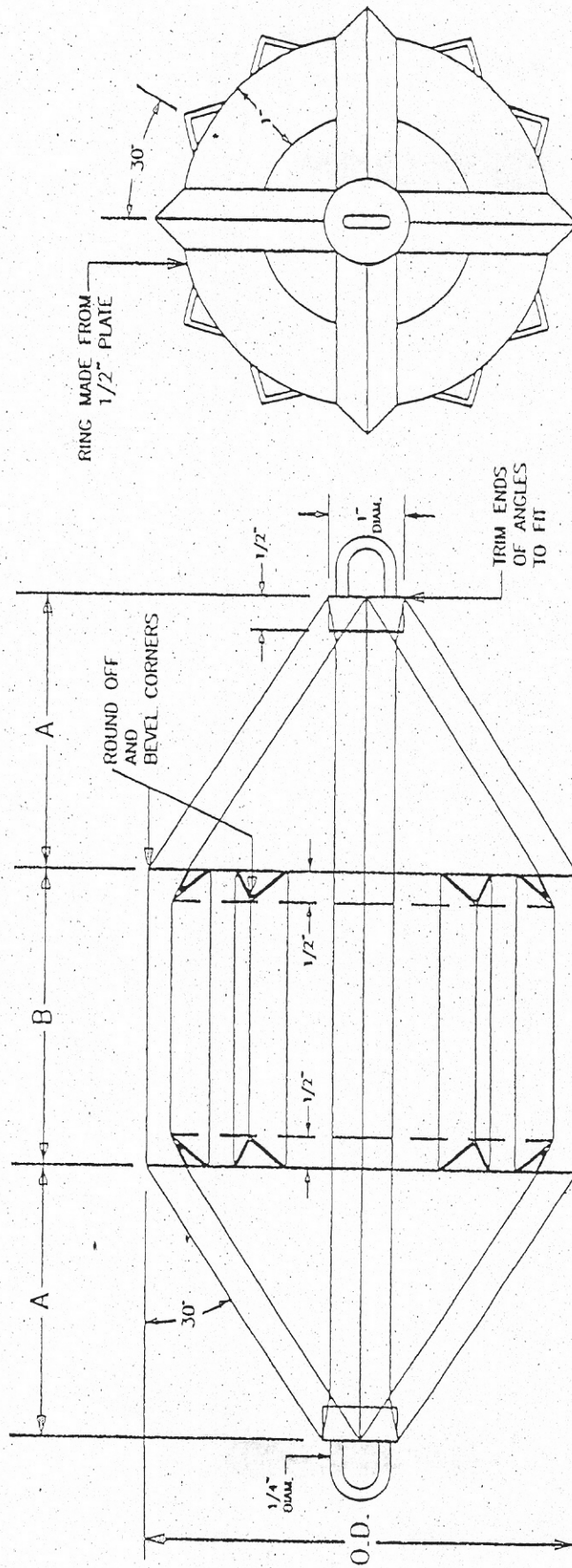
NOTE:

1) WHERE MOVABLE TRENCH SUPPORTS OR SHEETING EXTENDS BELOW THE TOP OF THE PIPE AND/OR HORIZONTALLY WITHIN 2-1/2 DIAMETERS OF THE PIPE ON EITHER SIDE, THE ENTIRE TRENCH WIDTH TO 2' OVER THE PIPE SHALL BE COMPACTED TO THE REQUIRED DENSITY AFTER REMOVAL OF ALL SUPPORTS.

2) THE MAXIMUM ALLOWABLE PIPE DEFLECTION (REDUCTION IN VERTICAL INSIDE DIAMETER) SHALL BE 5% OF THE BASE PIPE DIAMETER.

**STANDARD PIPE TRENCH DETAIL**  
(N.T.S.)

ASTM D3034/F679 PVC PIPE  
 DEFLECTION TESTING MANDREL  
 CONSTRUCTED FROM 1/2-INCH ANGLE IRON

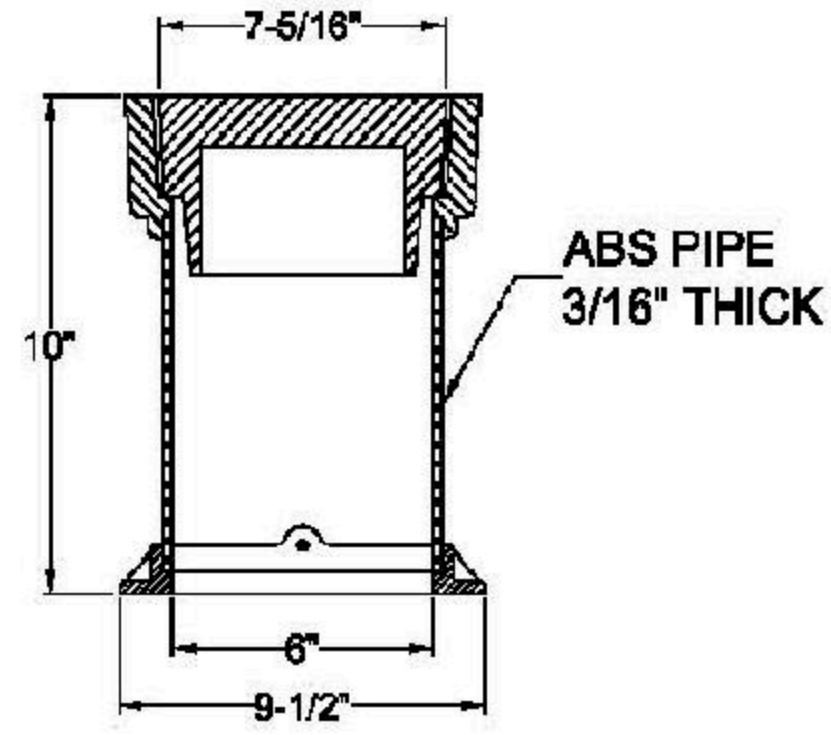
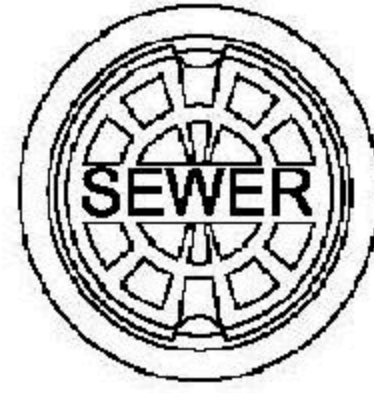


NOTE:

1. Drawing not to scale
2. Dimensions apply only to pipe manufactured in accordance with ASTM D3034 and F679
3. After welding is completed, the diameter for the full length of dimension B shall be true to a tolerance of +/-0.010"
4. The completed mandrel shall be sand blasted and coated with rust resistant paint
5. Base inside diameters have been developed for pipe manufactured in accordance with ASTM D3034 and F679

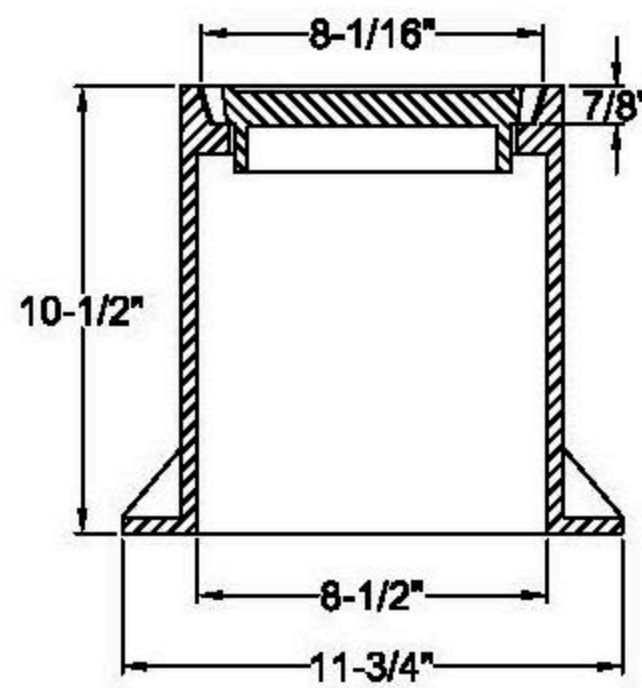
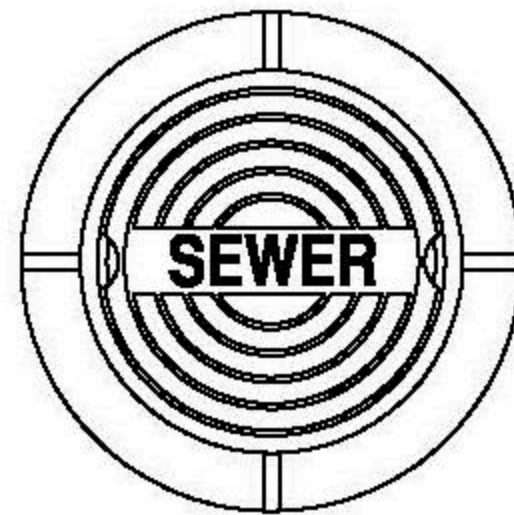
Size (inches)	A (inches)	B (inches)	Base Inside Diameter (inches)	Deflection Mandrel O.D. (inches)
8	3	6	5.742	5.45
10	4	8	7.665	7.28
12	4	10	9.563	9.00
15	5	12	11.361	10.79
18	6	15	13.898	13.20
21	7	18	16.976	16.13
24	8	24	20.004	19.00
27	9	27	22.480	21.36
			25.327	24.06





ITEM NUMBER 17101

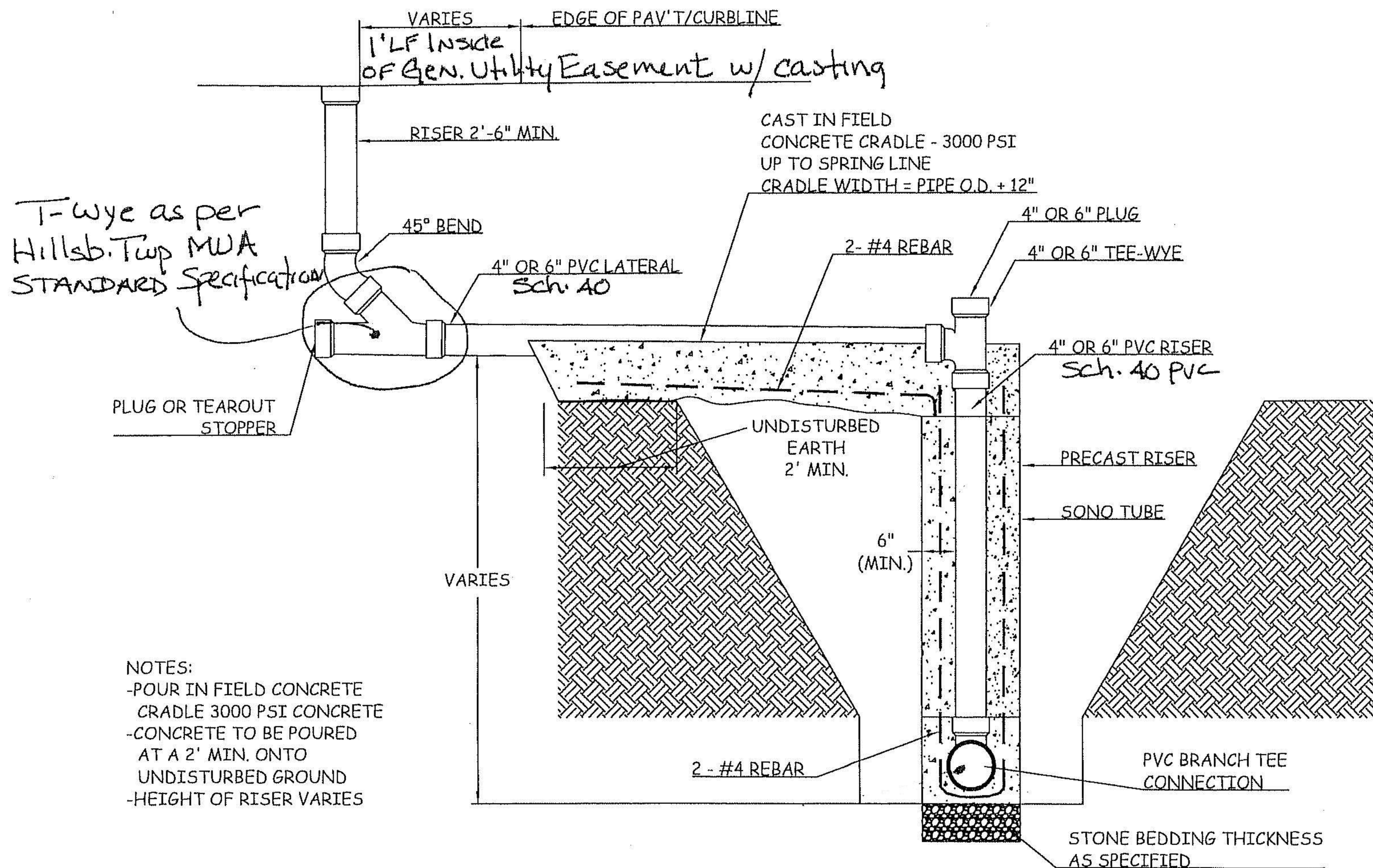
**4" CLEANOUT PROTECTION BOX IN GRASSED AREA**



ITEM NUMBER 18111

**6" CLEANOUT PROTECTION BOX IN GRASSED AREA**

GENERAL FOUNDRY INC. OR APPROVED EQUAL



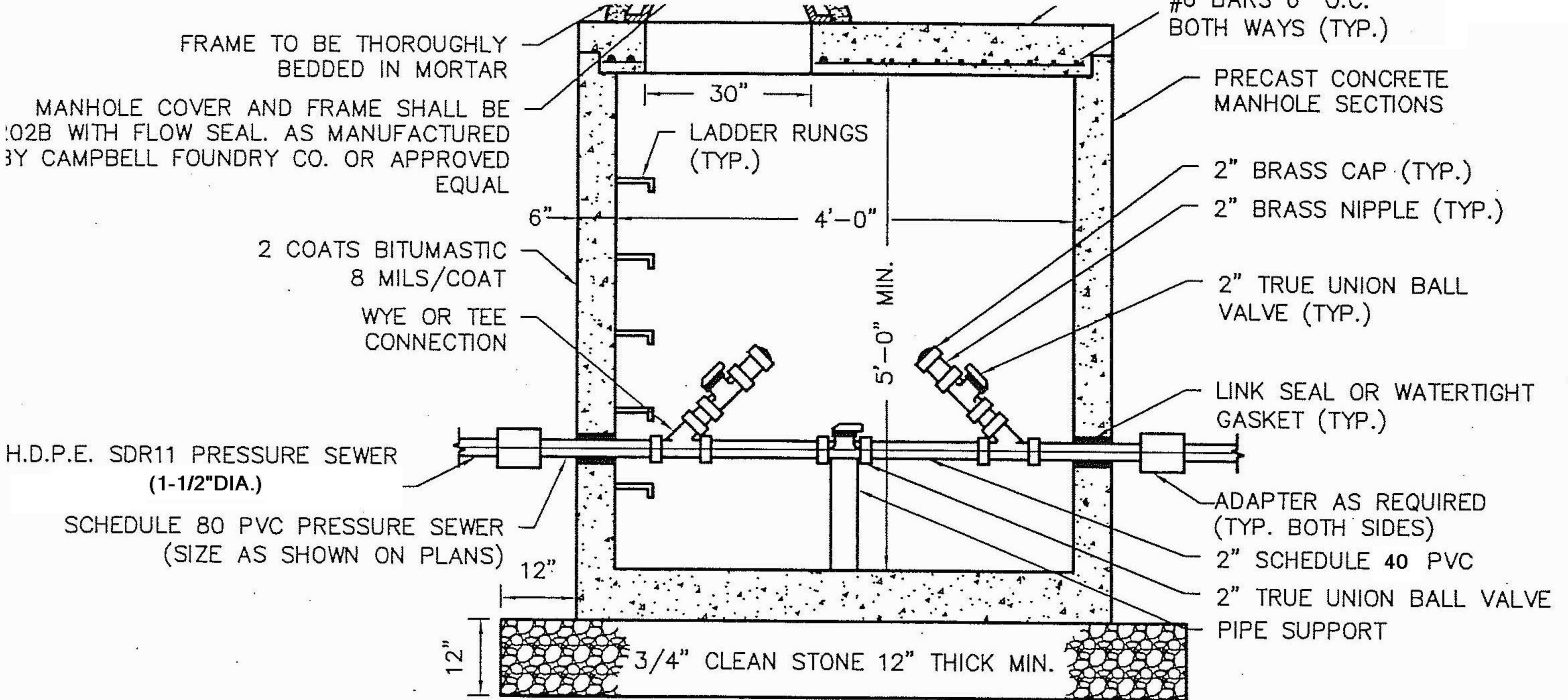
NOTES:  
 -POUR IN FIELD CONCRETE CRADLE 3000 PSI CONCRETE  
 -CONCRETE TO BE POURED AT A 2' MIN. ONTO UNDISTURBED GROUND  
 -HEIGHT OF RISER VARIES

**VERTICAL RISER CONNECTION**

**N.T.S.**

REINFORCED TOP SLAB  
TO BE DESIGNED FOR  
AASHTO H-20 LOAD    **DETAIL PLATE #15**

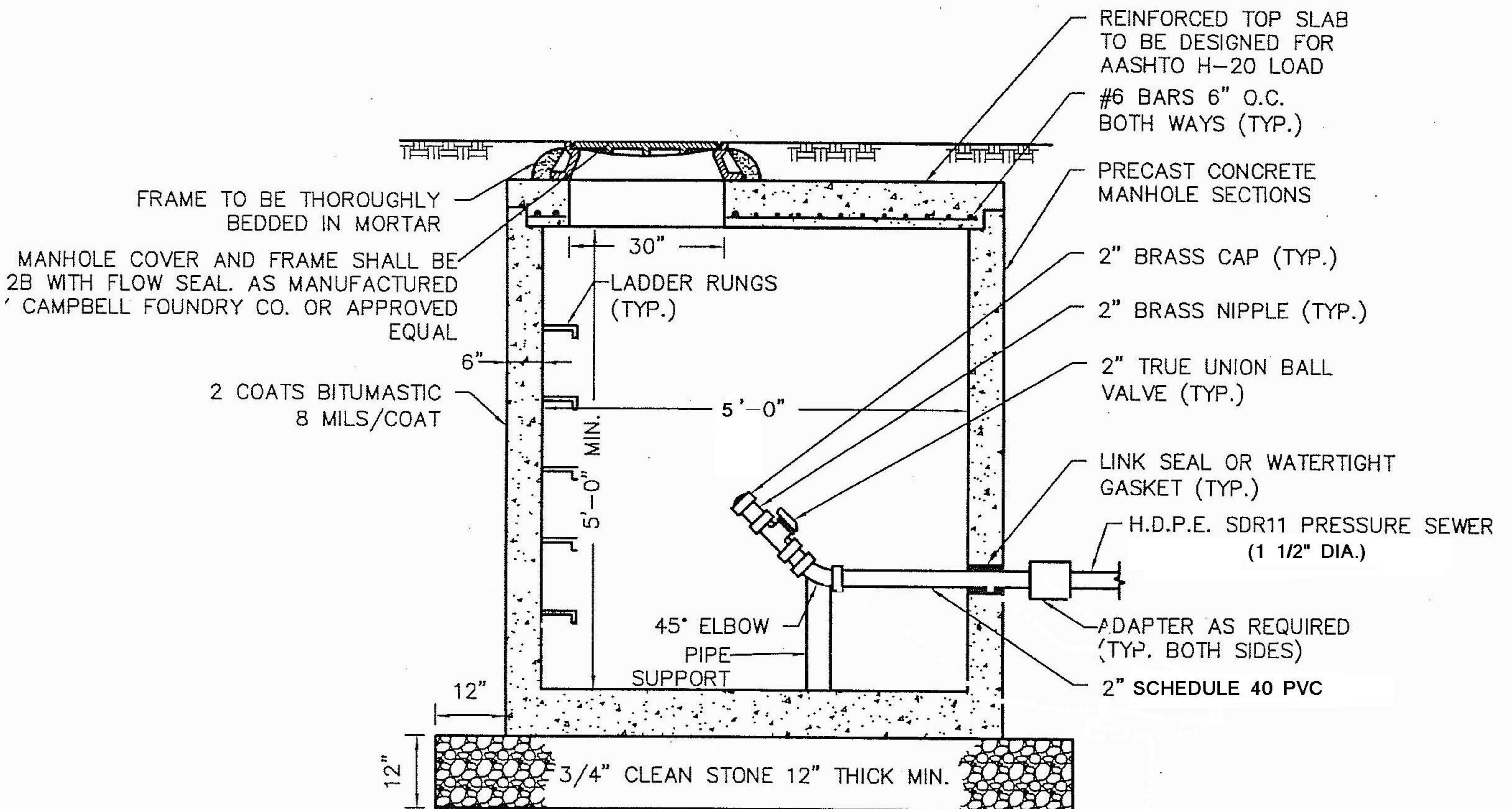
#6 BARS 6" O.C.  
BOTH WAYS (TYP.)



**NOTE:**  
BALL VALVE SHALL BE 2" AS MANUFACTURED BY HAYWARD  
OR EQUAL APPROVED BY THE M.U.A.

## IN-LINE FLUSHING CONNECTION MANHOLE DETAIL

N.T.S.



**NOTE:**  
BALL VALVE SHALL BE 2" AS MANUFACTURED BY HAYWARD  
OR EQUAL APPROVED BY THE M.U.A.

## TERMINAL FLUSHING CONNECTION MANHOLE DETAIL

N.T.S.