

TOWN OF BOONSBORO

Washington County, Maryland

SPECIFICATIONS FOR SANITARY SEWER SYSTEM CONSTRUCTION

January 2005



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Recipients of this document must keep themselves informed of any revisions which may be made to the Specifications.

FIRST EDITION – January 2005

**TOWN OF BOONSBORO
Boonsboro, Maryland**

**SPECIFICATIONS
FOR
SANITARY SEWER SYSTEM CONSTRUCTION**

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SECTION 1 - GENERAL REQUIREMENTS

A. GENERAL

1. Applicant/Owner.

All references to the "Applicant or Owner" in these specifications pertain to the individual, organization, company or developer who makes application to construct or install sewer lines, sewer systems and sewer services in the Town's sanitary sewer service areas.

2. Town's Right of Inspection.

- a. The Town shall have the right to inspect any sewer system construction being carried out by the Applicant, including the right to inspect the preparation, fabrication and manufacture of the materials to be used. The inspector shall have the authority to reject materials or suspend the work until any questions or issues can be referred to and decided by the Town. Inspectors shall perform their duties at such times and in such manner as will not unnecessarily impede progress on the Contract.
- b. The Inspector is not authorized to revoke, alter or waive any requirements of the Contract. The inspector shall in no case act as foreman or perform other duties for the Contractor nor interfere with the management of the work by the latter. Any advice which the Inspector may give the Contractor shall not be construed as binding the Town in any way or releasing the Contractor from fulfilling all the terms of the Contract.
- c. Where there is disagreement between the Contractor (or his representative) and the Inspector, the Inspector will immediately direct the Town's attention to the issues of disagreement and if the Contractor still refuses to make corrections, comply or suspend work, the Town will prepare and deliver to the Contractor a written order suspending the work and explaining the reason for such suspension. As soon as the Inspector is advised of the delivery of the suspension order, the Inspector shall immediately leave the site of the work and any work performed during the Inspector's absence will not be accepted or paid for.
- d. Should the inspected work prove to be unsatisfactory, the cost of removing and replacing, renewing and making good the unsatisfactory work shall be borne by the Applicant. No water service facility shall be placed in service until it has been successfully tested in the presence of an authorized Town representative.

3. Working Conditions.

No night, Saturday, Sunday or National Holiday work subject to Town inspection will be permitted except in cases of emergency with written Town consent or if it

is specifically outlined in the Contract. No work shall be done when, in the opinion of the Town, the weather is unsuitable.

4. Standard Specifications.

Standard specifications of societies, associations, institutes, etc., referred to in these Specifications, shall be the latest edition of such specifications unless otherwise noted.

5. Work Area Traffic Control and Maintenance.

- a. Traffic in work areas shall be controlled to protect the public and workmen, while minimizing the inconvenience to the public. Traffic control devices shall conform to the Maryland State Highway Administration (MD SHA) Temporary Traffic Control Typical Application, Standards MD 104.00 through 104.06. Traffic control measures shall be coordinated with the Town of Boonsboro.
- b. Unless authorized by the Town to completely close the road, the contractor must take the necessary measures to keep the road open for traffic, at his own expense. When vehicles must be stopped for short periods, work shall be performed during other than peak traffic periods. During progress of work, sidewalks and crossings must be kept open for pedestrians, unless otherwise authorized. Access to residential and business establishments shall be maintained, except when work is actually being performed in the area.
- c. All sidewalks, roadways and private property shall be kept clear of excessive dust, dirt, mud or other excavated material. The Town shall be empowered to require the cleaning and/or dampening of any area, if in his judgment such action is necessary for the safety and accommodation of traffic and the public. Trenches across driveways, side streets, alleys and entrances shall be maintained after backfilling.

6. Compliance with Provisions of Maryland Title 12: Underground Facilities Subtitle 1: Excavation or Demolition Near Underground Facilities.

Maryland Title 12, Subtitle 1 sets forth requirements designed to protect underground utility lines from damage during excavation. Generally, it requires that the location and type of utility lines at the work site be ascertained and detailed information from each user (utility owner or operator) be requested at least 48 hours before beginning work, excluding weekends and legal holidays. In Maryland, the organization to contact is MISS UTILITY. The telephone number is 1-800-257-7777.

7. Permits.

- a. The Applicant shall secure, in the name of the Town, all permits that are required from the Maryland Department of the Environment (MDE), Maryland State Highway Administration, and Washington County. The Applicant shall secure, in his own name, all required construction permits such as local street opening permits. Any existing street, highway or other improvements disturbed

during construction shall be restored to the satisfaction of the Town before the facilities will be accepted for final acceptance by the Town. All costs of such permits, including any and all bonds required, shall be the sole expense of the Applicant.

- b. The Applicant shall acquire all necessary permits for blasting and for special equipment. Any provisions in these permits shall supersede the above provisions.
- c. Approval by the Town inspector of all or part of any work performed under permit issued by an independent agency, shall not constitute acknowledgement that the work was performed in accordance with such permit; nor shall such approval by the inspector be construed as a release of the applicant from his obligations to meet the requirements of the permit, or that such approval be a waiver of the Town's right to seek enforcement from the permitting agency.

8. Special Requirements.

- a. All sewer lines shall be extended to the furthest property lines or corners of the development under consideration. The exception shall be where lines cannot be further extended at the sole discretion of the Town. The size and location of the sewer mains, pumping stations, treatment facilities, valves and other appurtenances shall be determined or approved by the Town's Engineer so as to comply with the Town's long-range facilities planning.
- b. All sewer mains to be dedicated to the Town shall have a 30' right-of-way.
- c. Gas utility mains shall be shown on water and sewer plan and profile sheets during the design phase of the project for Town approval prior to construction.
- d. Construction of sewers and appurtenances shall conform to the requirements of the Occupational Safety and Health Act (OSHA).
- e. All equipment used on roadways shall be equipped with rubber tires or treads. If other than rubber tires or treads are used, the pavement shall be protected by heavy rubber belting. If pavement, curb and/or sidewalk is damaged or marked by construction equipment, the areas shall be restored at no cost to the Town.
- f. Backfill material shall not be removed from the lines of work before the excavation is refilled, except with Town approval.
- g. The work shall be protected from damage during storms.
- h. A competent person shall be identified and made available within 2 hours in case emergency situations arise during non-working hours.
- i. The local Police and Fire Departments shall be informed of the work schedule and of possible street obstructions.

- j. Blasting for excavation shall be permitted only after securing approval(s) and establishing the hours of blasting. The blasting procedure, including protection of persons and property, shall be in strict accordance with federal, state and local regulations.

END OF SECTION

SECTION 2 - SERVICE LINES

A. GENERAL

1. Each Improved Property shall have its own individual service line. A service line consists of all piping, pumps and other appurtenances between the house or building to the receiving end of the Town's sewer lateral. Each side of a double house having a solid vertical partition wall shall be considered a separate property requiring individual sewer connections.

Where premises in single ownership consist of more than one building, the Town reserves the right to determine, under the circumstances of each case, whether each separate building must have its individual sewer connection or whether all buildings together may use a single connection.

For non-residential connections the Town may require a wastewater flow meter and/or monitoring manhole to be installed for billing purposes.

2. Maintenance and Repair of Service Lines.

All service lines shall be maintained and repaired by the Owner at the cost of the Owner of the improved property. Such repairs shall be subject to the approval and inspection of the Town.

3. Existing Service Lines.

Existing service lines may be utilized providing they have been inspected by the Town and found to be reasonably true to grade and alignment, in good condition for the purpose of conveying sanitary sewage or industrial wastes, and have tight joints of approved materials. The integrity of the existing line shall be determined by performing the air test described herein. If the existing line does not conform to these requirements, the line shall be corrected or a new line shall be laid at the expense of the Owner in accordance with the specifications contained herein. All testing required by the Town shall be at the expense of the Owner.

4. Supervision and Inspection.

The construction of service lines shall at all times be subject to the supervision and inspection by the Town or its duly authorized representative and shall conform to the Town's specifications. No owner shall permit service connections to be covered or backfilled until authorized by the Town to do so.

5. Basements.

The Town will not be responsible for any damage that may result from basements being flooded by a blockage in the service line. Basement floor drains and sump pumps that collect groundwater or surface water shall not be connected to the sewer system.

B. DESIGN

1. Minimum Grade.

All service lines shall be installed with a minimum grade of two percent. Pipes will be laid in straight lines.

2. Minimum Cover.

A minimum cover of three feet six inches over the top of the pipe shall be maintained to prevent crushing and freezing and to ensure sufficient clearance for water line conflicts, unless the Town's Engineer approves a lesser minimum cover. Minimum cover in drives, parking areas, and streets shall be four feet.

3. Cleanouts.

- a. Cleanouts shall be installed at maximum intervals of 50 feet in the service line and at changes of direction of 45-degrees or greater to permit complete rodding of the service line.
- b. Cleanouts shall be provided inside the building where the pipe enters the building and outside the building at the base of the vent stack at the beginning of the service line.
- c. Cleanouts shall extend 6 inches above final grade.

4. Pipes.

The internal diameter of the pipe shall be a minimum of 4 inches for residential applications and 6 inches for commercial applications. Ductile iron or PVC (SDR-26) piping are permissible for service line installation. Pipes for low pressure service line force mains shall comply with the requirements specified in Section 7 – Low Pressure Sewers.

C. MATERIALS AND EQUIPMENT

(References to ASTM, AWWA and ANSI Specifications imply Latest Edition.)

1. Ductile Iron Pipe and Fittings.

a. Ductile Iron Pipe.

- (1) Ductile iron pipe shall conform to AWWA C151 and ASTM A746. Pipe shall be supplied in standard lengths as much as possible with laying lengths of either 18 ft or 20 ft nominal lengths. Pipe shall be manufactured by Griffin Pipe Products Co. or approved equal.

(2) Ductile iron pipe and fittings for use in gravity sewers, service lines, and force mains shall be lined with either Protecto 401 ceramic-filled amine cured epoxy or SewerCoat calcium aluminate mortar as manufactured by Lafarge Calcium Aluminates, or approved equal. These linings shall be applied in accordance with the manufacturer's recommendations.

b. Joints.

Joints shall be rubber-gasket push-on type or rubber-gasket mechanical joint type conforming to AWWA C111. Gasket shall be of SBR. Ductile iron for use as restrained joint shall be mechanical joint pipe using Uni-Flange joint restraining glands or approved equal.

c. Minimum Thickness.

Thickness design shall be per AWWA C150, Class 52.

2. Polyvinyl Chloride Pipe and Fittings.

a. Polyvinyl Chloride Pipe.

Polyvinyl chloride (PVC) sewer pipe and fittings shall be PVC SDR 26 with full diameter dimensions and shall conform to ASTM D3034 and UNI-Bell UNI-B4. Pipe shall be manufactured by J.M. Manufacturing Co. or approved equal.

b. Joints.

PVC pipe and fittings shall have bell and spigot push-on joints. The bell shall consist of an integral wall section with a solid cross-section elastomeric gasket (as manufactured by J.M. Manufacturing Co. or approved equal) securely locked in place to prevent displacement during assembly. Installation of elastomeric gasketed joints and performance of the joint shall conform to ASTM F477, ASTM D3139, ASTM D3212 or UNI-B-1. No solvent cement joints will be permitted in field construction, except as specifically authorized by the Town.

c. All fittings and accessories for sewers shall have bell and/or spigot configurations compatible with the pipe.

d. Certifications of compliance of the above specifications shall be required from the manufacturer before acceptance of delivery or award of contract.

3. Flexible Coupling.

a. Flexible couplings composed of elastomeric PVC shall conform to ASTM C443, C425, C564 and D1869 as manufactured by Fernco, Inc.

b. Each coupling shall be supplied with two Type 305 stainless steel adjustable clamps.

4. Cleanouts.

- a. The cast iron cleanout adapter shall have a heavy-duty design, suitable for use in light traffic areas. All castings shall be tough and of even-grain, free of gas holes and flaws. All parts of the castings shall be thoroughly coated at the factory with one coat of black asphaltum paint. The castings shall have a grooved retainer ring for installation of a single-piece gasket. The joint, properly fitted, shall produce a flexible and watertight connection.
- b. The brass plug shall be cast of first line brass threaded to fit the cast adapter. The plug shall have a counter-sunk head. The cast iron cleanout adapter and brass plug shall be as manufactured by Jones Manufacturing Co. or approved equal.

D. INSTALLATION

1. Excavation.

The trench shall be excavated to a depth of six inches below the outside diameter of the pipe barrel, or deeper if so specified. The excavation may be done by machine. The resultant subgrade shall be undisturbed, or compacted as approved by the Engineer if disturbed.

2. Backfilling.

- a. Service line trenches shall be backfilled, from the bottom of the trench to the centerline of the pipe with sand or AASHTO No. 7 stone and placed in layers of 3 inches (uncompacted thickness) and compacted by tamping. Backfilling material shall be deposited in the trench for its full width on each side of the pipe and fittings simultaneously.
- b. From the centerline of the pipe and fittings to a depth of one foot above the top of the pipe, the trench shall be backfilled by hand or by approved mechanical methods. The Contractor shall use special care in placing this portion of the backfill so as to avoid damaging or moving the pipe. The backfill shall be placed in 8-inch layers (uncompacted thickness) and compacted by tamping. Backfill in this section of the trench shall be with sand or AASHTO No. 7 stone.
- c. No trench shall be backfilled until the service line has been inspected and approved by the Town or its representative.

3. Water in Trenches.

Trenches shall be dewatered prior to laying pipes. Ground and surface water in trenches shall not be permitted to enter the sewerage system.

4. Restoration.
 - a. All street, road, or highway surfaces which are disturbed or damaged during installation of the service lines shall be properly repaired at the Owner's cost.
 - b. Subsequent settlement of the street, road or highway surface resulting from improper compaction of the service line trench or failure to protect the lateral line trench shall be promptly repaired at the Owner's cost.
 - c. Town may require televising and air testing of lines in settled areas to confirm the absence of sags or damage to the sewer pipe.
5. Connections to Sewer Laterals.
 - a. Where the service line and the sewer lateral are both of the same size pipe, connections shall be made by properly joining the bell or spigot end of the service line with the lateral sewer.
 - b. If the service line and sewer lateral are of unlike materials, the connection may be made with a Fernco flexible coupling with stainless steel clamps suitable for the type and size of pipe to be connected. Projecting the smaller pipe into the larger pipe and sealing with grout or mastic will under no circumstances be permitted.
 - c. All connections to sewers shall be made at the terminus of the sewer lateral unless the Town specifically authorizes otherwise.
 - d. Whenever no sewer lateral has previously been constructed the construction of the sewer lateral and the connection of the sewer lateral to the sewer main shall be as described in Section 3 of these specifications.
6. Special Conditions and Requirements.
 - a. Where the service line is to be placed under a drive or other roadway and the depth is less than four feet, the line shall be encased in concrete or flowable fill to 6-inches above the top of the pipe, or as the Town may direct.
 - b. At the entry of the service line into the building a protective ductile iron or steel sleeve shall be provided through the wall of the building. The sleeve shall span across the excavated area outside the wall and at least two feet of the end of the sleeve shall rest on virgin soil. The sewer pipe shall be threaded through the sleeve and the annular space at both ends of the sleeve sealed with non-corrosive silicon based flexible sealant.
 - c. No hotel, restaurant, boarding house, or public eating place shall connect to the sewer system without first installing grease traps, of a type and size approved by the Town or its representative and a flow monitoring manhole, in the service line at locations approved by the Town or its representative.

- d. No service station, garage, factory building, or commercial establishment which handles oils, petroleum or similar products, or which washes cars, trucks, or other types of machinery, shall connect to the sewer system without first installing grease and sand traps of sizes and types approved by the Town or its representative, and a flow monitoring manhole, in the service line or at a locations approved by the Town or its representative.

E. TESTING

1. Each service line shall be subjected to a test prior to approval by the Town. The test shall be witnessed by an agent of the Town and the service line shall not be deemed acceptable until said service line has satisfactorily passed the test hereinafter described. All costs of testing and any subsequent test(s), including equipment, material, or labor required shall be the responsibility of the Owner.
2. The service line shall be tested by plugging the line at the point of the new connection with the Town's system by the use of a "test tee" and by plugging the line just before the point of connection with the building sewer. All risers, vents, plugs, and cleanouts should be adequately blocked, plugged or supported to withstand the pressure associated with the test. The test shall be an air test and shall be designed to provide a residual pressure of 5 psi above the level of the surrounding ground water level throughout the length of the service line.
3. The air test shall be made by attaching an air compressor testing apparatus to any suitable opening and after closing and supporting all other inlets and outlets to the service line, forcing air into the service line until there is a uniform gauge pressure of 5 psi above the level of the surrounding ground water level. The service line shall be deemed acceptable if this pressure is maintained for 15 minutes without the introduction of additional air.
4. Care must be taken that the pressures generated by the air testing equipment do not exceed the pipe manufacturer's recommendations.

F. DETAIL DRAWINGS

Relevant detail drawings are:

<u>No.</u>	<u>Description</u>
9	Typical Gravity Service Connection

END OF SECTION

SECTION 3 - SANITARY SEWER LATERALS

A. GENERAL

1. A sanitary sewer lateral is that section of a sanitary sewer that extends from the main sewer to the property line, curb line or right-of-way line of the property which it serves.
2. All sanitary sewer laterals constructed within the service area of the Town of Boonsboro shall meet the requirements of this specification.

B. DESIGN

1. Sewer laterals shall be installed with a minimum cover of 5 feet at any point along its entire length. Laterals shall be minimum 6-inch diameter, and shall be installed to serve all lots. Laterals shall be installed with a minimum 2% slope to the edge of the right-of-way or a point two feet beyond the sidewalk or proposed sidewalk, or ten feet beyond the curb line or edge of street, whichever is greater, and shall include a removable watertight cap or stopper. All lateral wyes shall be set in accordance with the detail drawings contained herein using 6-inch bends. The invert elevation of the 6-inch service lateral at the 45° bend shall be the same as the elevation of the crown of the main.
2. Fittings (wye branches, risers and bends) and sewer lateral pipe shall be furnished and installed in strict accordance with these specifications, and any and all practices and precautions required for the main gravity sewers specified in Section 3 of these specifications are equally applicable to the sewer laterals.
3. Laterals shall be installed at least 10 feet away from, measured horizontally, and 18 inches below, measured vertically, existing water mains. If these minimum distances cannot be achieved, alternative methods for protecting the water mains, as approved by the Town, shall be used.
4. Sewer laterals shall not be connected to manholes unless approved by the Town.
5. A cleanout shall be installed at the property line on each lateral and extend 6 inches above finished grade.

C. MATERIALS AND EQUIPMENT

(References to ASTM, AWWA and ANSI Specifications imply Latest Edition.)

1. Ductile Iron Pipe and Fittings.

a. Ductile Iron Pipe.

- (1) Ductile iron pipe shall conform to AWWA C151 and ASTM A746. Pipe shall be supplied in standard lengths as much as possible with laying lengths of either 18 ft or 20 ft nominal lengths. Pipe shall be manufactured by Griffin Pipe Products Co. or approved equal.
- (2) Ductile iron pipe and fittings for use in gravity sewers, service lines, and force mains shall be lined with either Protecto 401 ceramic-filled amine cured epoxy or SewerCoat calcium aluminate mortar as manufactured by Lafarge Calcium Aluminates, or approved equal. These linings shall be applied in accordance with the manufacturer's recommendations.

b. Joints.

Joints shall be rubber-gasket push-on type or rubber-gasket mechanical joint type conforming to AWWA C111. Gasket shall be of SBR. Ductile iron for use as restrained joint shall be mechanical joint pipe using Uni-Flange joint restraining glands.

c. Minimum Thickness.

Thickness design shall be per AWWA C150, Class 52.

2. Polyvinyl Chloride Pipe and Fittings.

a. Polyvinyl Chloride Pipe.

Polyvinyl chloride (PVC) sewer pipe and fittings shall be PVC SDR 26 with full diameter dimensions and shall conform to ASTM D3034 and UNI-Bell UNI-B4. Pipe shall be manufactured by J.M. Manufacturing Co. or approved equal.

b. Joints.

PVC pipe and fittings shall have bell and spigot push-on joints. The bell shall consist of an integral wall section with a solid cross-section elastomeric gasket (as manufactured by J.M. Manufacturing Co. or approved equal) securely locked in place to prevent displacement during assembly. Installation of elastomeric gasketed joints and performance of the joint shall conform to ASTM F477, ASTM D3139, ASTM D3212 or UNI-B-1. No solvent cement joints will be permitted in field construction, except as specifically authorized by the Town.

- c. All fittings and accessories for sewers shall have bell and/or spigot configurations compatible with the pipe.
- d. Certifications of compliance of the above specifications shall be required from the manufacturer before acceptance of delivery or award of contract.

3. Alternative Gravity Sewer Pipe Materials.

Alternative gravity sewer pipe materials may be considered and will be subject to approval by the Town on a case-by-case basis. Full details of alternatives must be submitted.

4. Cleanouts.

- a. The cast iron cleanout adapter shall have a heavy-duty design, suitable for use in light traffic areas. All castings shall be tough and of even-grain, free of gas holes and flaws. All parts of the castings shall be thoroughly coated at the factory with one coat of black asphaltum paint. The castings shall have a grooved retainer ring for installation of a single-piece gasket. The joint, properly fitted, shall produce a flexible and watertight connection.
- b. The brass plug shall be cast of first line brass threaded to fit the cast adapter. The plug shall have a counter-sunk head. The cast iron cleanout adapter and brass plug shall be as manufactured by Jones Manufacturing Co. or approved equal.

5. Wyes for Connection to Main Line.

Wyes shall conform to the pipe material specifications above.

6. Sewer Saddles

Ductile iron sewer saddles shall be manufactured of ductile iron meeting ASTM 536 grade 65-45-12. Ductile iron body shall be coated with corrosion resistant paint. Saddle straps shall be manufactured of stainless steel per ASTM A240 Type 304, 3 1/2" wide. Hose clamp shall be stainless steel. Bolts shall be stainless steel per ASTM A193 type 304 1/2" N.C. rolled thread Teflon coated. Nuts shall be stainless steel per ASTM A204 Type 304. Saddle gasket shall be virgin SBR per ASTM D2000 MBA 710, compounded for water and sewer service. Saddles shall be available with 4" and 6" outlets designed to accept PVC through clay as required. The gasket shall be able to conform itself to the existing pipe and provide a positive seal against infiltration. In sizes above 24", a gasket shall be provided in addition to the standard gasket to accomplish an adequate seal. Straps shall be available in three (3) sizes, dependent upon specific requirements to accommodate pipe diameters from 6" through 27". Saddle shall be similar to Romac Industries Style C.B. or approved equal.

D. INSTALLATION

1. General.

- a. Trench excavation, in any material, shall extend for four (4) feet beyond the end of the lateral for the full depth of the lateral. If the lateral is intended to be used at a later date, then prior to backfilling, a minimum 2-inch x 4-inch treated lumber locator marker shall be placed against the end of each lateral and shall extend a minimum of 12 inches above the ground.
- b. Where no wye branch is present in an existing sewer line, lateral connections shall be made with a saddle type connection. The hole for this saddle must be cut into the existing line with extreme care. The cut-out piece is not to be dropped into the pipe. It should be kept for inspection by the Town. The center of the saddle shall be located at a 45-degree angle from the crown of the main. A PVC reducer is required to connect to a low pressure main. Installation of the saddle shall be in accordance with the manufacturer's instructions. All connections to existing sewers must be witnessed and approved by a Town representative.

2. Excavation.

- a. The trench shall be excavated to a depth of six inches below the outside diameter of the pipe barrel, or deeper if so specified. The width of the trench shall be as shown on the detail drawings. All of this excavation may be done by machine. The resultant subgrade shall be undisturbed, or compacted as approved by the Engineer if disturbed.
- b. When the pipe is to be laid in fill, bring the fill to two feet above the elevation of the top of pipe to be laid before excavation commences. Compact the fill to 95% of the maximum density as determined by ASTM D1557-70 or AASHTO T-180, Method D (Modified Proctor). The bottom of the trench shall be compacted to 95% of maximum density prior to installation of the pipe bedding.

3. Bedding.

- a. The pipe shall be bedded on 6 inches of AASHTO No. 7 stone, the full width of the trench, and shall be covered with AASHTO No. 7 stone to a height of 12 inches over the top of the pipe.
- b. The bedding shall be thoroughly compacted to 95% of maximum Proctor density. The bedding shall provide uniform and continuous bearing and support for the pipe at every point between the bells.
- c. Unstable Subgrade.

Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, any type of refuse, vegetable, or other organic material, or large pieces or fragments of inorganic material, which, in the opinion of the

Town, should be removed, the Applicant shall excavate and remove such unsuitable material to the width and depth recommended by the Town. Before pipe is laid, the subgrade shall be formed by backfilling with AASHTO No. 7 stone in 3-inch layers thoroughly compacted to 95% of maximum Proctor density and the bedding prepared as hereinbefore specified.

d. Special Foundations.

Where the bottom of the trench at the subgrade is found to consist of material which is unstable to such a degree that, in the opinion of the Town, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, a suitable foundation for the pipe shall be designed and submitted to the Town for approval.

e. Concrete Encasement.

(1) Pipes to be encased in concrete shall have minimum six inches of concrete above and below the pipe and the concrete shall be extended for the full width of the natural trench. No formwork to limit the concrete width shall be used. Two flexible pipe joints shall be provided in the pipe at a distance of three times the pipe diameter from each end of the concrete encasement, to provide pipe articulation.

(2) Pipe shall be protected against floatation during placement of concrete encasement and may require two stage concrete placement with anchor straps.

4. Laying Pipe.

a. General.

Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA C600. PVC pipe and fittings shall be installed in accordance with the requirements of the manufacturer and ASTM D2321. All pipes shall be laid to a uniform line and grade, bell ends upgrade, with a firm and even bearing along the barrel of the pipe. The spigot end of the pipe is to be centered in, shoved tight and secured against, the bell of the previously laid pipe. The interior of each pipe shall be cleaned of all excess joint and foreign material before the next pipe is laid. Pipe-laying shall commence at the lowest point and proceed upgrade. At the close of each day's work, and at such other times when pipe is not being laid, the open end of the pipe shall be closed by a watertight plug or other approved means.

b. Pipe Clearance in Rocks.

(1) Ledge rock, boulders and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipe and fittings.

- (2) The specified minimum clearances are the minimum clear distances which will be permitted between any part of the pipe and/or fitting being laid and any part, projection or point of such rock, boulder or stone. Any rock encountered within four (4) feet of the end of lateral shall be removed.

5. Backfilling.

- a. The trench may be filled from 12-inches above the top of the pipe to restoration depth (above the AASHTO No. 7 stone as specified above) with excavated material except that stones larger than eight (8) inches may not be returned to the trench and the fill shall not contain more than 20% stone in total volume.
- b. The trench shall be properly tamped in lifts not to exceed the maximum thickness for the type of tamping equipment being used. All bedding and backfilling shall be compacted to 95% of maximum Proctor density. Backfilling shall not be done with frozen material. No backfilling shall be done if the material already in the trench is frozen.
- c. Utility excavations in areas of streets, access drives, parking areas and loading areas shall be backfilled in accordance with the foregoing requirements with the following exception: the trench shall be filled with concrete, flowable fill, or GAB stone above the AASHTO No. 7 pipe bedding. GAB shall be placed and compacted to the foregoing requirements.
- d. In State highways, all backfill shall be in accordance with the requirements of MD SHA.

6. Surface Restoration.

- a. In State highways surface restoration shall be in accordance with MD SHA Standard Specifications for Construction and Materials Section 500, or as specified in the MD SHA Permit issued for the subject project.
- b. In County roads, Town Roads, paved areas or other traffic areas surface restoration shall be in accordance with Washington County Roads Department Standards.

E. TESTING AND INSPECTION

1. Lateral connections which are constructed as part of new sanitary sewer installations shall be tested and inspected as described in Section 4 - GRAVITY SEWERS of these specifications.
2. Lateral connections to existing sanitary sewer lines shall be visually inspected prior to commencement of backfilling. Laterals shall be inspected for alignment, depth, slope, and for fittings and pipe material used.

F. DETAIL DRAWINGS

Relevant detail drawings are:

<u>No.</u>	<u>Description</u>
1	Pipe Bedding
2	Concrete Encasement
3	Lawn Restoration
4	Pavement Restoration (State, County, and Town Roads)
5	Cutting and Repairing in Roadway Shoulder
6	Gravity Sewer Service Lateral
7	Gravity Double Service Lateral
8	Gravity Sewer Service Lateral Drop Connection
9	Typical Gravity Service Connection

END OF SECTION

SECTION 4 - GRAVITY SEWERS

A. GENERAL

1. Regulatory Agencies.

All designs shall conform to good engineering practice and all proposed sewer construction projects shall meet the requirements of the Maryland Department of Environment, OSHA, and the Maryland Department of Labor, Licensing, and Regulation, and shall conform to the requirements contained herein.

B. DESIGN

1. Diameter and Slope.

The minimum sewer diameter shall be 8 inches. Minimum slopes shall be as those which appear in the Design Guidelines for Sewerage Facilities of the Environmental Health Administration Department of Health and Mental Hygiene, which is the current guidance document used by MDE. The minimum slope for all terminal sections of sewers shall be 1.0% for a maximum distance of 400-feet.

2. Depth of sewers.

- a. All sewers shall be designed to provide a minimum depth of cover of 5'-6" above the top of the pipe.
- b. If depths of sewers greater than 14 feet are deemed to be necessary, the design should be discussed with the Town prior to formal submission of the plans for approval. In all cases where subsequent approval is given by the Town, the pipe to be used shall be ductile iron.

3. Location of Sewers.

a. General

Sewer mains shall normally be located within the right-of-way lines of public streets. If it is necessary to locate a sewer main on private property, the Applicant shall provide a sewer easement in the name of the Town. The easement shall consist of a 30-foot wide permanent easement, normally centered on the pipeline, and an additional 20-foot wide temporary construction easement.

- b. Utility crossings shall be minimized. Maximum horizontal separation of utilities shall be provided for ease of future maintenance and health and safety reasons.

c. Sewers Near Water Mains.

- (1) Sewer installation near water mains shall conform to the Design Guidelines for Sewerage Facilities of the Environmental Health Administration Department of Health and Mental Hygiene.
- (2) Parallel Installation: Sewers shall be laid at least 10 feet horizontally from any existing or proposed water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, the Town may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the sewer closer to a water main, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.
- (3) Crossings: Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. This vertical separation shall be maintained for the portion of the sewer located within 10 feet horizontally of any water main it crosses. The 10 feet is to be measured as a perpendicular distance from the sewer line to the water line.
- (4) Exception: When it is impossible to obtain the proper horizontal and vertical separation as stipulated in Items (2) and (3) above, both the water main and sewer line shall be constructed of ductile iron pipe having mechanical joints. Other types of joints of equal or greater integrity may be used at the discretion of the Town. Where a sewer must cross over a water main, additional protection shall be provided by:
 - (a) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line;
 - (b) Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the water line; and
 - (c) Centering the length of the water line at the point of the crossing so that the joints are equidistant and as far as possible from the sewer.
- (5) The Town shall be consulted when any of the above conditions cannot be met, to discuss the use of double casing or concrete encasement of sewer and/or water lines as possible alternatives.
- (6) No water pipe shall pass through, or come into contact with, any part of a sewer manhole.

c. Sewer Mains Near Gas Mains and Other Utilities.

- (1) Parallel Installation: Sewer mains shall be laid at least 10 feet horizontally from any existing or proposed gas main or other utility. The distance shall

be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, the Town may allow deviation on a case-by-case basis, if supported by data from the design engineer.

- (2) Crossings: Whenever sewer mains must cross gas mains or other utilities, a minimum vertical separation of 18 inches shall be provided measured edge to edge. This vertical separation shall be maintained for the portion of the sewer main located within 10 feet horizontally of any gas main or other utility it crosses. The 10 feet is to be measured as a perpendicular distance from the gas main or other utility to the sewer main. Where the sewer main must cross under a gas main or other utility, adequate structural support for the gas main or other utility shall be provided to prevent excessive deflection of the joints and the settling on and breaking of the sewer line.
- (3) The Town shall be consulted when any of the above conditions cannot be met, to discuss possible alternatives.

4. Borings.

All construction methods and materials proposed for use in tunneling, jacking or boring shall be submitted to and approved by the Town prior to construction. The encasement pipe shall be installed with even bearing throughout its entire length, and shall slope to one end with the same slope as the sewer pipe. The ends of the casing pipe shall be sealed as shown in the standard detail drawings.

C. MATERIALS AND EQUIPMENT

(References to ASTM, AWWA and ANSI Specifications imply Latest Edition.)

1. Ductile Iron Pipe and Fittings.

a. Ductile Iron Pipe.

- (1) Ductile iron pipe shall conform to AWWA C151 and ASTM A746. Pipe shall be supplied in standard lengths as much as possible with laying lengths of either 18 ft or 20 ft nominal lengths. Pipe shall be manufactured by Griffin Pipe Products Co. or approved equal.
- (2) Ductile iron pipe and fittings for use in gravity sewers, service lines, and force mains shall be lined with either Protecto 401 ceramic-filled amine cured epoxy or SewerCoat calcium aluminate mortar as manufactured by Lafarge Calcium Aluminates, or approved equal. These linings shall be applied in accordance with the manufacturer's recommendations.

b. Joints.

Joints shall be rubber-gasket push-on type or rubber-gasket mechanical joint type conforming to AWWA C111. Gasket shall be of SBR. Ductile iron for use as restrained joint shall be mechanical joint pipe using Uni-Flange joint restraining glands. Pipe shall be used as indicated on drawings or details.

c. Fittings.

Mechanical joint fittings in sizes 4" through 24" shall meet the requirements of AWWA C153. Fitting shall be manufactured from a high strength, impact resistant ductile iron, having a minimum tensile of 70,000 psi with a minimum yield of 50,000 psi and a minimum elongation of 5%. Fitting wall thickness shall be CL 54 through 23" diameters and CL 56 through 24" diameters. Fittings shall be rated at 350 psi. Cement lining -- all accessories, glands, bolts, and gaskets shall conform to ANSI A221.11 AWWA C111. Fitting shall be listed with Underwriters Laboratories. All fittings must be manufactured domestically. Where fittings are to be used with PVC piping systems, appropriate gaskets shall be furnished if required. Tees shall be used for lateral connections. Fittings shall be as manufactured by Griffin Pipe Products Co. or approved equal.

d. Minimum Thickness.

Thickness design shall be per AWWA C150, Class 52.

2. Polyvinyl Chloride Sewer Pipe and Fittings.

a. Polyvinyl Chloride Pipe.

Polyvinyl chloride (PVC) sewer pipe and fittings shall be PVC SDR 35 with full diameter dimensions and shall conform to ASTM D3034 for sizes 8 through 15 inches and shall conform to ASTM F679 for sizes 18 through 36 inches. Standard lengths shall not lay less than 12.5 feet +/- 1 inch except for manhole stubs. Pipe shall be manufactured by J.M. Manufacturing Co. or approved equal.

b. Joints.

PVC pipe and fittings shall have bell and spigot push-on joints. The bell shall consist of an integral wall section with a solid cross-section elastomeric gasket (as manufactured by J.M. Manufacturing Co. or approved equal) securely locked in place to prevent displacement during assembly. Installation of elastomeric gasketed joints and performance of the joint shall conform to ASTM F477, ASTM D3139, ASTM D3212 or UNI-B-1. No solvent cement joints will be permitted in field construction.

c. Fittings

(1) All fittings and accessories for sewers shall have bell and/or spigot configurations compatible with the pipe. Sewer main fittings shall be made from PVC compounds as defined and described in ASTM designations D1784 for rigid PVC compounds and all PVC fittings supplied shall have the following markings:

1. Manufacturer's name or trademark
2. Nominal size
3. Material designation
4. ASTM designation

(2) PVC fittings in sizes 4" through 8" shall be manufactured by the injected molding process. PVC fittings in sizes 10" through 27" shall be manufactured by the factory fabricated process. The minimum bell depth on the above mentioned fittings shall be as specified per ASTM D3202, section 6.2 and 7.3.2 4" through 8", and section 7.11 on 10" and larger, as shown in the following sizes.

<u>Diameter</u>	<u>Minimum Bell Depth</u>
4"	1.75"
6"	3.00"
8"	4.00"
10"	5.00"
12"	6.00"
15"	7.5"
18"	manufacturers bell pipe
21"	manufacturers bell pipe
24"	manufacturers bell pipe
27"	manufacturers bell pipe

(3) Sealing gaskets shall have a minimum cross section area of 0.20 square inch. Fittings shall be so designed to have a minimum load resistance on an 8 x 6 wye of 900 lbs at a deflection of 5%.

d. Certifications of compliance of the above specifications shall be required from the manufacturer before acceptance of delivery or award of contract.

3. Alternative Gravity Sewer Pipe Materials.

Alternative gravity sewer pipe materials may be considered and will be subject to approval by the Town on a case-by-case basis. Full details of alternatives must be submitted.

4. Manhole Adapter with Sand (Sand Collar).

a. Pipe stubs for penetrations into existing manholes shall be PVC gasketed heavy wall "Sand Collar" sewer pipe and fitting.

- b. Pipe stub shall be type PSM SDR-26, ASTM D3034 as supplied by GPK Products, Inc. or approved equal.
5. Steel Casing Pipe.
- a. The steel casing pipe shall have a minimum yield strength of 35,000 psi, have a thickness as required but not less than 0.375 inches, be equipped with grout holes and conform to AWWA C200 and ASTM A53.
 - b. Casing interior and exterior shall be painted with two coats bitumastic enamel coating in accordance with AWWA C203.
 - c. Insulators shall be installed on the carrier pipe and end seals on the casing pipe. Refer to Detail 10 on the use of end seals on the casing, spacing of the insulators, and the cavity seal (between the inside diameter of the casing and the outside diameter of the pipeline). Casing insulators and end seals shall conform in design to Model 60 insulators and Multiflex molded end seals as manufactured by Maloney Pipeline Products Company, T.D. Williamson, Inc., or an approved equal.
 - d. Minimum casing diameter shall be in accordance with MD SHA requirements as applicable.

D. INSTALLATION

1. Excavation.

- a. The trench shall be excavated to a depth of six inches below the outside diameter of the pipe barrel, or deeper if so specified. The width of the trench shall be as shown on the detail drawings. All of this excavation may be done by machine. The resultant subgrade shall be undisturbed, or compacted as approved by the Engineer if disturbed.
- b. When the pipe is to be laid in fill, bring the fill to two feet above the elevation of the top of pipe to be laid before excavation commences. Compact fill to 95% of the maximum density as determined by ASTM D1557-70 or AASHTO T-180, Method D (Modified Proctor). The bottom of the trench shall be compacted to 95% of maximum density prior to installation of the pipe bedding.

2. Bedding.

- a. The pipe shall be bedded on 6 inches of AASHTO No. 7 stone, the full width of the trench, and shall be covered with AASHTO No. 7 stone to a height of 12 inches over the top of the pipe.

- b. The bedding shall be thoroughly compacted to 95% of maximum density. The bedding shall provide uniform and continuous bearing and support for the pipe at every point between the bells.
- c. Unstable Subgrade.
 - (1) Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, any type of refuse, vegetable, or other organic material, or large pieces or fragments of inorganic material, which, in the opinion of the Town, should be removed, the Applicant shall excavate and remove such unsuitable material to the width and depth recommended by the Town. Before pipe is laid, the subgrade shall be formed by backfilling with AASHTO No. 7 stone in 3-inch (uncompacted thickness) layers thoroughly compacted to 95% of maximum density and the bedding prepared as hereinbefore specified.
 - (2) Flowable Backfill meeting the requirements of MD SHA Specifications for Construction & Materials Section 314 may be used as an alternative to backfilling with stone. Material consists of a mixture of cement and water which shall have a 28-day unconfined minimum compressive strength of 100 psi based on the manufacturer's certification, and shall be placed in accordance with the manufacturer's recommendations.
- d. If potentially corrosive materials are encountered, polyethylene encasement shall be installed to protect ductile iron pipe in accordance with ANSI/AWWA C105/A21.5.
- e. Special Foundations.

Where the bottom of the trench at the subgrade is found to consist of material which is unstable to such a degree that, in the opinion of the Town, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, a suitable foundation for the pipe shall be designed and submitted to the Town for approval.

- f. Concrete Encasement.

Pipes to be encased in concrete shall have minimum six inches of concrete above and below the pipe and the concrete shall be extended for the full width of the natural trench. No formwork to limit the concrete width shall be used. Flexible pipe joints shall be provided in the pipe at a distance of three times the pipe diameter from the ends of the concrete encasement, to provide pipe articulation. Pipes shall be protected against flotation during placement of concrete encasement. This may require two stage concrete placement combined with anchor straps.

3. Laying Pipe.

- a. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA C600. PVC pipe and fittings shall be installed in accordance with the requirements of the manufacturer and ASTM D2321. No more than 10% of a section of sewer between two manholes shall consist of laying lengths less than 10 feet. All pipes shall be laid to a uniform line and grade, bell ends upgrade, with a firm and even bearing along the barrel of the pipe. The spigot end of the pipe is to be centered in, shoved tight and secured against the bell of the previously laid pipe. The interior of each pipe shall be cleaned of all foreign material before the next pipe is laid. Pipe laying shall commence at the lowest point and proceed upgrade. At the close of each day's work, and at such other times when pipe is not being laid, the open end of the pipe shall be closed by a watertight plug or other approved means.

- (1) Grade and Alignment Control.

Prior to construction, three copies of a grade sheet for each manhole run shall be furnished to the Town. Grade and alignment control shall be established by one of the following methods:

- (a) Laser - Direct reading
- (b) Twin string line offset

- b. Pipe Clearance in Rocks.

- (1) Ledge rock, boulders and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipe and fittings for pipes 24 inches in diameter or less, and 9 inches for pipes larger than 24 inches in diameter.
- (2) The specified minimum clearances are the minimum clear distances which will be permitted between any part of the pipe and/or fitting being laid and any part, projection or point of rock, boulder or stone.

- c. Pipes at Manholes or Other Rigid Structures.

Pipes directly connected to or supported by rigid structures (manholes, vaults, wall, etc.), shall not have a length beyond the rigid support in excess of that shown in the detail drawings. Two flexible joints shall be required within three pipe diameters of a rigid structure.

4. Backfilling.

- a. The trench may be filled with excavated material above the AASHTO No. 7 stone as specified above except that stones larger than eight (8) inches may not be placed in the trench and the fill shall not contain more than 20% stone in total volume.

- b. The trench shall be properly tamped in lifts not to exceed the maximum thickness for the type of tamping equipment being used. All bedding and backfilling shall be compacted to 95% of maximum density as determined by ASTM D1557-70 or AASHTO T-180, Method D (Modified Proctor). Backfilling shall not be done with frozen material. No backfilling shall be done if the material already in the trench is frozen.
 - c. Utility excavations in areas of streets, access drives, parking areas and loading areas shall be backfilled in accordance with the foregoing requirements with the following exception the trench shall be filled with concrete, flowable fill, or GAB stone above the AASHTO No. 7 pipe bedding. GAB shall be placed and compacted to the foregoing requirements.
 - d. In State highways, all backfill shall be in accordance with the requirements of MD SHA.
5. Surface Restoration.
- a. In State highways surface restoration shall be in accordance with MD SHA Standard Specifications for Construction and Materials Section 500, or as specified in the MD SHA Permit issued for the subject project.
 - b. In County roads, Town Roads, paved areas or other traffic areas surface restoration shall be in accordance with Washington County Roads Department Standards.
6. Bored Crossings
- a. The carrier pipe shall be installed to the exact line and grade required within the casing pipe utilizing a levelling grout course, adjustable pipe supports, or other methods as approved by the Town.
 - b. The carrier pipes shall be supported within the casing pipes so that the pipe bells do not rest directly on the casing. The load of the carrier pipes shall be distributed along the casing by the method of support shown on the detail drawings.
 - c. All work shall be performed in conformance with the requirements of MD SHA or other regulatory agencies involved.

E. TESTING & INSPECTION

1. Alignment Test

After the mains have been laid and backfill (bedding) placed, the Town's inspector will flash a light between manholes or manhole locations to determine whether the alignment of the sewer is true and whether any pipe has been displaced, broken or otherwise damaged subsequent to laying. This test will again be conducted before

final acceptance of the sewer. Each section (manhole to manhole) of sewer shall show a good light circle throughout its length and any and all defects shall be corrected to the satisfaction of the Town before acceptance.

2. Allowable Deflection Test

- a. Pipe deflection measured not less than 30 days after the backfill has been completed as specified shall not exceed 5 percent. Deflection shall be computed by multiplying the amount of deflection (nominal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.
- b. Deflection shall be measured with a rigid mandrel (Go/No Go) device cylindrical in shape and constructed with a minimum of nine evenly spaced arms or prongs. Drawings of the mandrel with complete dimensions shall be submitted to the Engineer for each diameter of pipe to be tested. The mandrel shall be hand pulled through all sewer lines. Provide certification that these tests have been conducted to the Town. These tests must be witnessed and approved by the Engineer or Town.
- c. Any section of sewer not passing the mandrel shall be uncovered at no additional cost to the Owner and the bedding and backfill replaced to prevent excessive deflection. Repaired pipe shall be retested at no additional cost to the Owner. Retested pipe shall not deflect more than 4 percent.

3. Leakage Test

a. General

- (1) Sewers shall be tested for leakage only after all sewers and sewer laterals, including stoppers, are installed. Each sewer section between manholes including all laterals will be tested with low pressure air. Testing will be done only after all backfilling has been completed and trench settlement has been minimized. The Applicant shall furnish all labor, materials, tools, equipment and accessories necessary to perform the required tests. All tests shall be made in the presence of, and to the complete satisfaction of the Town or the Town's inspector.
- (2) Submit copies of test conditions and results to Town for each section tested.
- (3) Test the first section of pipeline as soon as it is installed to demonstrate that the work conforms to this Section.
- (4) Testing of pipe shall closely follow pipe laying. No more than 1000-ft of pipe shall remain untested at any time.
- (5) Contractor shall notify the customers when service will be interrupted for testing.

b. Exfiltration Test with Air

- (1) Submit the proposed method of testing to the Engineer or Town for approval. Air testing shall be performed in accordance with the procedures described in UNI-B-6-98 (PVC or DI), ASTM C828 (Clay), or ASTM C924 (Concrete) for the appropriate pipe material.
- (2) The equipment shall be specifically designed and manufactured for testing pipelines with low-pressure air and shall be provided with an air regulator valve or air safety valve set to prevent the air pressure in the pipeline from exceeding 9 psig. It is extremely important that all plugs be installed and braced to prevent blowouts. Note that the force of 250 pounds is exerted on an 8-inch plug by an internal pressure of 5-psig, and a force of 5,090 pounds is exerted on a 36-inch plug by an internal pressure of 5 psig. No persons should be allowed in the alignment of the pipe during testing.
- (3) The above ground air control equipment shall include a shut-off valve, pressure regulating valve, pressure relief valve, input pressure gauge and a continuous monitoring pressure gauge having a range from 0 to 10 or 15 psi. The continuous monitoring gauge shall be no less than 4-inches in diameter with minimum divisions of 0.10 psi and an accuracy of ± 0.04 psi.
- (4) Low pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure of any groundwater above the pipe, but not greater than 9.0 psig. The air pressure correction which must be added to the 3.5 psig normal test starting pressure shall be calculated by dividing the average vertical height in feet of groundwater above the top of the sewer to be tested by 2.31. The result gives the air pressure correction in pounds per square inch (psi) to be added.
- (5) After a constant pressure of 4.0 psig (greater than the average groundwater back pressure over the pipe) is reached, the air supply shall be throttled to maintain that internal pressure for at least 2 minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall.
- (6) When the temperatures have been equalized and the pressure stabilized at 4.0 psig (greater than the average groundwater backpressure), the air hose from the control panel to the air supply shall be shut off or disconnected. The continuous monitoring pressure gauge shall then be observed while the pressure is decreased to no less than 3.5 psig (greater than the average groundwater backpressure over the pipe). At a reading of 3.5 psig, or any convenient observed pressure reading between 3.5 and 4.0 psig, (greater than the average groundwater backpressure),

timing shall commence with a stop watch or other device that is at least 99.8 percent accurate.

- (7) The time required for a 0.5 psi pressure drop in PVC or DI pipe shall not be less than the time computed by using the Ramseier's equation and as indicated in the table included with this Section:

$$T = \frac{0.085xDxK}{2xQ}$$

Where: T = Shortest time, in seconds, allowed for the air pressure to drop 0.5 psig,
K = 0.000419 DL, but not less than 1.0,
Q = 0.0015 cubic feet per minute per square foot of internal pipe surface,
D = Nominal pipe diameter in inches, and
L = Length of pipe being tested in feet.

- (8) If the results of the air test are unsatisfactory, perform the exfiltration test as outlined above. If both tests are unsatisfactory, the Contractor shall, at his own expense, determine the source of the leakage and make all necessary corrections and retest. The extent and type of repair which may be allowed, as well as results, shall be subject to approval of the Engineer or Town.

4 Cleaning.

At the conclusion of the work, thoroughly clean all pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered the pipes during the construction period. Debris cleaned from the lines shall be removed from the low end of the pipeline. If after this cleaning, obstructions remain, they shall be removed. After the pipelines are cleaned and if the groundwater level is above the pipe or following a heavy rain, the Engineer will examine the pipes for leaks. If any defective pipes or joints are discovered, they shall be repaired or replaced as directed by the Engineer or Town.

F. DETAIL DRAWINGS

Relevant Detail Drawings are:

<u>No.</u>	<u>Description</u>
1	Pipe Bedding
2	Concrete Encasement
3	Lawn Restoration
4	Pavement Restoration (State, County, and Town Roads)
5	Cutting & Repairing in Roadway Shoulder
10	Steel Pipe Encasement for Water & Sewer Mains

UNI-B-6-98

**MINIMUM SPECIFIED TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PVC OF DI PIPE INDICATED FOR Q=0.0015**

1 Pipe Diameter (in.)	2 Minimum Time (min.: sec)	3 Length for Minimum Time (ft)	4 Time for Longer Length (sec)	Specification Time for Length (L) Shown (min.:sec)									
				100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.		
4	1:53	597	.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760L	3:47	3:47	3:47	3:47	3:47	3:47	3:47	3:48	5:04	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:43	4:43	4:43	4:43	5:56	7:54	8:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50	20:02	
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02		
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51		
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16		
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17		
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54		
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07		
33	15:35	72	12.926L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57		
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23		
42	19:54	57	20.942L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04		
48	22:47	50	27.352L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	205:09		
54	25:31	44	34.618L	57:42	86:33	115:24	144:15	173:05	201:56	230:47	259:38		
60	28:20	40	42.738L	71:14	106:51	142:28	178:05	213:41	249:18	284:55	320:32		

Note: If there has been no leakage (zero psig drop) after one hour of testing, the test section shall be accepted and the test complete.

END OF SECTION

SECTION 5 - MANHOLES

A. DESIGN

1. Manholes for gravity sewers shall be placed at all changes of direction, pipe intersections and at intervals not greater than 400 feet. Manholes shall be placed at all changes in grade, pipe size, and alignment. External drop manholes are required if the invert of the incoming pipe is greater than 2'-0" above the invert of the outgoing pipe. All external drop manholes shall be lined with PVC or HDPE. Lining shall cover the invert, walls, and corbelled top up to the cast iron manhole frame.
2. Unless otherwise noted, manholes shall be constructed of precast concrete with cast iron frames and covers, as shown on the detail drawings contained herein. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Channels for changes in direction of flow shall be as large a radius as the size of the manhole will permit.
3. All manhole covers shall be set to finished grade in paved areas and 12 inches to 18 inches above grade in rights-of-way or unpaved areas. If a manhole is to be at grade in unpaved areas, a manhole insert shall be installed. In flood plains, or where deemed necessary by the Town, a watertight manhole cover shall be installed. If the proposed construction includes an existing street or right-of-way in which the existing grade will be changed, the Applicant shall be responsible for adjusting all existing manholes to finished grade. All adjustments required shall be in accordance with methods approved by the Town. Such approval must be obtained in writing prior to construction.
4. Lift holes in manholes shall not extend through the entire width of the wall.
5. Manholes shall be constructed in accordance with the standard details noted on the detail drawings contained herein. Shop drawings shall be submitted for approval.

B. MATERIALS AND EQUIPMENT

1. Precast Reinforced Concrete Manholes.
 - a. Precast reinforced concrete manhole risers and tops shall conform to ASTM Specification C-478 Latest Edition and shall be of watertight construction, and shall have an interior diameter of 48" unless required otherwise by the Town. All external and internal surfaces shall be coated or lined. Joints between manhole sections shall be provided with preformed plastic joint sealing material such as Rub'R-Nek as manufactured by K.T. Snyder Co., MAS-STIK as manufactured by Concrete Products Supply Co., or approved equal. The preformed joint sealer shall be protected by a removable two-piece wrapper and shall be applied in strict accordance with the manufacturer's recommendations. The chemical composition of the sealer shall meet the following requirements: the latest revision of: Bitumen-ASTM D-477, Inert Ash Mineral AASHTO T-11-42, Volatile

Matter ASTM D-667. Joints between manhole sections may be made by other methods if approved by the Town. Shop drawings and specifications must be submitted for approval prior to installation.

- b. Manhole bases may be cast-in-place Type II Portland cement concrete, and shall have a compressive strength of not less than 2,500 psi after 28 days (tests to be in accordance with ASTM Specification C-39, Latest Revision). Manhole bases shall have a 6" flange as shown on the detail drawings.
- c. Precast manhole bases shall have flexible watertight joints at the point of entry of any sewer pipe into the manhole. The rubber materials shall conform to ASTM C443. The gaskets shall be cast into the manhole base to become an integral part of the concrete. The gaskets shall be Press Wedge II as manufactured by Press-Seal Gasket Corporation or equivalent. Manhole bases shall have a 6" flange as shown on the detail drawings.
- d. Precast concrete grade rings for levelling and adjusting to grade shall be of compressive strength as specified above. Design must provide for full bearing of manhole frame. Joints between grade rings must be sealed using Rub'R-Nek or other approved sealing material. Cement mortar will not be permitted in any joints.

2. Frame and Cover.

- a. Manhole frame and cover shall be heavy duty type, 380 pounds in weight, 24" opening of cast iron, equal in design to Number R-1642 manufactured by the Neenah Foundry Company, Neenah, Wisconsin, machined and having the words "SANITARY SEWER" cast approximately in the center of the cover.
- b. Frames shall be drilled or cast with holes for anchor bolts. All manhole cover frames shall be securely attached to the manhole by use of anchor bolts.
- c. The joint between the frame and the precast manhole section shall be provided with preformed plastic joint sealing material equal to Rub'R-Nek as manufactured by K.T. Snyder Company, Inc. of Houston, TX, or approved equal, and shall be watertight. No mortar joints will be permitted.
- d. Castings shall be manufactured true to pattern. Component parts shall fit together in a satisfactory manner. Castings shall be smooth and well cleaned by shot blasting. Metal shall be ASTM-A-48 class 35B gray iron minimum or ASTM-A-536 grade 80-55-06 for ductile iron. Castings shall have a minimum tensile strength of 35,000 psi H2O loading.

3. Watertight Manhole Frame and Cover.

- a. Watertight manhole frames shall be of soft grey iron similar in design to Number R-1916 as manufactured by Neenah Foundry Co., Neenah, Wisconsin, and having the words "SANITARY SEWER" cast approximately in the center of the cover.

- b. Watertight frames shall be securely attached to the manhole by use of anchor bolts.
 - c. The joint between the frame and the precast manhole section shall be provided with preformed plastic joint sealing material equal to Rub'R-Nek as manufactured by K.T. Snyder Company, Inc. of Houston TX or approved equal. All joints shall be watertight. Manhole covers with gasketed lids may be used if approved by the Town.
 - d. Shop drawings for this type of cover must be submitted for approval before installation.
4. Manhole Inserts.
- Inserts with vent holes and strap shall be of PVC with deep bowl as manufactured by Parsons Environmental Products of Reading PA., or approved equal.
5. Manhole Steps.
- a. Manhole steps shall be composed of a ½ inch Grade 60, ASTM A615 deformed steel reinforcing bar completely encapsulated in Grade 49108, ASTM D2146 polypropylene copolymer compound, as manufactured by M.A. Industries, Inc., or equal.
 - b. The Town reserves the right to have steps tested according to the latest revision of ASTM Specification C-478 at the Applicant's cost.
 - c. Manhole steps shall be positioned in the manhole in such a manner to permit easy access to the manhole and not conflict with either influent or effluent lines. The first step shall be no further than 24-inches from the top of the manhole.
6. Protective Coatings and Linings
- a. Exterior Coating
 - (1) Dampproofing shall be coal tar waterproofing pitch; Pro-Mastic 900 by Pro-Guard Coatings; Hydrocide 648 by Sonneborn Building Products; Dehydratine 4 by A.C. Horn Inc; Meadows Trowel Mastic (Type 3) or approved equal.
 - b. Interior Coating (hydrogen sulfide corrosion protection) for manholes with internal drop of less than 2-feet or those having watertight lids or inflow inserts shall be one of the following coal tar epoxy coatings; the color shall be white:
 - (1) Pro-Guard Coatings
 - (2) Propoxy 3009
 - (3) Koppers 300M
 - (4) or approved equivalent

- c. Interior Lining (hydrogen sulfide corrosion protection) for manholes with internal drop of 2-feet or greater or force main terminal manholes shall be one of the following:
- (1) A High Density Polyethylene (HDPE) liner to provide an impermeable lining on the interior concrete surfaces shall be AGRU Sure Grip HDPE of polypropylene random copolymer or approved equal. The Sure Grip liner shall have a minimum thickness of 2-mm (0.0787-inches). The minimum anchor stud density shall be 39 studs per square foot. The anchoring studs shall not be welded or mechanically attached to the liner. The liner shall be installed during the manhole casting process in accordance with the manufacturer's instructions. All joints shall be sealed by thermal welding performed by AGRU certified welders. The interior surfaces to be protected shall include the wall, ceiling, pipe entries and structure chimney.
 - (2) A Polyvinyl Chloride (PVC) resin liner to provide an impermeable lining on the interior concrete surfaces shall be Dura Plate 100 as manufactured by A-Lok Products, Inc. Tullytown, PA 19077 or approved equal. The Dura Plate liner shall have a minimum thickness of 0.065-inches (1.65-mm). The PVC liner, channel joints, H-joints, and corner joints shall be manufactured from PVC and shall be white in color. A combination of standing ribs and dovetails shall be used to secure the liner panels to the wall of the structure and shall be spaced a maximum of 6-inches apart. Liner panels for 48" through 60" diameter manholes shall be a minimum of 0.50-inches high and shall be 0.75-inches high for 72" and larger diameter manholes. Liner panels shall be formed to the correct radius and have a PVC return into the joint of 0.50-inch. The fabricated liner panels shall be joined together by a slotted strip of EPDM rubber meeting the manufacturer's specifications. Sections of lined concrete structure shall be joined together by an approved butyl rubber strip as manufactured by A-Lok Products, Inc., MT-329, designed to produce sufficient squeeze-out between PVC returns. The liner shall be installed during the manhole casting process in accordance with the manufacturer's instructions. Pipe penetrations through the wall shall be afforded protection by applying 0.125-inch cementitious corrosion resistant material, Forsroc Epoxy Liner, to the unlined exposed areas within the openings and shall overlap the liner wall a minimum of 1.50-inches. The manhole chimney shall be protected by installing a telescoping PVC connector, Water-Lok, as manufactured by A-Lok. The interior surfaces to be protected shall include the wall, ceiling, pipe entries and structure chimney.

C. INSTALLATION

1. General.

The relevant parts of Section 4 GRAVITY SEWERS shall apply regarding earthwork.

2. Precast Concrete Bases.

a. Bedding.

Install bases on a 6-inch deep compacted layer of aggregate meeting requirements of Pipe Bedding as specified previously in Section 4 GRAVITY SEWERS.

b. When using prefabricated pipe opening seals (i.e., A-LOK, RES-SEAL, PRES-WEDGE II, etc.) for connecting pipes into manholes, and such seals create an annular space on interior and exterior of manhole wall pipe openings after pipe connection is made, fill such annular spaces with preformed flexible plastic sealing compound.

- (1) Tightly caulk sealing compound into annular spaces in a manner to completely fill the spaces and render the installation watertight.
- (2) Following sealing compound installation, trowel compound surface smooth and flush with interior face of manhole.

3. Concrete Channel Fill.

a. Field pour concrete channel fill for each manhole base.

- (1) Form inverts directly in concrete channel fill.
- (2) Accurately shape invert to a semi-circular bottom conforming to inside of connecting pipes, and steel trowel finish to a smooth dense surface.
- (3) Make changes in size and grade gradually.
- (4) Make changes in direction of entering sewer and branches to a true curve of as large a radius as manhole size will permit.
- (5) Make slopes gradual outside the invert channels.

b. Use 2,500 psi Type II Portland Cement concrete unless indicated otherwise on Detail drawings.

c. Channels shall be full pipe height and PVC channels may be used for invert section.

4. Manhole Installation.

a. Precast Components.

Provide precast reinforced concrete straight riser, tapered riser and top sections necessary to construct complete manholes. Fit the different manhole

components together to permit watertight jointing and true vertical alignment of manhole steps.

- b. If rubber compression gaskets are used between sections, install gaskets and join sections in accordance with written instructions of manhole component manufacturer.
 - c. If preformed plastic sealing compound is used between sections, install sealing compound in accordance with manufacturer's recommendations, and join sections also in accordance with written instructions of manhole component manufacturer.
 - (1) Prime joint surfaces if required by preformed sealing compound manufacturer.
 - (2) If sealing compound is installed in advance of section joining leave exposed half of two piece protective wrapper in place until just prior to section joining.
 - (3) Use preformed sealing compound as the sole element utilized in sealing section joints from internal and external hydrostatic pressure.
 - (4) Following manhole section installation, trowel sealing compound surface smooth and flush with interior face of manhole.
 - (5) Make pipe connections into manhole walls as specified previously for pipes connecting into manhole bases.
 - d. Backfill carefully and evenly around manhole sections in accordance with the backfilling requirements of Section 4.D.4.
5. Manhole Pipe Connections.

Construct manhole pipe connections, including pipe stubs, as specified above. Close or seal pipe stubs for future connections with a gasketed watertight plug. All pipe connections shall have two flexible joints immediately adjacent to the manhole to provide pipe articulation. The first flexible joint shall be either a flexible, non-grouted, rubber boot at the manhole or a standard pipe O-ring joint within 12-inches of the manhole wall. The second flexible joint shall be a standard O-ring joint within three (3) pipe diameters of the first flexible joint.

6. Frame and Cover Installation.

- a. Adjust frames using precast Grade rings. Set precast grade rings in preformed plastic joint sealing material equal to Rub'R-Nek as manufactured by K.T. Snyder Company, Inc. of Houston, TX or approved equal.
- b. Bolt manhole frames in place on manhole top section, or on steel reinforced precast concrete grade rings, if required, after installing ½-inch thick preformed plastic sealing compound on bearing surface of manhole frame and between

grade rings. Remove excess sealing compound squeeze-out after manhole frame is bolted in place.

- c. Use bolts of sufficient length to properly pass through steel reinforced precast concrete grade rings, if any; engage full depth of manhole top section inserts and allowing enough threaded end to pass through manhole frame to properly tighten nut and washer.

7. Drop Manholes.

Construct as depicted on the Detail Drawings.

D. TESTING AND INSPECTION

1. All manholes shall be tested for water infiltration. The Applicant shall furnish all labor, materials, water, tools, equipment and accessories necessary to perform the required tests. All tests shall be made in the presence of and to the complete satisfaction of the Town.
2. The manhole shall be thoroughly cleaned and all openings sealed to the satisfaction of the Town. All pipe openings in the base and the walls shall be plugged with plugs properly designed to provide a watertight and airtight seal. All excess joint sealing material protruding into the manhole shall be removed.
3. There shall be no groundwater around the outside of the manhole during the vacuum test. If there is groundwater around the manhole during the vacuum test and any water is found in the manhole at the conclusion of the test, it shall be deemed to have failed the test.
4. The manhole shall be tested using the vacuum testing method (ASTM C1244).
 - a. Install an inflatable circular rubberized test head in the manhole cover frame. Evacuate the air until the internal air pressure of the manhole is lowered by 10-inches of mercury. Close the valve on the vacuum line and shut off the vacuum pump.
 - b. Determine the time (in seconds) for the vacuum pressure to drop to 9-inches of mercury.

Manhole Depth (Feet)	Manhole Internal Diameter (Inches)											
	30	33	36	42	48	54	60	66	72	84	96	120
	Manhole Test Time (Seconds)											
8	11	12	14	17	20	23	26	29	33	38	44	56
10	14	15	18	21	25	29	33	36	41	47	55	70
12	17	18	21	25	30	35	39	43	49	57	65	83
14	20	21	25	30	35	41	46	51	57	67	77	98
16	22	24	28	34	40	46	52	58	67	76	88	112
18	25	27	32	38	45	52	59	65	73	85	99	126
20	28	30	35	42	50	57	65	72	81	95	109	139

- c. The manhole shall pass the test if the time for the vacuum reading to drop from 10-inches to 9-inches of mercury meets or exceeds the values indicated in the table.
- d. If the manhole fails the initial test, the Applicant shall determine at his own expense the source of the leakage. At no cost to the Town, the Applicant shall repair or replace all defective material and/or workmanship and shall conduct such additional retesting as required to demonstrate that the manhole meets the requirements. All materials and methods used to repair the manholes shall meet with the approval of the Town's Engineer.
- e. Use of or failure of this vacuum test shall not preclude acceptance by appropriate water infiltration or exfiltration (hydrostatic) testing per ASTM C 969, or other means.

E. DETAIL DRAWINGS

Relevant detail drawings are:

- 11 Precast Concrete Manhole
- 12 Drop Manhole
- 13 Cast-In-Place Base - New Manhole over Existing Sewer
- 14 New Sewer to Existing Manhole Connection
- 15 Force Main Connection to Manhole
- 16 Precast Concrete Flow Monitoring Manhole

END OF SECTION

SECTION 6 - FORCE MAINS

A. GENERAL

1. Force mains described and specified in this section are sewers which convey sewage under high pressure from pumping stations to locations in the gravity sewer system. Low-pressure sewers utilized with grinder pumps are specified in Section 7 of these specifications.
2. Force mains shall be installed in strict accordance with these specifications, and any applicable practices and precautions required for gravity sewers (Section 4) are equally applicable to the installation of force mains. These include, but are not limited to, excavation, pipe bedding, concrete encasement, and backfilling.

B. DESIGN

1. Pipe Material and Diameter of Pipe.

Pipe materials for force mains shall be Ductile Iron. The diameter shall be determined by the flow required to be conveyed and shall not be less than 4 inches.

2. Vertical Alignment.

During the installation of a force main, the pipe shall be laid at a constantly increasing grade to each air release manhole, or point of discharge. The Applicant shall provide sufficient construction control to assure that there are no sags or decrease in slope in the force main which could tend to accumulate and trap air.

3. Thrust Restraints and Blocking.

Thrust restraints shall be provided at all tees, crosses, bends, wyes, pipe ends, or other locations that have unbalanced pressure forces.

4. Air Valves.

The use of Air Release Valves will only be considered if it is demonstrated that they are absolutely necessary and that no alternatives are possible.

C. MATERIALS AND EQUIPMENT

1. Ductile Iron Pipe

- a. Pipe shall conform to ANSI Specification A21.51 or AWWA C151, latest edition, for the material class or pressure designated and ANSI A21.50 or AWWA C150, latest edition, for wall thickness.

- b. Minimum Thickness: Class 52.
- c. Pipe shall be by U.S. Pipe and Foundry Company, Inc., Griffin Pipe Products Company, American Ductile Iron Pipe Company, or approved equal.
- d. Joints
 - (1) Ductile iron pipe shall have rubber-gasket push-on joint or rubber-gasket mechanical joint. Rubber-gasket joints shall conform to AWWA C111. Gasket shall be of SBR. Ductile iron for use as restrained joint shall be mechanical joint pipe using Uni-Flange joint restraining glands. Pipe shall be used as indicated on drawings or details.
 - (2) Restrained joints shall be "Locked-type" joints manufactured by the pipe and fitting manufacturer that utilize restraint independent of the joint gasket. Restrained joints shall be suitable for the specified test pressure or the pressure rating of the pipe, whichever is greater. "Megalug" Series 1100 mechanical joint retainer glands as manufactured by EBAA Iron Inc. of Texas can be selected for restraining the mechanical joint of ductile iron pipe. Push-on restrained joints as manufactured by the pipe supplier or manufacturer, such as "Field-Lok" by U.S. Pipe or approved equivalent may be used subject to the Engineer's approval.
 - (3) Sleeve type couplings shall be Dresser Style 38, 138 or equal.

2. Ductile Iron Fittings

- a. Pipe fittings shall be ductile iron with pressure rating of 350 psi for 24-in and smaller piping and 250 psi for 30-in and larger piping. Fittings shall meet the requirements of AWWA C110 or AWWA C153 as applicable. Fittings shall have the same pressure rating, as a minimum, of the connecting pipe.
- b. Closures shall be made with mechanical joint ductile iron solid sleeves and shall be located in straight runs of pipe at minimum cover outside the limits of restrained joint sections. Location of closures shall be subject to approval of the Engineer.
- c. Mechanical joint fittings in sizes 4" through 24" shall meet the requirements of AWWA C153. Fitting shall be manufactured from a high strength, impact resistant ductile iron, having a minimum tensile of 70,000 psi with a minimum yield of 50,000 psi and a minimum elongation of 5%. Fitting wall thickness shall be CL 54 through 23" diameters and CL 56 through 24" diameters. Fittings shall be rated at 350 psi. Cement lining – all accessories, glands, bolts, and gaskets shall conform to ANSI A221.11 AWWA C111. Fitting shall be listed with Underwriters Laboratories. All fittings must be manufactured domestically. Where fittings are to be used with PVC piping systems, appropriate gaskets shall be furnished if required. Tees shall be used for lateral connections. Fittings shall be as manufactured by Griffin Pipe Products Co. or approved equal.

3. Ductile Iron Pipe and Fitting Interior Lining

- a. Cement mortar lining shall only be utilized in pipe and fittings that are continuously filled or full flow not exposed to the atmosphere. The cement mortar lining with an asphalt seal coat shall conform to ANSI Specification A21.4 or AWWA C104, latest Edition, except the thickness of linings should not be less than 1/8-inch.
- b. Hydrogen sulfide resistant linings shall be utilized in all pipe and fittings with partial flow depth or exposed to the atmosphere (in the vicinity of air valves, terminal manholes, etc.). These linings shall be one of the following:
 - (1) Protecto 401 ceramic-filled amine cured epoxy lining shall be as manufactured by Indurall. The lining thickness shall be 40 mils minimum. Application shall be performed by an applicator approved by the coating manufacturer, in accordance with manufacturer's instructions and under controlled conditions at the applicator's shop or the pipe manufacturer's plant. Applicator shall submit a certified affidavit of compliance with manufacturer's instructions and requirements specified herein.
 - (2) Calcium aluminate mortar shall be made of fused calcium aluminate cement and fused calcium aluminate aggregates as manufactured by Lafarge Calcium Aluminates or approved equal. The minimum lining thickness shall be 0.125-inch for 6 through 12-inch pipe, 0.1875-inch for 14 through 24-inch pipe, and 0.250-inch for 30 through 54-inch pipe. The interior and exterior of the spigot end and the interior of the socket end, including a portion of the pipe barrel, shall be coated with a minimum of 8-mils of epoxy prior to lining.
 - (3) Polyethylene lining shall consist of a blend of polyethylene powders applied to the interior of a preheated pipe. The nominal lining film thickness shall be 40 mils minimum. Polyethylene lining of ductile iron pipe shall be done at pipe manufacturer's plant; fittings shall be done at pipe manufacturer's plant, or at experienced shop approved by the pipe manufacturer. Applicator shall submit a certified affidavit of compliance with manufacturer's instructions and requirements specified herein.

4. Ductile Iron Pipe and Fitting Exterior Coating

- a. Buried pipe in corrosive soils shall be installed with a bituminous coating in accordance with AWWA C151 and C110 respectively.
- b. Buried pipe shall be installed with polyethylene encasement conforming to AWWA C105, where indicated on the Drawings or as directed by the Town. The polyethylene sheet shall be 8 mils thick minimum.
- c. Buried sleeve-type couplings shall have a protective wrapping of "Denso" material by DENSO Inc. of Texas or equal. Where "Denso" material is used, the joint shall be packed up with "Densyl mastic" to give an even contour for

c. Unstable Subgrade.

Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, any type of refuse, vegetable, or other organic material, or large pieces or fragments of inorganic material, which, in the opinion of the Town, should be removed such unsuitable material shall be removed to the width and depth recommended by the Town. Before pipe is laid, the subgrade shall be formed by backfilling with AASHTO No. 7 stone in 3-inch (uncompacted thickness) layers thoroughly compacted to 95% of maximum Proctor density and the bedding prepared as hereinbefore specified.

d. Special Foundations

Where the bottom of the trench at the subgrade is found to consist of material which is unstable to such a degree that, in the opinion of the Town, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, the applicant shall submit plans and descriptions, for the Town's approval, of an alternative method of stabilizing the foundation for the pipes.

4. Pipe.

a. General.

All pipes shall be laid and maintained to the required lines and grades with fittings and valves at the required locations; spigots centered in bells; and all valves plumb. Pipe laying shall commence at the lowest point and proceed upgrade.

b. Construction Control.

During the installation of a force main, the pipe shall be laid at a horizontal or positive grade to each high point, air release manhole, or point of discharge, as indicated on the Drawings. The Contractor shall provide sufficient construction control to assure that there are no sags or loss in grade in the force main which could tend to accumulate air.

c. Depth of Pipe.

All force main pipe shall be laid to a minimum depth of 3'-6" from grade to the crown of pipe.

d. Permissible Deflection at Joints.

If deflection is required, the amount of deflection shall not exceed the maximum limits as specified in the AWWA Standard C600, or these specified by the pipe manufacturer.

5. Fittings and Valves

a. General.

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

b. Valve Chamber.

Provide a PVC or HDPE lined precast concrete manhole for every air release and vacuum valve meeting the requirements for manholes as specified in SECTION 5 - PRECAST REINFORCED CONCRETE MANHOLES. The manholes shall be constructed of sufficient size to permit entry for valve repairs and afford protection to the valve and pipe from impact where they pass through the manhole walls. All valves and fittings shall be supported as indicated on the detail drawings.

6. Anchorage.

Anchorage of pipe and fittings shall be provided at all tees, crosses, bends, wyes, pipe ends, or at other locations that have unbalanced pressure forces. Anchorage shall be provided by one of the following:

a. Pipe manufacturer's restrained joint system as approved by the Town.

- (1) Provide computations for the embedment lengths required for the following minimum conditions:

Design pressure	=	150 psi
Depth of cover	=	3.5 feet
Safety factor	=	1.5
Soil type	=	cohesive granular
Soil internal friction angle	=	20 degrees
Soil cohesion	=	200 psf
Soil density	=	90 pcf

Ref. - "Thrust Restraint for Ductile Iron Pipe", DIPRA

- (2) Minimum restrained lengths required for pipe anchorage with restrained joints is detailed on Detail 20

b. Metal harness or tie rods

- (1) Metal harness or tie rods of adequate strength to prevent movement shall be used.
- (2) Restrained pipe length shall be the same as those for restrained joints.

- (3) Steel rods or clamps shall be type 304 stainless steel. The minimum number shall be as follows:
 - (a) Use a minimum of two ¾-inch diameter rods for pipes 6-inches and smaller
 - (b) Use a minimum of four 1-inch diameter rods for pipes 8-inches through 14-inches
 - (c) Mega-Lug retainer glands shall be utilized for securing anchor rods to the pipe. Duc-lugs shall not be utilized.
 - (d) Minimum restrained length required for pipe anchorage with metal harness and tie rods shall be the same as those indicated for restrained joint pipe.

c. Concrete anchor blocks

- (1) Concrete anchor blocks shall be designed for the same parameters as those for restrained joints with the additional condition:
- (2) Minimum allowable soil bearing pressure = 2000 psf
- (3) Minimum anchor blocks shall be as detailed on Details 21 and 22.

7. Backfilling.

- a. The trench may be filled with excavated material above the AASHTO No. 7 stone as specified above except that stones larger than eight (8) inches may not go in the trench and the fill shall not contain more than 20% stone in total volume.
- b. The trench shall be properly tamped in lifts not to exceed the maximum thickness for the type of tamping equipment being used. If the trench is in an existing street, the surface is to be restored as required by the regulating Town.
- c. All bedding and backfill shall be compacted to 95% of modified Proctor density.
- d. Backfilling shall not be done with frozen material. No backfilling shall be done if the material already in the trench is frozen.
- e. In State highways all backfill shall be in accordance with the requirements MD SHA.

8. Surface Restoration.

- a. In State highways surface restoration shall be in accordance with MD SHA Standard Specifications for Construction and Materials Section 500, or as specified in the MD SHA Permit issued for the subject project.

- b. In County roads, Town Roads, paved areas or other traffic areas surface restoration shall be in accordance with Washington County Roads Department Standards.

E. TESTING AND INSPECTION

1. Pressure Test.

a. General

- (1) After the pipe has been laid and backfilled as specified, all newly laid pipe shall be subjected to a hydrostatic pressure of 150 pounds per square inch, or 150% of the normal working pressure, whichever is greater in accordance with AWWA C-600.
- (2) Where any section of a force main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least five days have elapsed after the concrete reaction backing was installed. If high early strength cement is used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least two days have elapsed.
- (3) Air release valves shall be installed but isolated during testing of the pipeline.

b. Duration of Pressure Tests.

- (1) The duration of each pressure test shall be two hours or as determined by the Town.

c. Procedure.

- (1) Each section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. The pump, pipe connections, and all necessary apparatus, including gauges, shall be furnished by the Applicant and are subject to approval by the Engineer. The Applicant will make all taps into the pipe, and furnish all necessary assistance for conducting the tests. The Applicant shall supply either a container calibrated in 0.1 gallon increments or a laboratory certified calibrated water meter calibrated to an accuracy of 0.1 gallons.

(2) Expelling Air Before Test.

Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Applicant shall make the necessary taps at such points before the test is made. After the test has been completed, the Applicant shall remove and plug the taps or leave them in place at the direction of the Engineer.

(3) Examination Under Pressure.

Any cracks or defective pipes, fittings, or valves discovered in consequence of this pressure test, shall be removed and replaced by the Applicant, and the test shall be repeated.

(4) Leakage Test.

(a) A leakage test shall be conducted concurrently with the pressure test. The Applicant will furnish laboratory calibrated test gauge and measuring device and all necessary labor to conduct the test.

(b) Leakage is defined as the quantity of water that must be supplied into the newly laid pipe to maintain pressure within 5 psi of the specified test pressure after the pipe has been filled with water and the air expelled.

(c) No pipe will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

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

Where:

- L = testing allowance (makeup water), in gallons per hour
- S = length of pipe tested, in feet
- D = nominal diameter of the pipe, in inches
- P = average test pressure during the hydrostatic test, in pounds per square inch (gauge)

HYDROSTATIC TESTING ALLOWANCE PER 1,000 FT OF PIPELINE* - gph
(AWWA C600)

Avg. Test Pressure <i>psi</i>	Normal Pipe Diameter- <i>in.</i>										
	3	4	6	8	10	12	14	16	18	20	24
450	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82
400	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60
350	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37
300	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12
275	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80

*If the pipeline under test contains sections of various diameters, the testing allowance will be the sum of the testing allowance for each size.

- (d) When testing against closed valves, an additional leakage per closed valve of 0.0078 gallons per hour per inch of nominal valve size shall be allowed.
- (e) The Engineer will record both the makeup water and pressure at one-half hour intervals during the test period.
- (f) Should any test of pipe laid disclose leakage greater than that specified above, the Applicant shall, at his expense, locate, repair, and replace the defective joints, pipe, or fittings until the leakage is within the specified allowance.

F. DETAIL DRAWINGS

The relevant detail drawings are:

<u>No.</u>	<u>Description</u>
1	Pipe Bedding
2	Concrete Encasement
3	Lawn Restoration
4	Pavement Restoration (State, County and Town Roads)
5	Cutting & Repairing in Roadway Shoulder
15	Force Main Connection to Manhole

- 17 Air Release Valve and Chamber
- 18 Valve and Box Installation
- 19 Thrust Blocks for Tees, Caps and Plugs
- 20 Thrust Blocks for horizontal Bends and Lower Vertical Bends
- 21 Minimum Restrained Pipe Length for Pipe with Restrained Joints

END OF SECTION

SECTION 7 - LOW PRESSURE SEWERS

A. GENERAL

1. Intention.

The use of low pressure sewers, which are located in public roads or rights-of-way, is intended to provide sewer service to existing properties which cannot be served by conventional gravity type sewers or common pumping stations and force mains or as dictated by Town programs, which delineate a special service area to be governed by a Town generated management plan.

2. Approvals.

The Town will approve the use of low pressure sewers only under special circumstances. Where it is possible to install gravity-type sewers, or where it is feasible to utilize sewage pumping stations and force mains, the use of low pressure sewers will not be permitted.

3. Developers.

Developers, who wish to provide sewer service by using low pressure sewers within tracts to be developed, must familiarize themselves with all applicable management plans. Grinder pump systems will be used in low pressure sewer systems. The proposed use of grinder pumps and low pressure sewers will be reviewed on a case-by-case basis.

B. DESIGN

1. Design.

It is incumbent upon the Applicant to provide full details of the proposed design of low-pressure sewer systems for review by the Town.

2. Pipe Profile

Every attempt shall be made to construct low pressure sewers at a continuously rising grade to the point of discharge (high point). Where this is impossible and localized high points in the line (profile) are created, air-release valve(s) must be installed.

3. Pumps.

Pumping units will be individual on-lot grinder pumps for residential applications and duplex grinder pump systems for commercial and industrial applications as described and specified in Section 8 - GRINDER PUMPS.

SECTION 8 - GRINDER PUMPS

A. GENERAL

1. Grinder pumps are to be used if it is intended that low pressure sewers, as described in Section 5, are to be installed. Grinder pumps shall also be used if the property to be served cannot be served by a gravity type system. The proposed use of grinder pumps will be reviewed on a case-by-case basis.
2. Simplex (single) grinder pump units shall be used at residential property locations, and duplex (double) grinder pump systems shall be utilized at non-residential properties. Additionally, provision of a spare pump and a standby power supply are recommended for non-residential uses.
3. Grinder pump units shall be installed in either concrete or fiberglass-reinforced polyester basins for outdoor installations only. Indoor installations will not be permitted.
4. The grinder pump package shall consist of the basin, grinder pump(s) and motor(s), quick disconnect rail system, junction box, start-stop level controls, motor high temperature shutoff, motor seal leak alarm, high water alarm, shutoff valve, pump check valve and redundant check valve, discharge piping and fittings, and all internal wiring terminating in a junction box.
5. The location of the grinder pump package and control panel shall be determined by the Applicant.

B. GRINDER PUMP UNIT

1. The pump unit shall consist of a centrifugal grinder type pump with accessories as specified herein. The pumps shall comply with the following characteristics:
2. Pumps shall be of sufficient horsepower to perform the intended work and shall be a minimum of 2 horsepower.
 - a. Residential
 - (1) Maximum Flow = No greater than 50 gpm at 10 feet Total Head
 - (2) Minimum Flow = 10 gpm at 90 feet Total Head
 - (3) Minimum Shutoff Head = 105 feet
 - b. Non-Residential
 - (1) Maximum Flow = To be determined based on application

(2) Minimum Flow = To be determined based on application

(3) Minimum Shutoff Head = To be determined based on application

3. Acceptable Pump Types.

- a. The manufacturer and model of acceptable grinder pump, or equal approved by the Town, is the following:

Manufacturer

Model

F.E. Myers Co.

WG-20 (residential)

F.E. Myers Co.

WGX20, WGX30, WGX30H, WGX50H, WGX75H (non-residential).

4. Submersible Pump and Motor.

- a. The grinder pump and motor are to be specifically designed and manufactured so they can operate completely submerged in wastewater. Electrical power cord is to be sealed by use of a cord grip, with individual conductors additionally sealed into the cord cap assembly with epoxy sealing compound, thus eliminating water entering the motor by following individual conductors inside the insulation. The cord cap shall be sealed into the motor housing with a Buna-N o-ring, providing an electrical connection which is completely watertight, yet may be easily removed for service.
- b. The combination centrifugal pump impeller and grinder unit shall be attached to a common motor and pump shaft made of stainless steel. The grinder unit shall be on the suction side of the pump impeller inlet leaving no exposed shaft to permit packing of ground solids. Both stationary and rotating cutters shall be made of hardened and ground stainless steel.
- c. The pump-motor shaft shall be sealed by two mechanical carbon and ceramic faced seals or similar material within an oil filled seal chamber. An electric sensing probe shall be mounted in the seal chamber to detect any water leakage past the lower seal before damage is done to the motor. The seal probe circuit sensitivity shall not be affected by cable length between the motor and the seal probe circuitry in the control panel. This probe shall be connected to an amber light in the control panel.
- d. The shaft shall be supported by two radial and thrust ball bearings and a lower bronze radial sleeve guide bushing for radial load from grinder impeller. Ball bearings shall be designed for 50,000 hours B-10 life.
- e. The rotor winding and rotor are to be mounted in a sealed, submersible type housing which is filled with clean high dielectric oil or air as pump design dictates. A heat sensor thermostat which will detect overheat conditions and

stop the pump shall be located in the motor winding. When the temperature drops to a safe level, the pump will automatically reset.

- f. Submersible motor shall be constant speed, suitable to operate on a 240 volt, 60 HZ, single-phase service. The motors shall be of proper size to drive the pump at any point on the pump curve. The motor shall be a capacitor start-capacitor run type with high starting torque.
 - g. Motor shall be amply rated for the head and capacity values specified, on continuous duty, without exceeding 1.0 service factor load at the minimum capacity design point, and without exceeding the motor full service factor load at any head between shutoff and 10 feet TDH, which is the minimum expected dynamic head to be found in this installation.
 - h. For non-residential installations, the use of explosion proof motors and the provision of a spare pump are recommended.
5. Rail Assembly.
- a. A lift-out guide rail assembly shall be included as part of the grinder pump unit, which will permit easy removal and installation of the pump and lower check valve without the necessity of personnel entering the basin. Stainless steel guide brackets with guide brackets and guide yokes of sufficient bearing strength to prevent binding shall bolt to the pump. The yokes shall mate over stainless steel guide rail support which shall be attached to and be supported by the basin sidewalls and the fixed attachment point on the floor of the basin. The guide rails may be supported by a fixed connection to the top of the basin provided that the connection is not part of the removable access cover and is not affected by the removal of the access cover. All bolts, brackets and fittings used in the lift-out assembly shall be of stainless steel.
 - b. A stainless steel lifting chain shall be securely fastened to the top of the pump and to the top of the basin to facilitate removal of the pump. The chain shall be minimum of 1/4" welded link type to support the weight while removing and installing the pump.
6. Level Controls.

Sealed float-type mercury switches shall be supplied to control sump level and alarm signal. The mercury type switches shall be sealed in a solid polypropylene float for corrosion and shock resistance. The support wire shall have a heavy neoprene jacket. A weight shall be attached to cord above the float to hold switch in the sump. Weight shall be above the float to effectively prevent sharp bends in the cord when the float operates. Two float switches shall be used to control level: one for pump turn-on and one for pump turn-off. A third switch shall be provided for high water alarm and redundant pump turn-on. The float switch shall hang in the sump and be supported by a stainless steel bracket and cord snubber which will give positive support to the controls and allow flexibility in the setting of levels.

7. Operation of System.

On sump level rise, lower mercury switch shall first be energized, then upper level switch shall next energize and start pump. With pump operating, sump level shall lower to low switch turn-off setting and pump shall stop. If level continues to rise when pump is operating, alarm switch shall energize and activate the alarm. All level switches shall be adjustable for level setting from the surface.

8. Corrosion Protection.

All materials exposed to wastewater shall have inherent corrosion protection, i.e., cast iron, fiberglass, stainless steel, or PVC. Any interior steel surfaces are to be suitably protected against corrosion. All fasteners shall be stainless steel.

9. Junction Box.

- a. The junction box shall be constructed of fiberglass for corrosion resistance at residential properties and NEMA 7 at commercial/industrial properties. The enclosure shall be of adequate thickness and properly reinforced to provide good mechanical strength. The junction box shall have a fully gasketed cover that is held in place by four stainless steel captive screws with slotted/flat sided heads totally encapsulated in PVC so that no metal parts are exposed. The cover shall be connected to the body with stainless steel chain.
- b. An adequate number of sealing type cord grips shall be supplied for incoming pump and switch cords. The cord grips shall be made of non-corrosive material, such as PVC or nylon, and shall have rubber compression bushing that will make an effective seal around the wire jackets. The cord grip shall also seal to the junction box wall with an o-ring, gasket, or other effective means.
- c. The hub shall be of a corrosion resistance material and shall be of adequate size to accommodate the number of wires required to operate the pump.
- d. A method for sealing the incoming wires in the junction box shall be supplied by the manufacturer so that condensation from the conduit or ground water will not enter the enclosure; or, an explosion-proof conduit seal shall be required. Duct seal shall not be used.
- e. Wires shall be connected within junction box by means of wirenuts and the connections further protected by non-hardening sealant.
- f. Electrical cable for power and control wiring between the junction box and each pumping unit shall be supplied. Wire size shall be selected in accordance with amp capacities required by the National Electric Code.

C. VALVES

1. Check Valves.

- a. The pumps shall be equipped with factory-installed integral flapper-type check valve or integral ball check valve built into the discharge pipe. This valve shall provide a full-ported passageway when open, and shall introduce a friction loss of less than six inches of water at maximum rated flow. The valve body shall be made of cast iron.
- b. Working parts of flapper-type check valves shall be made of 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A non-metallic hinge shall be an integral part of the flapper assembly providing maximum degree of freedom for assured seating even at a very low pressure.
- c. Ball check valves shall include a corrosion resistant non-metallic ball and rubber sealed seat.

2. Ball Valve.

The pump shall be equipped with an isolation ball valve which shall be PVC (Sch. 80), or stainless steel construction, three-piece design, full port, with TFE seals and seat valves shall have screwed end connections and shall be lever-operated with an extension handle extended vertically to a supporting bracket fixed not more than twelve (12) inches below finish grade. Valves shall be as manufactured by Jamesway Corporation, Worcester Controls, or approved equal.

3. Redundant Check Valve.

- a. All pumps shall include one additional separate check valve per unit for installation in the discharge line inside the pump basin to ensure maximum protection against backflow.
- b. The valve shall be gravity operated flapper-type or ball type. The check valve shall provide a full-ported passageway when open and shall introduce a friction loss of less than six inches of water at maximum rated flow. Working and internal parts shall be at least equal to those specified above for the check valve.
- c. The valve body shall be a high gloss, injection molded part made of PVC Type I-II with hub and socket compatible with 1-1/2-inch PVC pressure pipe, Schedule 80. Dimensions for hub and socket shall be in accordance with commercial standards C5-272-65.

4. Anti-Siphon Valve.

The basin assembly shall be arranged for quick and easy acceptance of an anti-siphon valve in the field when required. A riser pipe shall extend from the pump

discharge between the check valve and the shutoff valve to within two feet of the surface of the basin. The riser shall be capped. When required, an anti-siphon valve shall be offered to assemble to the riser pipe. The valve assembly shall include all materials required to complete the assembly. The anti-siphon valve shall mount horizontally, shall be made of PVC and not interfere with pump removal or installation.

5. Flexible Discharge Coupling.

The pump discharge piping within the pump basin and the discharge force main shall be connected with a flexible discharge coupling to accommodate differential settling of the force main and the pump basin. Flexible discharge couplings shall be made of an inner corrugated hose sheathed in an outer braid. Flexible discharge couplings shall be constructed of stainless steel (all parts) and shall be rated for 345 psi.

D. BASINS

1. General.

- a. Either concrete or fiberglass basins may be provided. All basins shall register a minimum 4-inch above finished grade to prevent infiltration of surface water. The basin shall be located in an area not subject to flooding or ponding.
- b. For residential installations, a minimum net effective storage volume of 50 gallons between the pump shut-off elevation and the invert of influent line from the connected structure shall be provided for residential installations. For non-residential installation, a minimum operating tank volume of 1,000 gallons or 24 hours of storage, whichever is greater, shall be provided. Non-residential storage requirements may be reduced by provision of a back-up power source and a spare pump.
- c. A non-corrosive sign shall be attached to the basin cover indicating that the pump basin is a hazardous area where confined space entry procedures are required.
- d. The basin shall be provided with an anti-flotation collar to prevent flotation of the basin at high groundwater elevation when the basin is empty.
- e. The minimum acceptable basin diameters are as follows:

For pumps of 5 horsepower or less:	48-inch diameter (minimum)
For pumps greater than 5 horsepower:	60-inch diameter (minimum)
- f. In all cases, the developer shall confirm that a basin of sufficient volume and area is provided to allow for effective pumping system operation and maintenance.

2. Concrete Basin.

- a. Precast reinforced concrete chambers shall conform to ASTM Specifications C-478 (Latest Revision) and shall be of watertight construction. Joints between sections shall be provided with preformed plastic joint sealing material such as Rub'R-Nek as manufactured by K.T. Snyder Co.
- b. The preformed joint sealer shall be protected by a removable two-piece wrapper and shall be applied in strict accordance with the manufacturer's recommendations. The chemical composition of the sealer shall meet the following requirements: bitumen - ASTM D-4-52, Inert Ash Mineral AASHTO T-111-42, Volatile Matter ASTM D-6-39T.
- c. Mixing water for mortar and concrete shall be clean and free from oil, acid, alkali, sewage or other deleterious substances.
- d. Portland cement shall conform to ASTM Specification C-150, Type I. Where specifically authorized or required, high early strength (Type 3) shall be used.
- e. Concrete shall have a compressive strength of not less than 3,000 psi after 28 days (tests to be in accordance with ASTM Specification C-39, Latest Revision). Aggregate shall be of quality, gradation, and proportions as approved by Engineer after submission of test results on the design mix. Each cubic yard of concrete shall contain no less than 6 bags of Portland cement. Slump of concrete shall not exceed 4 inches. Ready mixed concrete shall conform to ASTM Specification C-94 (Latest Revision).
- f. Reinforcing steel shall be clean and free from rust, scale or coatings that will reduce bond.
- g. The exterior of concrete basins shall be coated with bitumastic no less than twenty (20) mils in thickness. The coating shall be Bitumastic Super Service Black as manufactured by Koppers or approved equal.
- h. The interior of concrete basins shall be lined with PVC or HDPE to prevent hydrogen sulphide corrosion.
- i. Concrete basins shall be equipped with access cover and frame assembly of extruded aluminum with aluminum or stainless steel fittings. Each cover shall be provided with a lifting handle, safety catch to hold cover and locking hasps. The cover surface shall be of a non-skid checkered pattern and shall be provided with a padlock. This lock shall be of the solid rustless case design with hardened steel shackle and zinc coating. In paved/traffic areas, basins shall meet the loading requirements of H-20 or H-25 as appropriate.

3. Fiberglass Basin.

- a. The basin shall be custom molded of fiberglass reinforced polyester resin using a lay-up and spray technique which will assure that the interior surface is

smooth and resin-rich. The basin shall have a nominal wall thickness of 1/4-inch.

- b. The fiberglass basins shall be built in accordance with:
 - (1) Plastics Laminate ASTM C581 and C582.
 - (2) Chemical-Resistance Test ASTM C581. Previous tests will be acceptable provided laminates are representative.
- c. The basins shall be free of imperfections, sound, watertight, and of high quality workmanship. Basins shall have lifting lugs or other devices for unloading and installation. All conduit and piping connections shall be plugged for shipment.
- d. One minimum 4-inch diameter inlet hub shall be provided for each grinder pump unit. The inlet hub shall be suitable for use with 4-inch PVC, Schedule 40 pipe. Hubs shall be field installed to meet field conditions.
- e. One discharge coupling, as specified in the VALVES section, shall be provided for the grinder pump unit. Internal piping shall be provided to this discharge coupling. The depth of the discharge coupling (crown of coupling to finish grade) shall be no less than 54-inches.
- f. Fiberglass basins shall be equipped with an aluminum or fiberglass cover. The cover shall be bolted to the basin with stainless steel cap screws. Stainless steel nuts for the screws shall be bedded in the fiberglass to prevent turning and for corrosion resistance.
- g. Provision of bollards to protect the structure is recommended in areas where there is potential for traffic.

E. ELECTRICAL CONTROL PANEL

1. General.

- a. A separate remote electrical control panel shall be installed as shown on the detail drawings. In addition, the panel shall contain a U.L. Listed NEMA sized motor contactor having a guaranteed component life span, without maintenance or contact replacement; of one million operations (Definite purpose contactors will not be allowed). The panel shall have an adjustable or non-adjustable 2 pole bi-metallic temperature compensated U.L. listed overload relay meeting NEMA Class 10 tripping characteristics, and the auxiliary contact of the overload relay must be connected in series with the motor contactor coil to switch off the contactor in event of overload. The panel shall also have lightning protection and any other items required for proper control of the centrifugal type grinder pump unit. The incoming wires/conduit shall be provided with a water tight seal.

- b. The enclosure shall contain an inner back panel for mounting of the internal components. The enclosure shall be fully gasketed, hinged, NEMA 3R design of 16 Ga. metal, primed and painted grey enamel, with combination closing latch and locking hasp.
- c. The control panel shall be fitted with an integral amber tamperproof polycarbonate alarm light on the top. The light unit shall be as furnished by (or approved equal):
 - (1) Ohio Electrical Control, Inc.
1661 Cleveland Road
Ashland, Ohio 44805
Telephone: (419)289-1153
 - (2) Electromate Corp.
7531 Salisbury Road
Jacksonville, Florida 32216
Telephone: (904)731-9270
- d. The lamp shall be 40 watt medium base type and be easily replaceable from within the enclosure. The light shall be provided with a lamp test switch mounted within the panel. The alarm light shall be flashing type activated by both moisture in the pump seal chamber and high water in the wet well and shall go out when the condition(s) cease.
- e. Inside the control enclosure shall be a red 1-inch neon glow lamp high water indication and an amber 1-inch neon glow lamp for moisture leak detection. The flashing light on the enclosure top shall flash when either or both lights within enclosure are activated due to failure.
- f. A silkscreen or phenolic nameplate shall be provided above each component with the name of the component inscribed or failure inscribed when labelling the indicator lights.
- g. A "Hand-Off-Auto" selector switch shall be provided within a control panel for operating the pump manually when in "Hand", pump disable when in "Off", and normal operation when in the "Auto" position. The selector switch shall not disable the alarms under any condition.
- h. A stainless steel main disconnect switch shall be provided with padlocking device to deenergize the panel. Toggle switch shall not be considered. From the load side of this switch shall be a two-pole circuit breaker for motor overload and short-circuit protection. Also, and in parallel with the above breaker shall be a circuit breaker for protection of the control circuit.
- i. An electrical wiring diagram shall be supplied and attached to the inside of the panel enclosure. This diagram shall identify wire color, external connections to a numbered terminal block and shall be arranged in a functional sequence ladder type diagram.

- j. The control panel enclosure shall be provided with padlock. This lock shall be of the solid rustless case design, with a hardened steel shackle and zinc coating.

2. Control Panel Supports.

The control panel support for Property Owner installations, shall consist of 2" diameter stainless steel posts with cap or 3" x 3" x 3/16" gauge structural steel tubing (minimum yield strength 46,000 psi), all horizontal support channels and panel connection hardware, coated with baked-on epoxy ASA 61 paint. The length of pipe or post shall be embedded in a concrete foundation to the dimensions shown on the detail drawings. The top of the channel shall be permanently sealed from the elements.

F. INSTALLATION

1. The grinder pump unit shall be installed at a location to be determined by the Property Owner or Applicant. Generally, the unit will be located in close proximity to the existing sewer service line near the building.
2. The depth of the grinder pump unit will be dependent upon the location and depth of the existing house service. The minimum total unit depth from the invert of sump pit to top of entry hatch shall be no less than six feet and no greater than sixteen feet.
3. All grinder pump basins shall be installed on a 6 inch bed consisting of AASHTO No. 7 coarse aggregate and shall have a concrete anti-flotation collar poured around the bottom that shall prevent floatation when there is high groundwater to top of basin and the basin is dewatered. The remaining excavated area shall be backfilled to grade with excavated material containing no soil lumps, stones, concrete, or foreign objects greater than one inch in maximum dimension. The top of the pump unit or basin shall project above grade and topsoil with seed and supplements shall be placed around the unit and sloped away from the unit to prevent ingress of surface water.

G. TESTING AND INSPECTION

1. It is incumbent upon the Applicant to request the Town to inspect the pump after installation is completed. The Applicant shall provide all pressure gauges and other equipment necessary to perform the tests. The work will be tested and inspected for:
 - a. Tank cracks, loose fittings and general workmanship.
 - b. Minimum depth of force main and stone bedding.
 - c. All specified required fittings, valves, and appurtenances.

2. Hydraulic test pressure of 50 pounds per square inch, or 150 percent of the normal working pressure, whichever is greater, or as determined by the Engineer, shall be applied to the force main in accordance with AWWA C-600. There shall be no drop in pressure for a period of 15 minutes.
3. The pump shall be run against a closed valve and the shut-off pressure observed. The pressure gauge may be located at any point on the discharge side of the pump.
4. The pipe trench will be backfilled only after the inspection and testing has been completed.

H. DETAIL DRAWINGS

Relevant detail drawings are:

<u>No.</u>	<u>Description</u>
25	Typical Grinder Pump Service Connection Schematic to Gravity Main
26	Typical Grinder Pump Service Connection to Low Pressure Sewer
27	Fiberglass Basin for Typical Individual Grinder Pump
28	Concrete Basin for Typical Individual Grinder Pump
29	Wall Mounted Control Panel (External Installation)
30	Post Mounted Control Panel (External Installation)

END OF SECTION

SECTION 9 - PUMPING STATIONS

A. GENERAL

1. State Requirements.

Sewage pumping stations shall be properly designed to conform to all applicable regulations of the Maryland Department of Environment, OSHA, and the Maryland Department of Labor, Licensing, & Regulation. Prior to acceptance by the Town, detailed construction drawings and specifications, as well as the design calculations, must be submitted for review and approval.

2. Pumping Station Types.

- a. The standard sewage pumping station shall be based on Gorman-Rupp self-priming suction lift pumps, taking flow from a concrete wet well, combined with an end of pipe comminutor, and a diesel powered emergency electrical generator with transfer switch. All above ground facilities shall be enclosed in a permanent masonry building.
- b. Both wet well/drywell and submersible type stations will be considered for unique conditions that cannot be adequately addressed by the standard suction lift pumping station. These requirements pertain to pumping stations that will serve multiple and/or industrial or other developments that discharge sewage by gravity to the pump station site. They do not apply to individual effluent or sewage pumps in low-pressure systems.
- c. Pumping stations using submersible pumps will be limited in size by flow and head conditions. As a guide for design purposes, if the Total Head in feet, multiplied by the Flow in gallons per minute, is greater than 30,000 then a walk-down concrete wet well/drywell station may be required. Future flow conditions will be included when determining the type of pumping station required. The type of pumping station is subject to the approval of the Town.

3. Permits.

The Applicant shall secure, in the name of the Town, all permits that are required in the name of the Town such as those from MDE and MD SHA. The Applicant shall secure, in his own name, all required construction permits such as local street opening permits. Any existing street, highway, or other improvements disturbed during construction shall be restored to the satisfaction of the appropriate municipality or Owner before the facilities will be accepted for final acceptance by the Town. All costs of such permits, including any and all bonds required, shall be the sole expense of the Applicant.

4. Environmental Class.

Special consideration must be given to the fact that wet wells, other than those in residential properties, are considered a hazardous Class 1, Group D environment.

5. Safety Requirements.

All gears, chains, coupling, projecting set screws, keys and similar rotating or reciprocating parts shall be protected in accordance with American Standards Association Safety Code for Mechanical Power-Transmission Apparatus 815-1927.

6. Drawings and Details.

The Applicant shall furnish the Town detailed plans and instructions for installation and operation of the pumps, detailed drawings showing the specific piping arrangement required for the proposed pumping station, and two copies of the characteristic performance curves for each proposed pump. The drawings will be examined only for general design, general dimensions and apparent suitability and will be approved or returned for the changes required. Such approval will not relieve the Applicant of the responsibility for furnishing equipment which will satisfactorily perform under the conditions specified.

B. DESIGN

1. Site.

- a. The pumping station site shall be properly graded to eliminate any storm water problems and/or ponding conditions. After grading, the site shall be seeded and landscaped. Provisions shall be made to include shrubbery in the landscaping to enhance the appearance of the station as determined by the Town of Boonsboro Zoning Ordinance & Town Charter. The Applicant is responsible for obtaining a good stand of grass until the time of first cutting.
- b. The site shall be of sufficient size to accommodate the pumping facilities and to permit necessary vehicular access for maintenance of the equipment and facilities as well as the turn-around of service vehicles. The minimum size shall be as determined by the Town of Boonsboro Zoning Ordinance & Town Charter. Depending upon the locality, topography and pumping station type, a larger area, as determined by the Town may be required.

2. Access Road and Turn-around.

- a. The access road and turn-around at the pumping station shall have a paved surface. The minimum width of the paved surface of the access road shall be 12 feet and the access road and turn-around shall be constructed to the following minimum requirements:

Formed, shaped and compacted subgrade
Compacted graded aggregate base -- 6" thick

Hot mix asphalt base - Superpave 12.5 mm -- 1-1/2" thick
Hot mix asphalt surface - Superpave 9.0 mm -- 1" thick
Toe drains and stormwater culverts as dictated by topography

- b. The paved area within the fenced area must be large enough and be designed to allow the turn-around of an AASHTO standard Single Unit Utility Vehicle with a wheelbase of 20 feet and width of 8 feet 6 inches.

3. Fencing.

- a. The site shall be fenced with a 6'-0" high, barbed wire topped, polyvinyl chloride (PVC) coated chain link fence with single or double swing gate vehicle access gate and a man access gate. The man-gate may be integral with the swing gate or may be a separate gate.
- b. The chain link fabric shall conform to Federal Specification RR-F-191/1D. The chain link fabric shall be Type 1. The fabric shall be 9 gauge core wire and galvanized all conforming to ASTM A641, woven after PVC coating in a 2-inch mesh. Top and bottom selvages shall have a twisted barbed finish, barbs to be formed by cutting wire on a bias. Fabric to be attached to intermediate posts with No. 6 aluminum fabric wire spaced approximately 15-inches apart and to the top rail with 9 gauge wires spaced approximately 18-inches apart. The fabric shall be fastened to all terminal and gate posts with 1.4-inch by 3/4 inch stretcher bars with No. 11 gauge pressed steel bands spaced approximately 12-inches apart. All bands, wires and tension bars shall conform to Federal Specification RR-F-191/4D.
- c. Posts, rails, and braces shall conform to Federal Specification RR-F-191/3D and be fabricated of Class I (round steel sections), Grade A (hot dipped galvanized), seamless steel pipe, in accordance with ASTM A53 (Schedule 40), PVC coated to match fabric and be of the following sizes:
 - (1) Corner and terminal posts: SP3 (2.375-inch o.d.)
 - (2) Line posts: SP2 (1.900-inch o.d.)
 - (3) Gate posts: SP5 (4.000-inch o.d.)
 - (4) Rails and braces: SP1 (1.66-inch o.d.)
 - (5) Spacing of posts shall not exceed 10-feet.
- d. Gate and hardware shall conform to Federal Specification RR-F-191/2D. Gate shall be constructed of Class I, Grade A seamless steel pipe, size SP1, plus additional intermediate members when required and meeting the requirements of RR-F-191/3D. Gate frame shall be of welded construction or shall be assembled using fittings. When fittings are used, the frame shall be fitted with 3/8-inch minimum diameter adjustable length truss rods, meeting the requirements of Federal Specification RR-F-191/4D. When the frame is welded, all welding shall be done prior to galvanizing and application of PVC coating. Gate fabric shall be the same as for the fence. Install fabric with stretcher bars attached to gate frame at not more than 12-inches o.c. Extend end members 1-foot above the top horizontal member of the gate frame and attach three strands of barged wire, uniformly spaced to end members with bands, clips or eyebolts.

- e. Both gates shall be provided with hot-dipped galvanized hinges, latches, stops and keepers in accordance with ASTM A153 and PVC coated to match the chain link fabric. Hinges shall be pressed steel or malleable iron, non-lift-off type, and offset to permit 180-degree gate opening. Latch shall be forked type to permit operation from either side of the gate. Provide padlock eye as integral part of latch.
- f. The PVC coating for the chain link fabric shall be Class 2a or 2b as defined by ASTM F668. Posts, rails, and appurtenances shall be PVC coated 10 to 14 mil thick by factory heating adhesive coated steel and melting powered PVC to the surfaces. Bolts and nuts shall be cleaned as required and field coated after installation with two coats minimum of an approved liquid PVC patching compound compatible with and of the same quality as all other PVC coatings.
- g. Fence and gate(s) shall be topped with three strands of barbed wire consisting of two 12-1/2 gauge twisted line wires with 14 gauge round aluminium wire barbs having 4 points and spaced at 5-inches on center, with color to match fabric. Barbed wire support arms shall be single arm, for three strands of barbed wire and be at an angle of 45-degrees, with the top strand being 12-inches above and 12-inches out from the fence line.
- h. Set all posts to a depth of 3-feet unless otherwise shown. After setting and plumbing the posts fill the holes with 2,500 psi concrete. Crown top of concrete to shed water.

4. Lighting:

- a. The site shall be provided with overhead exterior lighting.

5. Flow Metering.

- a. A flow metering device which is capable of continuously recording pumped flows and displaying instantaneous flow rate and totalized flow shall be provided. Meter shall be a COPA-X, Series 10D14654, magnetic flowmeter by Bailer-Fischer & Porter Company. It shall have a polyurethane liner; ANSI 150, 304 stainless steel flanges and metering tube; 316 SST bullet nose type electrodes; Division 2, Hazardous Location, safety rating; operating on 120 V AC, 60 Hz power; 120 V AC, 60 Hz remote mounted electronics; occasional submergence enclosure; process temperature to 190° F; 4-20 mA DC output signal. Meter shall be factory calibrated with a copy of the report in the O & M manual. Meter grounding shall be in accordance with the manufactures recommendations. Meter shall be capable of running empty indefinitely without damage to any component.
- b. A flow converter / transmitter shall be furnished with the meter. It shall operate on 120 V, 60 Hz power, have an isolated 4-20 mA output into a 0 to 1000 ohms; with a NEMA 4Xwall mount; connecting signal cable between flow meter and signal converter; and a seven digit, non-reset tantalizer on the face of the enclosure and a scalable pulse output to drive the totalizer with a multiplier power of 10.

- c. A microprocessor based circular chart pen recorder and totalizer shall be provided to record the flow on a circular 10" or 12" diameter chart, 7-days/24 hour adjustable chart speed and a one year supply of pens and charts. Recorder shall be by Bailey-Fischer & Porter, Bristol or Honeywell. It shall operate on 120 V, 60 Hz power, and an input signal of 4-20 mADC. Recorder shall integrate and display the totalized flow and be of the non-reset type and shall not reset on loss of power. Pens shall be of the disposable ink type. The mounting case shall be NEMA 3 or 4, as required, for wall or panel mounting.

6. Comminutors.

- a. All pumping stations shall be provided with comminutors. The comminutor shall normally be mounted on the end of the wet well influent pipe and be equipped with an auto-coupling slide rail system allowing for removal to surface with no requirement to enter the wet well. The unit shall be manufactured by G.E. T. Industries, Inc., JWC Environmental, Inc., or Moyno, Inc. and shall be specifically designed for the proposed installation by the manufacturer. Any other comminutor makes and models are subject to the approval of the Town. The unit shall be capable of passing the peak hour design flow without bypassing flow and have satisfactory operation under zero flow conditions. The unit shall be powered by a totally enclosed, non-vented, floodproof motor, suited for occasional total submergence. The rotating drum screen shall be cast ductile iron and the casing shall be cast iron with an A.S.A. 125 lb. standard flange for pipe mounting. The cutting elements shall be manufactured from A2 tool steel hardened to 56 Rockwell C57. The stationary cutter shall be reversible allowing for four sets of cutting edges prior to replacement. All fasteners, swing bolts and hinge pins shall be of stainless steel.
- b. The auto-coupling slide rail system shall be manufactured with Type 316 stainless steel having a minimum diameter of 1.5-inches, extending from the lower operating position to the upper guide holed which shall be an integral part of the stainless steel access cover frame. It shall also incorporate an emergency bypass overflow pipe section ahead of the comminutor to allow flow to bypass to the wet well in the event of comminutor blockage. This unit shall be fabricated with Type 316 stainless steel. The comminutor access hatch shall be fitted with concealed hinges and a lockable lifting handle. A removable lifting davit and stainless steel chain shall be provided to raise and lower the comminutor.
- c. A reverse clearing control panel shall be provided in a NEMA 4X enclosure with momentary reversing, automatic shutdown and alarm protecting the comminutor from damage. The control system shall sense an overload or jam condition; reverse the drum rotation for a 2-second period, then restore forward rotation. This sequence shall persist until the obstruction has been cleared, or until the motor overload protection trips out the motor.

7. Water Supply.

- a. Where public water supply is available, furnish and install a minimum 1" diameter metered water service with reduced pressure backflow preventer (RPBP). The RPBP shall be installed in a location above grade, where it will not be susceptible to

flooding. The water supply shall terminate at a frost-proof yard hydrant. Hose bibs shall also be provided in the drywell in the case of wet well/drywell station. Service to include all fees and charges for the provision thereof.

- b. Where public water supply is not available, furnish and install a well and pump with all controls, power supply, bladder type hydro-pneumatic pressure tank, air line / gage well water level detection system, frost proof hydrant, and necessary appurtenances. The well and pump must be capable of producing a minimum of 5 gpm at 50 to 70 psi gage pressure at the hydro-pneumatic tank.

C. MATERIALS AND EQUIPMENT

1. Description of Equipment.

The Applicant shall furnish a complete description of all equipment to be supplied including manufacturer's information and relevant pump characteristic curves based on laboratory tests of existing similar pumps. The curves shall show the capacity, head, efficiency and brake-power throughout the head and capacity range.

2. Spare Parts and Tools.

- a. The Applicant shall furnish one complete set of all the tools that are necessary for the maintenance and repair of the pumps. One pressure grease gun for each type of grease required for pumps and motors shall be furnished.
- b. Spare parts shall consist of one extra set of ball and/or roller bearings, two sets packing, or mechanical seals for each pump, and one extra shaft sleeve for each pump size. For submersible pumping applications, one spare pump shall be provided.

3. Pipes and Fittings.

- a. Suction and discharge flanged piping shall be Class 53 (Min), cement lined Ductile Iron in accordance with ANSI A21.50 and ANSI A21.51 or AWWA C115 and C150. Fittings shall be Ductile Iron in accordance with ANSI A21.10 or AWWA C110, up to 12" inclusive, 250 psi rated. Flanged joints shall be used inside structures or above grade.
- b. Cement mortar lining shall be twice the normal thickness and have an asphaltic seal coat. Unless otherwise specified, all coatings shall be shop applied with "hold-backs" provided as required at pipe and fitting ends for satisfactory installation for joint connections in the field. Provide all necessary coating materials to perform field coating applications at joints. Unless otherwise noted, field applied coating material shall be compatible with or equal to the shop applied material. Field repair of pipe with damaged coating shall receive prior approval of the Engineer. If, in the opinion of the Engineer, the coating damage is beyond repair, the pipe shall be replaced at the expense of the Contractor. All flange bearing surfaces shall be uncoated.

- c. Unless otherwise specified, all exposed exterior ferrous surfaces shall be painted with an applicable paint system.
- d. Pipe hangers and supports shall be provided at suitable distances along the pipeline. Pipe hangers and supports shall conform to MSS SP-58: Pipe Hangers and Supports - Materials, Design and Manufacture and MSS SP-69: Pipe Hangers and Supports - Selection and Application. All hangers and supports shall be of an approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for all supporting equipment, with the exception of springs, shall be five times the ultimate tensile strength of the material, assuming 10-feet of water filled pipe being supported. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment.
- e. All rods, clamps, hangers, inserts, anchor bolts, brackets and components for interior pipe supports shall be furnished with galvanized finish, hot dipped or electro-galvanized coated, except where field welding is required, where cold-applied galvanizing may be used. Interior clamps on plastic pipe shall be plastic coated. Supports for copper pipe shall be copper plated or shall have a 1/16-inch plastic coating. All rods, clamps, hangers, inserts, anchor bolts, brackets and components for exterior pipe, submerged pipe, pipe within outdoor structures, and pipe in wet wells shall be of Type 316 stainless steel.
- f. Cast iron and ductile iron, steel and stainless steel pippins shall be supported at a maximum support spacing of 10-feet with a minimum of one pipe support per pipe section or joint. Floor supports shall be given preference. Support spacing for steel and stainless steel piping, 2-inch and smaller in diameter, and copper tubing shall not exceed 5-feet. For all stainless steel piping, provide neoprene isolators between the pipe and support components. Supports for individual PVC pipes shall be as recommended by the manufacturer except that the support spacing shall not exceed 3-feet. All vertical pipes shall be supported at each floor or at interval of not more than 12-feet by approved pipe collars, clamps, brackets, or wall rests and at all points necessary to insure rigid construction. All vertical pipes passing through pipe sleeves shall be secured using a pipe collar. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless specifically direct or authorized by the Engineer.

4. Valves.

a. Gate Valves.

- (1) Gate valves 2-1/2 inch diameter and smaller shall have flanged, screwed or solder ends as required and shall be brass, bronze, or Type 304 stainless steel, solid wedge, union bonnet, rising-stem, Fig. 47 or 48 as manufactured by Jenkins Brothers or similar products as manufactured by Crane, Fairbanks, or Lukenhiemer.

- (2) All water valves 2-1/2 and 3-inch, unless otherwise noted, shall be brass body gates and shall be Jenkins No. 1240, or Hammond 1B-647.
- (3) Valves shall open to the left (counter-clockwise). Operating nuts or wheels shall have cast thereon, an arrow and the word "open" indicating the direction of opening.

b. Plug Valves.

- (1) Plug valves shall be of the offset disc type, 1/4 turn, non-lubricated, serviceable (able to be repacked) under full line pressure and capable of sealing in both directions at the rated pressure. The disc shall be completely out of the flow path when open. Plug valves shall be as manufactured by DeZurik.
- (2) Plug valves shall have a minimum port area of 80-percent. Valves shall be rated for 175 psi WOG (Water, Oil and Gas) working pressure for sizes 4-in to 12-in inclusive, and conform to the requirements of AWWA C504. All exposed bolts, nuts, and hardware shall be Type 316 stainless steel.
- (3) The valve disc shall be cast iron, ASTM A126, Grade B, or ductile iron, ASTM A536, Grade 65-45-12, and be of one piece. It shall be removable without removing the valve from the line.
- (4) Valve seats shall be resilient and of the continuous interface type having consistent opening and closing torques and shall be no-jamming in the closed position. Screw-in seats are not acceptable.
- (5) All valves shall be provided with a handwheel actuator with valve position indicator.
- (6) Plug valves shall be installed so that the direction of flow through the valve and the shaft orientation is in accordance with the manufacturer's recommendations. Unless otherwise noted, the shaft shall be horizontal with the plug opening up.

c. Check Valves.

- (1) Check valves 2-inch diameter and larger shall be iron body, bronze mounted, single cast iron or cast steel disc with bronze seat ring, extended stainless steel hinge arm with outside lever(s) and weight(s), with oil damped controlled closing, full opening with bolted cover, and shall conform to AWWA C508. They shall be designed for a minimum working water pressure of 150 psi water working pressure nonshock and hydrostatically tested at 300 psi.
- (2) Check valves shall be Golden-Anderson Model 25-DXH or APCO Model 6100.
- (3) Check valves smaller than 2-in and smaller for installation in copper and steel pipes shall be bronze, swing type, 125-lb with solder or screwed ends and shall be Hammond 1B-940, or Jenkins 92A.

d. Surge Relief Valves

Sewage surge relief valves may be required in combination with the controlled closing swing check valves to limit water hammer associated with pump shut down and check valve closure on pumping stations with high total dynamic head and/or long force mains. If required, they shall be Golden-Anderson, Models 624-D or 625-D, or APCO, Model 6300. If surge valves are utilized, they shall be manufactured by the same manufacturer as that of the controlled closing check valves. A manufacturer's representative shall be on-site to coordinate the operation of these valves during start-up.

e. Sewage Air Release Valves

- (1) Every effort shall be made to avoid the need for sewage air release valves due to their susceptibility to malfunctioning. Consider alternative pumping locations, alternative force main profiles, or deeper installation to eliminate high spots that would require the installation of air release valves. If these alternatives are completely impractical, the installation of air release valve might be considered. If utilized they must be properly sized and installed in pairs to provide a backup if one fails.
- (2) Sewage air release valves shall be as manufactured by Golden-Anderson Model 925 or APCO Model 400 or 450, tall body style, stainless steel fitted, with inlet, blowoff, and shutoff valves, and back-flushing attachments.
- (3) If sewage air release valves are utilized, they shall be installed in a precast concrete vault or manhole with a minimum dimension of 6'-6" between floor and ceiling and a minimum clearance of 2-feet between piping and walls, and 1-foot between top of air release valve and ceiling. The valve shall be installed on a non-reducing tee with a threaded restrained plug on the full diameter branch outlet. The vault or manhole shall be provided with an aluminium or stainless steel hatch and access stair to facilitate entry and maintenance. A screened ventilation pipe shall be provided to allow equalization of air pressure inside and outside of vault. A 12-inch diameter stone drainage sump shall be provided in the vault floor in areas not susceptible to high ground water. In areas with high groundwater, the stone sump shall be replaced by a concrete sump with the sump pump discharging to grade. Vaults and hatches shall be designed for highway loading if located in or adjacent to travelled areas. The top of the vault or manhole shall be located a minimum of 6-inches above surrounding grade to limit the potential for inflow of runoff.

5. Emergency Generator Building.

- a. An emergency generator shall be mounted permanently in a building together with all appropriate electrical controls (including automatic transfer switch). The building shall also house the pump control panel specified elsewhere. The building shall be a masonry type building blending aesthetically with the surrounding environment. Construction details of the building shall be subject to approval by the Town.

Temporary structures will not be accepted, nor will metal or fiberglass generator housings.

- b. The floor elevation of the generator building shall be minimum 2 feet above the 100 year flood elevation and 6-inches above surrounding grade.

D. SUCTION LIFT PUMPING STATIONS

1. General.

- a. Wet wells shall be designed in accordance with the Maryland Environmental Health Administration Design Guidelines for Sewerage Facilities, 1978 Edition. Wet wells shall be sized to avoid heat buildup in the pump motor due to frequent starts and to avoid septic conditions due to excessive detention time. The effective capacity (e.g., capacity between working levels) of the wet well shall generally provide a holding period not to exceed 10-minutes for the maximum monthly average flow. Where tributary flow distance is short, a holding period, not to exceed 30-minutes for the maximum monthly average flow, should be considered.
- b. The wet well floor slope shall have a minimum slope of one horizontal to one vertical (1:1) to the hopper bottom. The horizontal area of the hopper bottom shall be not greater than necessary for proper installation and functions of the inlet.
- c. The wet well shall be designed to minimize the turbulence from the incoming sewer, such as a cascade that might entrain air in the liquid. There must be sufficient submergence at the low water level to allow entrained air to escape, to prevent vortex formation, and provide adequate NPSHA at the pump inlet.
- d. Wet wells shall be of reinforced concrete. All interior concrete surfaces (floor, walls, ceiling, pipe entries, and structure chimney) shall have an impermeable HDPE or PVC lining to protect against hydrogen sulfide corrosion. The liner shall be permanently fused to the concrete structure during the structure casting process.
 - (1) HDPE lining shall have a minimum thickness of 2-mm (0.0787-inches) with a minimum of 39 anchor studs per square foot. Flat liner sheet used for overlapping joints shall have a minimum thickness of 3 mm. All joints shall be sealed by thermal welding by manufacturer's certified welders. HDPE lining shall be AGRU Sure Grip HDPE, Polypropylene Random Copolymer or equal.
 - (2) PVC lining shall have a minimum thickness of 1.65-mm (0.065-inches). The PVC liner, channel joints, H-joints, and corner joints shall be manufactured from Polyvinyl Chloride resin (PVC) and shall be white in color. A combination of standing ribs and mechanical dovetails shall be used to secure the liner panels and shall be spaced a maximum of 6-inches apart. Liner panels shall be formed to the correct radius for circular surfaces. Liner panels with locking extensions shall be able to withstand a test pull of 100 pounds per linear inch applied perpendicular to the concrete surface for a period of 60-seconds with a temperature between 70° and 80° F. PVC liner panels shall have a continuous

return into the joint for a minimum of 0.50-inch. PVC lining shall be Dura Plate 100 as manufactured by A-Lok Products, Inc. or equal.

- e. The wet well access hatches shall be Type 316 stainless steel.
 - f. A work platform shall be installed in the wet well above the high water elevation near the elevation of the end-of-pipe comminutor. Safety chains or railings shall be provided if required. All metal fabrications or hardware shall be Type 316 stainless steel. The platform shall be attached to the walls with stainless steel anchors and liner penetration adapters as recommended by the lining manufacturer.
 - g. The wet well must be capable of being isolated from the incoming flow by means of a valve located upstream of the wet well.
 - h. The elevation of the top floor and/or access to the pumping station shall be a minimum of 2 feet above the 100 year flood elevation and 6-inches above surrounding grade.
 - i. All pumping equipment shall be housed in a masonry type building blending aesthetically with the surrounding environment. Adequate floor space and clearance from walls shall be provided for access to all equipment for maintenance. Construction details of the building shall be subject to approval by the Town.
 - j. Mechanical lifting mechanism(s) shall be provided for all equipment weighing more than 60-lbs. The lifting mechanism shall be appropriate for the application.
 - k. The station shall be designed and constructed in accordance with the requirements of MDE, OSHA, and the Maryland Department of Labor, Licensing, and Regulation.
2. Pumping Equipment.

A minimum of two (2) pumps shall be provided and installed. Pumps shall be Gorman-Rupp T-Series, self priming, horizontal, centrifugal, V-belt driven sewage pumps, sized to meet the design flow. The pumps shall be equipped with tungsten titanium carbide mechanical shaft seals and removable cover plate for complete access to pump interior. Pumps shall be furnished with internal piping and valves consisting of discharge check valves, automatic air release valve for each pump and a three-way discharge plug valve.

3. Motors.

- a. The pump motors shall be horizontal, open drip-proof, induction type, suitable for 3-phase, 60 Hz, 230/460 volt electrical service. The motors shall have a service factor of 1.15 that shall not be utilized under normal operating conditions. They shall have normal starting torque and low starting current, as specified for NEMA Design B characteristics. The motors shall not be overloaded at the design condition, or at any head in the specified operating range. Each motor shall be in current NEMA design cast iron frame with copper windings.

- b. Power shall be transmitted from motors to pumps by means of V-belt drive assemblies. The drive assemblies must be selected to establish proper pump speed to meet the specified operating conditions. Each drive assembly shall have a minimum of two V-belts. Drive systems with a factor of safety of less than 1.5 to 1.0 shall not be considered sufficient. Computations of the factor of safety shall be based on performance data provided by the drive manufacturer.
 - c. Pump drive transmission belts shall be enclosed on all sides with safety guards having no opening larger than ½-inch. They shall be capable of being removed from the pump unit without interference with any unit component.
 - d. The pump motors shall be specifically built NEMA P base, open drip-proof induction type, suitable for 3-phase, 60 Hz, 230/460 volt electrical service. The motors shall have a service factor of 1.15 that shall not be utilized under normal operating conditions. They shall have normal starting torque and low starting current, as specified for NEMA Design B characteristics. The motors shall not be overloaded at the design condition, nor at any head in the specified operating range.
 - e. Motors shall have Class F insulation, Class B temperature rise, 40° ambient. Insulation shall be of non-hygroscopic materials which resist moisture and are fungus resistant.
 - f. Each motor shall have oversized, grease-lubricated ball bearings with the thrust bearing at the bottom locked in position to eliminate shaft end-play. The motor shaft shall be solid stainless steel.
 - g. The motor-pump shaft shall be centered, in relation to the motor base, within 0.005". The shaft run-out shall be limited to 0.003".
 - h. A special varnish treatment shall be applied to the stator windings and rust preventative compounds shall be used to coat the rotor and stator air gap surfaces and protect the motor against corrosion.
4. Controls.

The control equipment shall be as for submersible type stations (See item E.6.a, et.seq.) OR, approved Abubbler" type system.

5. Dehumidifier.

The Applicant shall install an automatic refrigeration type dehumidifier to maintain the relative humidity of the air in the pump chamber as low as possible. The dehumidifier shall be capable of removing three gallons of moisture per twenty-four hours, and shall be automatically controlled by an adjustable thermostat and a panel-mounted humidistat. The condensation shall drain to the sump.

6. Sump Pump.

The Applicant shall install in each pump station a submersible sewage or grinder sump pump with motor mounted directly above the impeller. The volute casting shall have feet to support the impeller entrance the proper distance above the bottom of the sump. The pump shall have a minimum capacity of 100 gpm. The pump shall be controlled by a level control switch, capable of operation on a 2" differential water level. It shall discharge to the wet well through a 1-1/4" - 2" pipe with two check valves and a gate valve within the pump chamber.

7. Mechanical Ventilation.

Mechanical ventilation shall be provided for the wet well and other structures. The equipment must be capable of providing a continuous rate of 12 air changes per hour in the wet well and at least 30 air changes per hour for an intermittent rate in other structures as dictated by the requirements of MDE and OSHA. Air shall be forced into the wet well by mechanical means rather than exhausted from the wet well.

8. Wiring.

The wiring and power feed lines shall conform to the National Electric Code. All wiring in the pump station shall be color-coded as indicated on the wiring diagram. Minimum wire size shall be #12 AWG copper. All wiring outside the panel shall be in rigid galvanized steel conduit, 3/4" minimum, except for 115 volt accessory items which are provided with connecting insulated service cord by the manufacturer. Accessory items such as the sump pump, dehumidifier, and air compressors shall be plugged into polarized, grounded convenience outlets, located close to their installed position so that such items can be readily removed and serviced if necessary.

9. Heater.

An electrical heater shall be installed in each room of the pumping station building(s) and shall be sized to maintain a minimum ambient temperature of 60° F in the room. The heater shall be thermostatically controlled. The heater shall not be placed within two (2) feet of a control panel.

10. Station Painting.

a. Metal Surfaces.

All motors, pumps, bases, brackets, ladders, piping and steel supports shall be properly primed and painted with two coats of rust inhibitor paint in strict accordance with the manufacturer's recommendations.

b. Plastic Surfaces.

One coat of epoxy primer followed by one coat of acrylic urethane.

c. Concrete and Masonry Walls and Ceilings.

One coat of epoxy primer followed by one coat of washable enamel paint.

d. Floors.

Approved floor paint with non-skid additive.

E. SUBMERSIBLE TYPE STATIONS

1. General.

A minimum of two pumps must be provided and installed. The station, including pump and valve chambers, manholes, meter pits, and other structures constructed below grade shall be watertight and must meet current ASTM Specifications. A separate valve chamber must be provided. The elevation of the top of the wet well shall be minimum 2 feet above the 100 year flood elevation.

2. Sump Basin and Cover.

The sump basin shall be of reinforced concrete and shall be provided with a hinged aluminum cover of non-skid pattern. The cover shall be large enough to comfortably accommodate the pumps. The cover shall have angle frame with rectangular opening of sufficient size to permit easy removal of the pumps. Cover shall have a hold-open bar that can be locked in open position. Cover shall have a hasp and staple for locking with a padlock. All hardware shall be of non-corrosive material. Paint all interior concrete surfaces with SAVEREISEN Corrosion Clad Polymer Lining no. 210 or approved equivalent.

3. Valve Chamber.

- a. A separate valve chamber shall be provided on the discharge side of the sump basin. The valve chamber shall accommodate a check valve and an isolation valve for each pump, and shall be large enough to comfortably accommodate the valves and fittings.
- b. A NEMA 4 light switch shall be provided on each check valve to signal open/close operation. The switches shall have N.O./N.C. contacts rated 120 volts, 10 amps. These switches shall be connected to the pump fail circuitry.
- c. The valve chamber shall be provided with an aluminum hatch cover as described in item 2b above. Chamber shall be minimum 4'-6" deep with aluminum access ladder with rungs at 12" on center. A 3" diameter drain shall be provided from the floor of the chamber to the pump sump. The floor shall be sloped towards the drain. The drain shall have a check valve to prevent backflow from pump sump in case of high water level in the pump sump.

4. Lift-out Rail System.

Station shall be provided with a rail system to facilitate easy removal of the pumps. Rails shall be made of stainless steel and are to be firmly fixed with rail supports to the wall of the sump basin.

5. Submersible Pumps.

a. Casings.

Pump casing and motor casing of ASTM-A48 cast iron. Pump casing of the single volute type, ribbed to prevent excessive deflection and hydrostatically tested to twice the design head, or one and one half times the shutoff head, whichever is greater. Volute sized at all points to pass solids which can pass through the impeller and internally finished to provide smooth, unobstructed flow.

b. Impeller.

Non-clogging type of ASTM-A48 cast iron, statically, dynamically and hydraulically balanced, capable of passing 3" solids. Key seat the impeller and secure it to the shaft by a hex head impeller nut.

c. Pump Shaft.

Stainless steel of sufficient strength and size to safely transmit the maximum torque developed by the drive unit. Shaft sized to provide rigid support of the impeller and prevent excessive vibration.

d. Pump Shaft Bearings.

Ball or roller type, oil lubricated. Upper bearings to support full dead load and hydraulic thrust. Design bearings with a 20,000 hour B10 minimum bearing life per AFBMA test procedure.

e. Shaft Seals.

Provide each pumping unit with a double mechanical seal, running in an oil filled reservoir, composed of two separate lapped faced seals, each consisting of one stationary and one rotating tungsten carbide ring each held in contact by a separate spring, so that the outside pressure assists spring compression in preventing the seal faces from opening.

(1) Protect the compression spring against exposure to the pumped liquid. Seal the pumped liquid from the oil reservoir by one face seal and the oil reservoir from the motor chamber by the other.

(2) Equip each pumping unit with a liquid sensing device to prevent damage to the motor in the event of a shaft seal failure.

- (3) One N.O. auxiliary contact for run status and one N.C. auxiliary contact for stop status, overload relay, and all other controls and accessories necessary for proper operation and protection.
- (4) Low voltage (24 VAC) level sensing circuitry for intrinsically safe relaying.
- (5) Solid state alternator for duplex controls.
- (6) Individual toggle type selector switches to provide "Auto-Off-Hand" control of each pump.
- (7) 24 Volt AC control transformer, protected by circuit breakers or fuses on both the primary and secondary.
- (8) Terminals shall be provided for connection of the level sensors.
- (9) A removable dead-front panel shall be provided to protect the operator.
- (10) All operator controls, toggle switched, circuit breakers, etc. shall be accessible without removing the dead-front panel.
- (11) NEMA 1 enclosure with latch mechanism Duplex 3-phase 240 or 480 volt power supply as dictated by the power company and motor requirements.
- (12) A relay which automatically reconnects the control circuit to pump number 2 if pump number 1 circuit breaker trips.
- (13) High level and low level alarm relays with unpowered contacts and terminals shall be included.
- (14) Pump running transformer type pilot lights (red) mounted on operator's control panel. Pump stopped pilot lights (green) mounted on operator's control panel.
- (15) Non-resettable running time meters mounted on operator's control panel.
- (16) Seal leak detector for each pump with unpowered relay contacts for alarming.
- (17) 3-phase power monitor with adjustable settings, stops pump for low voltage, single phasing and phase reversal.
- (18) One pump to be locked off during generator operation with ability to switch to other pump should selected pump fail.
- (19) A "Hand-Off-Auto" selector switch provided for each of the two pumps controlled with the following operation:
 - (a) Hand Position: In this position, the pump controlled by the switch will run regardless of the wet well level. The pump will continue to run until the switch is turned to "Off" or "Auto".

(b) Auto Position: In this position, the operation of the pumps is controlled automatically by the level sensors in the wet well as follows:

(20) The control circuit is placed in standby mode when the liquid level rises to tilt the lowest level sensor which is a redundant cutoff and low water alarm.

(21) As the level continues to rise, the control circuit is energized when the pump off level sensor rises.

(22) As the level continues to rise and the next level sensor is tilted, the first (lead) pump will start. In this step, the pumps will alternate on successive cycles. If pump number 1 starts first on one cycle, pump number 2 will start first on the next cycle. This insures equal operating time and wear on each pump.

(23) As the level in the well is pumped down, the pump(s) will continue to operate until the level drops just below the pumps off level sensor.

(24) If the level in the well continues to rise with one pump in operation, the second pump will be turned on when the level reaches the lag pump on high water alarm level float.

(25) If the water continues to rise, the high water alarm level sensor will activate an alarm.

F. ELECTRICAL REQUIREMENTS

1. Alarm System.

a. An alarm system capable of monitoring the following functions and transmitting the relevant signal to the designated location, shall be installed:

(1) Wet well/Drywell Type Stations.

- Power failure
- High wet well
- Low wet well
- Water in drywell
- Generator failure
- Louver failure
- Pump failure

(2) Submersible Type Stations.

- Power failure
- High wet well
- Low wet well
- Seal Leak

Generator failure
Louver failure
Pump failure

- b. An automatic dialler shall be installed. The dialler shall be a real voice type with 8-channel capacity. Acceptable dialler manufacturers: Verbatim by RACO.
- c. Provide a wall-mounted push-button telephone and RJ-11 jack. Acceptable manufacturer: Bell, AT&T, G.E., or approved equal. Applicant shall make all arrangements with telephone company and pay all relevant installation charges and fees.

2. Emergency Power.

- a. The Applicant shall install a diesel emergency generator set and automatic transfer switch required to run the pumps and all equipment within the station upon loss of normal power.
- b. The system components shall be new equipment of current design, not one-of-a-kind, and consist of a Pennsylvania approved engine-driven, electric plant with mounted start-stop controls, an automatic load transfer control, fuel, oil, and anti-freeze, and necessary accessories. All components shall be completely built, tested, and shipped by a manufacturer who has been regularly engaged in the production of such equipment for the past ten years and who has a local parts and service facility, so there is one responsibility for the proper functioning of the entire system. The plant shall be as manufactured by Kohler, Caterpillar, Onan, or approved equal.
- c. The plant shall be mounted on a welded steel skid base, which in turn shall mount on 6" high I-beams securely mounted to the frame and a concrete pad. The pad shall be sloped to prevent standing water to accumulate under the generator set. The starting batteries shall be placed on a cast iron rack inside the housing. The muffler shall be a Hospital-grade silencer attached to the exhaust line by 125-lb. standard pipe flanges. The exhaust line shall contain a condensate trap with drain cock at the first point of rise in the line from the engine. Only long radius elbows shall be used in the exhaust line.
- d. All required anchor bolts shall be furnished and installed. A stainless steel flexible pipe shall connect engine to the exhaust system.
- e. Exhaust air ductwork between radiator and exhaust louver shall be 20-gauge galvanized sheet steel. Engine radiator shall have a flexible duct adapter.
- f. A thermostatically controlled jacket water heater shall be provided to maintain a jacket water temperature of 90° F. This unit shall be as manufactured by Chromalox, Singer, or approved equal.
- g. Provide a line circuit breaker with the generator. Breaker shall be rated to handle the generated fault currents and shall be one of those listed by the transfer switch

manufacturer. Breaker shall have the required number of poles and current rating capable of handling required load.

- h. Provide generator control panel with the following: voltmeter, ammeter, selector switch, start controls, voltage level adjustment rheostat, oil pressure gauge, fault indicators for safety shutdown, "Auto/Manual" switch, water temperature gauge, battery charge rate ammeter, field circuit breaker, running time meter, panel face illumination from the battery, generator failure output contacts.
- i. Provide base mounted diesel fuel tank of sufficient capacity to sustain a minimum of 24 hours running at full load, fuel gauge, fuel lines, threaded vent opening and a full tank of diesel fuel.
- j. The use of propane gas as an alternative energy source will be considered by the Town.
- k. A current limiting battery charger shall be furnished to automatically recharge the starting batteries. Charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, and fused AC input. AC input voltages shall be 120 volts. Amperage output shall be no less than 5 amperes. Charger shall be LaMarche Manufacturing Company, Model A-5, ESB Inc., or approved equal.

3. Transfer Switch.

- a. The automatic transfer switch shall be fully rated, to protect all types of loads, inductive and resistive, from loss of continuity of power. The switch shall afford complete protection. The switch shall be rated as suitable for all classes of loads without derating, either open or enclosed.
- b. The transfer switch shall automatically transfer its load circuit to an emergency or alternate power supply from failure of its normal or original supply. Upon restoration of the normal supply, the transfer switch shall automatically retransfer its load circuits to the normal supply.
- c. All pilot devices/relays shall be of the industrial type rated 10 amperes with self-cleaning contacts.
- d. Components of the operating mechanism shall be insulated or electrically dead.
- e. All electrical equipment or apparatus of any one system must be the product of one manufacturer, or equivalent products of a number of manufacturers which are suitable for use in a unified system. No circuit breaker types are acceptable, nor parts thereof.
- f. For complete protection, close differential voltage sensing relays shall be provided to monitor each phase of the normal supply. A drop in voltage in any phase below the predetermined dropout value of the relay shall initiate load transfer. The relay shall

initiate retransfer of the load to normal supply as soon as the voltage is restored in all phases beyond the predetermined pickup value of the relay.

- g. The transfer switch shall obtain its operating current from the sources to which the load is being transferred.
- h. The automatic transfer switch shall also be furnished with the following options: adjustable 2 to 120 seconds time delay on normal to emergency; adjustable 0 to 15 second time delay on engine starting; adjustable 12 seconds to 30 minutes time delay on emergency to normal; adjustable 0 to 30 minutes, set at five (5) minutes time delay for engine cooloff; frequency/voltage relay for emergency source; test switch in cover of switch; normal supply pilot lights, emergency supply pilot light; engine start-stop contacts; relay auxiliary contacts on normal and emergency source, 1 N.O. and 1 N.C.; solid neutral bar assembly; plant exerciser for automatic test operation of plant with transfer of load for pre-selected intervals (adjustable 0-168 hours in multiples of 15 minutes) at least once a week.
- i. All accessories and equipment shall be front accessible for ease of maintenance or removal.
- j. Transfer switches and options shall be as manufactured by ASCO 940, Kohler, Onan, or approved equal.

4. Lighting.

- a. The Applicant shall furnish and install lamps and accessories as required. Prior to acceptance of building by the Town, all fixtures shall be cleaned, free of dust, insects and all foreign matter. The light fixture schedule is listed below:
 - (1) Industrial, ceiling mounted fluorescent, 2-lamp, 4 foot, 10-15 apertured up-light porcelain enamel reflectors, 120 volts.
 - (2) Outdoor wall-mounted high pressure sodium, 120 volts, photo control.

5. Electrical Unit Heaters.

- a. Horizontal forced air unit heaters shall be rated for the building size. Mounting brackets designed for either ceiling or wall swivel mounting shall be furnished for each heater. The cabinet shall be of 18 gauge die-formed furniture grade steel. Individual adjustable louvers shall be furnished to provide desired control of discharge air. All metal surfaces of the casing shall be phosphate coated to resist corrosion, with a baked enamel finish.
- b. Automatic reset thermal over-heat protection shall be provided.
- c. Motors shall be of the totally enclosed fan-cooled continuous duty (TEFC), sleeve bearing type, equipped with built-in thermal overload protection.

- d. Fans shall be aluminum, directly connected to fan motor, dynamically balanced and designed specifically for unit heater application.
- e. Heaters shall be equipped with built-in comfort control thermostats and necessary control transformers and contactors. Heaters shall be equipped with cord and twist lock plug for connection to receptacle and shall be Chromalox Type MUH, Singer, Berko, or approved equal.

6. Metal Louvers.

- a. The Applicant shall furnish and install all metal louvers (both the gravity and motor operated type) required for installation in the Generator Building. The metal louvers shall be complete with all motors, controls, screens, trim and closure pieces for a complete installation. It shall be the responsibility of the Applicant to check all opening sizes and completely coordinate the installation to insure a neat workmanlike job.
- b. A gravity louver shall be furnished for installation on the generator discharge. This shall be a fully automatic louver with the exhaust blades normally in a closed position and set to open when air pressure is applied. The blades shall move independently of each other, smoothly and without flutter.
- c. The head, sill, jambs and blades shall be extruded aluminum section, 6063-T52 alloy with reinforced bosses. The exhaust blades shall be cushioned the full length by vinyl gaskets. The heads, sills and jambs shall be one piece structural members with integral caulking strips and retaining beads. All fasteners to be stainless steel or aluminum. All louvers shall be provided with #2 mesh .063 inch diameter wire bird screen secured by an extruded aluminum frame on the louver exterior which can be easily removed for cleaning.
- d. The louvers shall be free of scratches and blemishes and provided in a fluorocarbon polymer finish in a color to be selected by the Town.
- e. The gravity louver shall be Model SA/FBE as manufactured by Penn Ventilator Airstream, Airolite Co., or approved equal.
- f. A motor operated louver shall be furnished for use as the generator air intake. This shall be a fully automatic louver with the operating blades normally in a spring closed position and opened by a motorized operator. The blades shall operate in a smooth continuous motion.
- g. The head, sill, jambs, and blades shall be extruded aluminum sections, 6063-T52 alloy with reinforced bosses. The operating blades shall be double gasketed with a vinyl material. The heads, sills, and jambs shall be one piece structural members with integral caulking slot and retaining beads. All fasteners shall be stainless steel or aluminum.
- h. The operating blades shall be operated by an electrically controlled motor operator. The motor shall be totally enclosed and suitable for operation on 120 volt, 60 Hz,

single-phase service. The unit shall be furnished with all controls and miscellaneous accessories for a complete working installation.

- i. The motor operated louver shall be Model ASA/FBI manufactured by Penn Ventilator AirStream, Airolite, or approved equal.
 - j. The louvers are to be sized to suit the generator air requirements. The exhaust louver shall be sized so that the maximum pressure drop shall not exceed 1/2" of water when the generator is operating at full speed. The intake louver shall be sized 25% larger than the exhaust louver.
 - k. The motor operated intake louver shall be wired for both manual and automatic operation. A selector switch shall be provided for manual open-close operation.
 - l. The intake louver shall automatically open when the emergency generator starts, and shall remain open until the generator shuts down. All necessary controls, relays, and wiring necessary for complete working installation shall be furnished and installed.
 - m. A thermostat shall also be provided to automatically open the intake louver on excessive heat build-up within the generator building. Thermostat shall have control range of 70° to 140° F, with a 2° F differential, and shall be Model T631C, as manufactured by Honeywell, Chromalox or approved equal.
 - n. A limit switch shall be installed at the intake louver location, and shall be positioned so that the switch is operated by the opening of the louver blades. If the louver and switch do not open after a preset time, a relay shall signal a "louver failure" condition to the telemetering alarm system. Limit switch shall be as manufactured by Westinghouse Type RR, Square D, or approved equal.
7. Electrical Construction.
- a. The Applicant shall meet with the electric company and the local telephone company to determine all requirements at the site for service and metering. Any excess charges by the utilities for furnishing the required service shall be the responsibility of the Applicant.
 - b. The Applicant shall furnish and install a service pole at each pumping station if the service is overhead. Service conductors and raceways shall be installed from the generator building underground to the service pole and up the pole terminating in an approved entrance fitting. The power company will furnish and install an overhead service drop to the pole and connect to service conductors. Poles shall be guyed if required to offset pull of power company's service drop.
 - c. If the service is underground, the Applicant shall furnish and install underground conduit, current transformer cabinet, and meter base. Current transformer cabinet or self-contained meter base, as necessary, shall be mounted on the generator building. The utility companies will furnish and install the service lateral.

- d. A grounding grid shall be provided at the service pole. Metal raceways, metal enclosures of electrical devices, transformer frames, neutral conductor and other equipment shall be completely grounded in accordance with the National Electrical Code. All necessary conduit, conductors, clamps, connectors, etc. for the grounding system shall be furnished and installed by the Applicant.
- e. Provide a main service entrance approved disconnect switch with current limiting fuses as required. Heavy-duty type, NEMA 1 enclosure indoors, NEMA 3R enclosure outdoors with padlock attachment; Square D, Cutler-Hammer, G.E. or approved equal.
- f. The panel board shall be rated for the voltage present, dead-front type, lockable with thermal-magnetic bolt-on circuit breakers, neutral and ground bus, typed circuit directory.
- g. Lightning protection shall be provided on the feeders immediately on the load side of the main disconnect switch, grounding lead as short as possible to grounding system, Innovative Technology, Inc. "P-Plus" series, no equal; A plug-in protector shall be used which has receptacles and RJ-11 jack for the telephone/dialler connections, Innovative Technology, Inc. Model PIU, no equal.
- h. Light switches to be 20 amp, 120/277 volt rated, P&S Series 20AC or approved equal; if weatherproof use P&S WP-1 lever handle weathersealing cover with FS box.
- i. Receptacles shall be 20 amp rated, 120 volt, two-pole, grounding duplex, P&S 5362 or approved equal; ground fault type to be P&S 2091-F; if weatherproof use FS box with wet location cover; power outlet receptacle rated as required, heavy-duty, twist-lock, P&S Series or approved equal.
- j. Underground conduit shall be polyvinyl chloride Schedule 30 as manufactured by Carlon, Sedco, or approved equal. All bends in duct lines of 40° and greater shall be manufactured steel elbows of the same size as the PVC ducts. Ducts shall be encased in four inches of concrete. Where conduits pass under roadways, parking lots, or on filled ground, a mat shall be provided in concrete, consisting of two longitudinal #4 bars with #3 ties, one foot on center. Trenches shall be backfilled with clean dirt, thoroughly compacted.
- k. Fittings for IMC conduit shall conform to Federal Specifications W-F-408 and shall be threaded type.
- l. Install sealing fittings, Crouse-Hinds type EYS or EZS, Appleton type EYS or ESU, or approved equal, wherever a conduit passes into a hazardous area, or extends between areas having widely different temperatures.
- m. Wires and cables minimum size shall be #12, medium hard drawn copper. For 600 volt service and under, wire shall have Type THHN-THWN insulation. Wire size of #10 and larger shall be stranded. All wiring shall be color coded in accordance with current NEC requirements.

- n. For wire size #10 and smaller, a solderless type press connector similar to "Buchanan" shall be used with snap-on type nylon insulator; splices of larger sizes of wire shall be made using an indenter type coupling applied with a hydraulic pressure tool.
- o. All materials and workmanship shall meet the minimum requirements of the following standards where applicable:
 - (1) National Electrical Code - National Fire Protection Association, 60 Battery March Street, Boston, Massachusetts (N.E.C.)
 - (2) National Electrical Manufacturers Association, 155 East 44th Street, New York, New York - Standards (NEMA)
 - (3) Institute of Electrical and Electronic Engineers, 33 West 39th Street, New York, New York - Standards (IEEE)
 - (4) The U.S.A. Standards Institute, 29 West 39th Street, New York, New York - Standards & Definitions of Electrical Terms (U.S.A.S.)
 - (5) National Bureau of Standards, Washington, D.C. - National Electrical Safety Code
 - (6) Reflector and Lamp Manufacturers Institute, Inc. 307 North Michigan Avenue, Chicago, Illinois - Lamp Reflector
 - (7) Underwriter's Laboratories Inc. - Standards
 - (8) OSHA Standards, where applicable, shall also be met, including those for temporary wiring on construction sites.
- p. All necessary permits and fees for this work shall be secured and paid for by the Applicant. Inspection shall be by an approved inspection agency licensed by the Commonwealth of Pennsylvania and final certificate of approval shall be delivered to the Town prior to acceptance.

9. Phase Converters.

Three phase power must be provided. No phase converters will be permitted.

G. START-UP

- 1. The Applicant shall provide the services of fully qualified manufacturer's representatives for services during installation, at start-up, and for instructing the Town's personnel in the operation, routine maintenance, and "trouble-shooting" for all equipment, mechanical and electrical, furnished with the pumping station. Applicant shall full load test the generator for four (4) continuous hours using Applicant furnished load bank. Notify Engineer 48-

hours prior to the test. If testing stops for any reason, correct the problem and start new four (4) hour test. Submit test results. Applicant shall notify the Town at least 24 hours prior to performing load test.

2. The Applicant shall provide five (5) bound copies of a manual fully explaining the operation, routine maintenance and "trouble-shooting" for equipment. The manuals shall include copies of all approved shop drawings and pump curves with all required revisions. These manuals must be submitted to the Town for approval prior to acceptance.
3. The manuals must include information relative to suppliers of spare and replacement parts.

H. FIELD TESTS

1. Field tests shall be carried out and all testing equipment and labor required shall be provided at no cost to the Town, to ensure that pumps and all equipment meet the design criteria.
2. The Town's personnel will witness the field tests.

I. DETAIL DRAWINGS

Relevant detail drawings are:

<u>No.</u>	<u>Description</u>
31	Typical Fence and Gate

END OF SECTION

SECTION 10 - SUPPLEMENTAL ON-LOT SEWAGE PUMPS

A. INTENTION

1. The use of supplemental (non-grinder) sewage pumps is intended for the discharge of graywater only (discharge from washing machines, sinks, bathwater etc.) to a point in the gravity type or gravity section of the service line within the property boundaries. The discharge by supplemental sewage pumps of wastewater containing human waste will not be permitted.
2. The responsibility for maintenance of operation of the pump will rest entirely with the Applicant, and no recourse for assistance in replacement or repair can be made to the Town.
3. If the first floor of the existing or proposed property cannot be served by a gravity type service line system, reference should be made to SECTION 8 of these specifications.

B. GENERAL

1. Sewage pump units shall be used for pumping graywater only and NOT for dewatering basements or yard areas. Pump units shall be sealed and protected from the ingress of surface or stormwater or floor washings. No water other than graywater shall be allowed to enter the pump sump.
2. Pump units shall be installed in concrete or fiberglass basins for out-door installations or custom basins in buildings or basements.
3. The location of the pump package and control panel shall be determined by the Applicant subject to approval by the Town.
4. The pump and motor package shall consist of a centrifugal sewage pump capable of performing the intended task.

C. INSPECTION

Pump installations will be visually inspected to ensure that no water other than graywater will enter the pump sump. It is incumbent upon the Applicant to request the Town to perform the inspection.

END OF SECTION

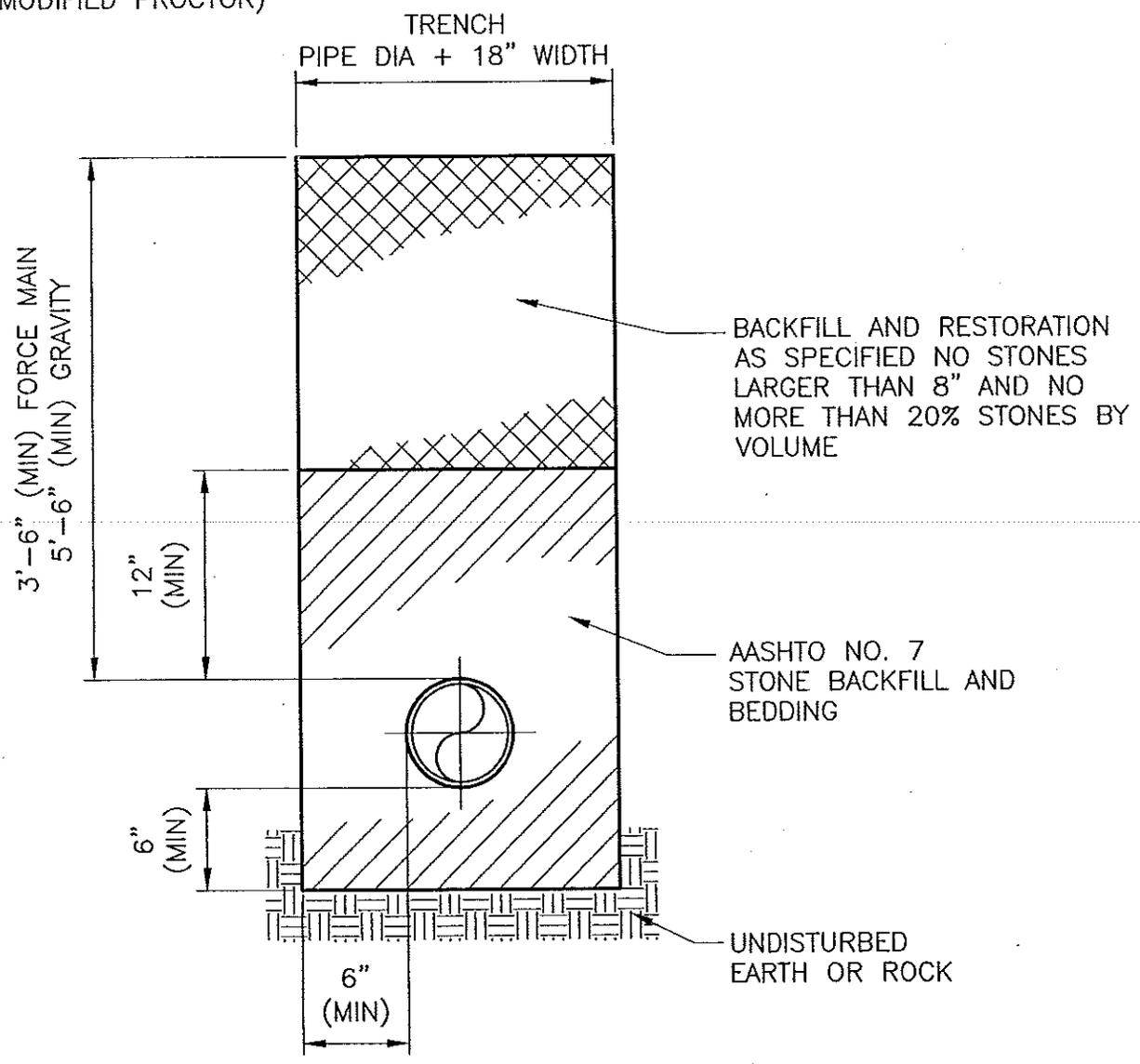
APPENDIX A

DETAIL DRAWINGS INDEX

<u>No.</u>	<u>Description</u>
1.	Pipe Bedding
2.	Concrete Encasement
3.	Lawn Restoration
4.	Pavement Restoration (State, County, and Township Roads)
5.	Cutting & Repairing in Roadway Shoulder
6.	Gravity Sewer Service Lateral
7.	Gravity Double Service Lateral
8.	Gravity Sewer Service Lateral Drop Connection
9.	Typical Gravity Service Connection
10.	Steel Pipe Encasement for Water & Sewer Mains
11.	Precast Concrete Manhole
12.	Drop Manhole
13.	Cast-in-Place Base New Manhole over Existing Sewer
14.	New Sewer to Existing Manhole
15.	Force Main Connection to Manhole
16.	Precast Flow Monitoring Manhole
17.	Air Release Valve and Chamber
18.	Valve and Box Installation
19.	Thrust Blocks for Tees, Caps and Plugs
20.	Thrust Blocks for Horizontal Bends and Lower Vertical Bends
21.	Restrained Pipe Length
22.	Typical Lateral Connection to Low Pressure Sewer
23.	Low Pressure Sewer Valve and Cleanout Manhole
24.	Low Pressure Sewer Forcemain Terminal Cleanout Manhole
25.	Typical Grinder Pump Service Connection Schematic to Gravity Main
26.	Typical Grinder Pump Service Connection Schematic to Low Pressure Sewer
27.	Fiberglass Basin for Typical Individual Grinder Pump
28.	Concrete Basin for Typical Individual Grinder Pump
29.	Wall Mounted Control Panel (External Installation)
30.	Post Mounted Control Panel (External Installation)
31.	Typical Fence and Gate

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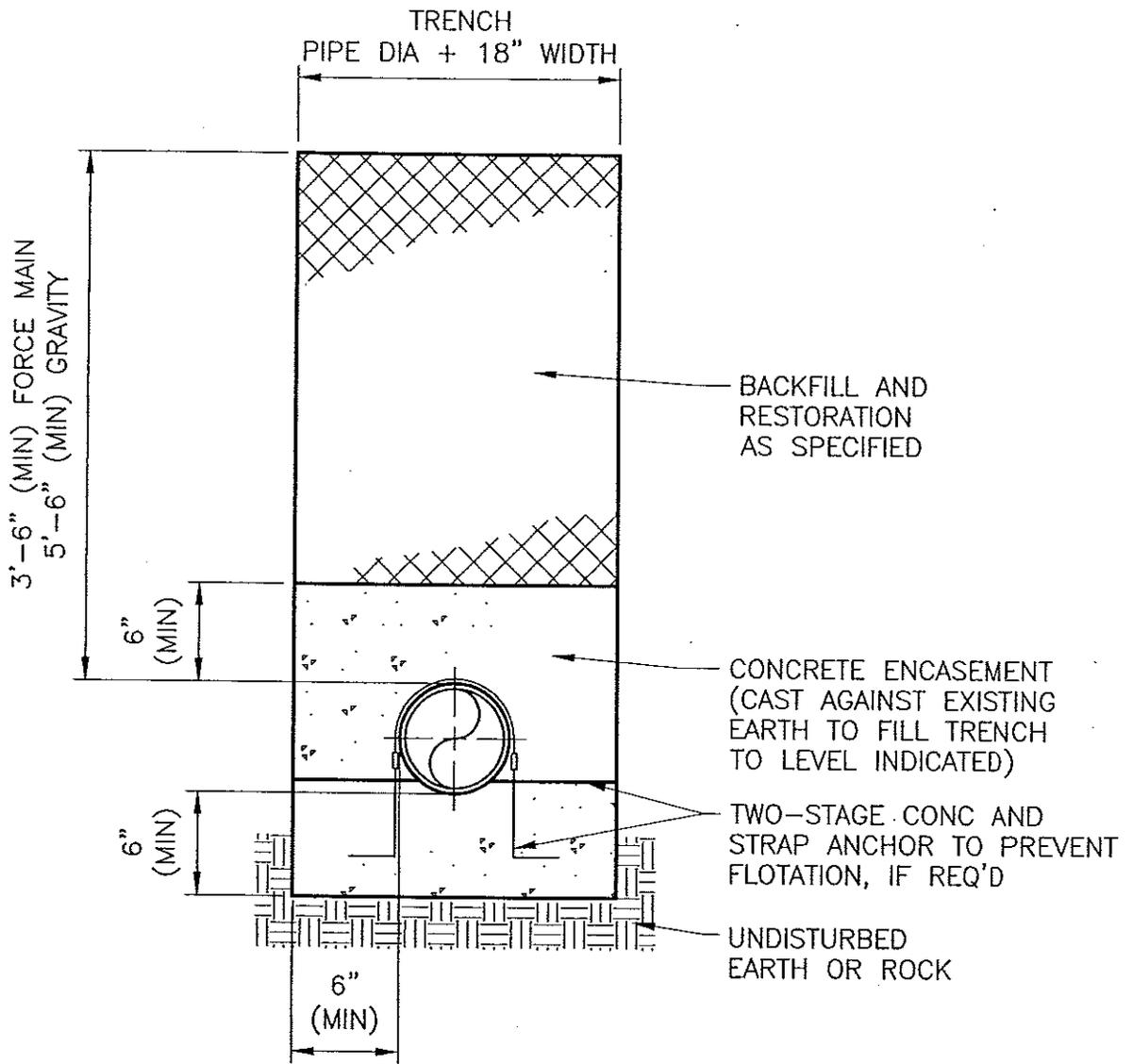
NOTE:
BACKFILL TO BE COMPACTED IN 8" LAYERS
(6" LAYERS FOR STATE ROADS) TO 95% OF
MAXIMUM DENSITY AS DETERMINED BY ASTM D
1557-70 OR AASHTO T-180, METHOD D
(MODIFIED PROCTOR)



PIPE BEDDING DETAIL
NO SCALE

Figure No. 1

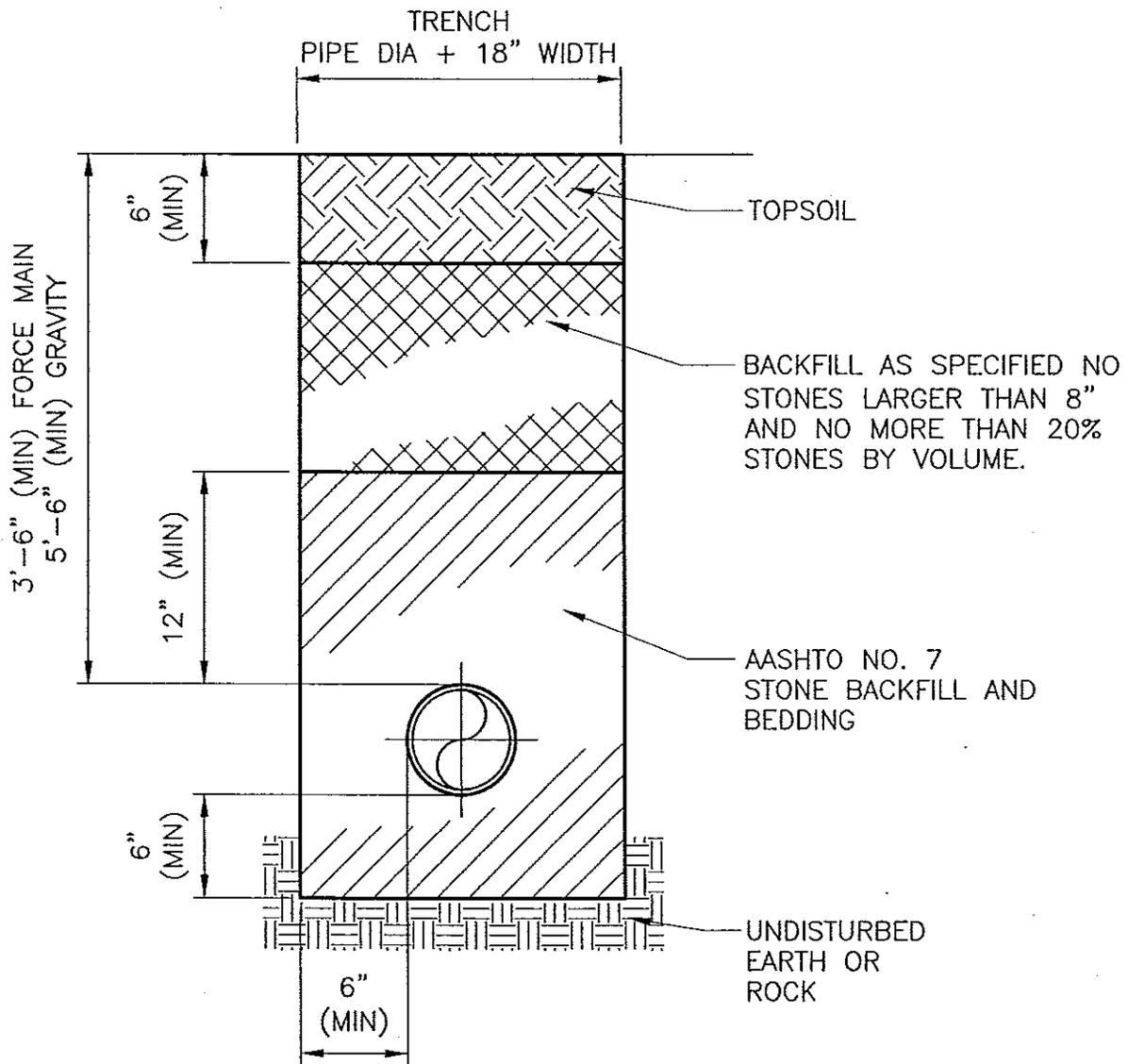
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CONCRETE ENCASEMENT DETAIL

NO SCALE

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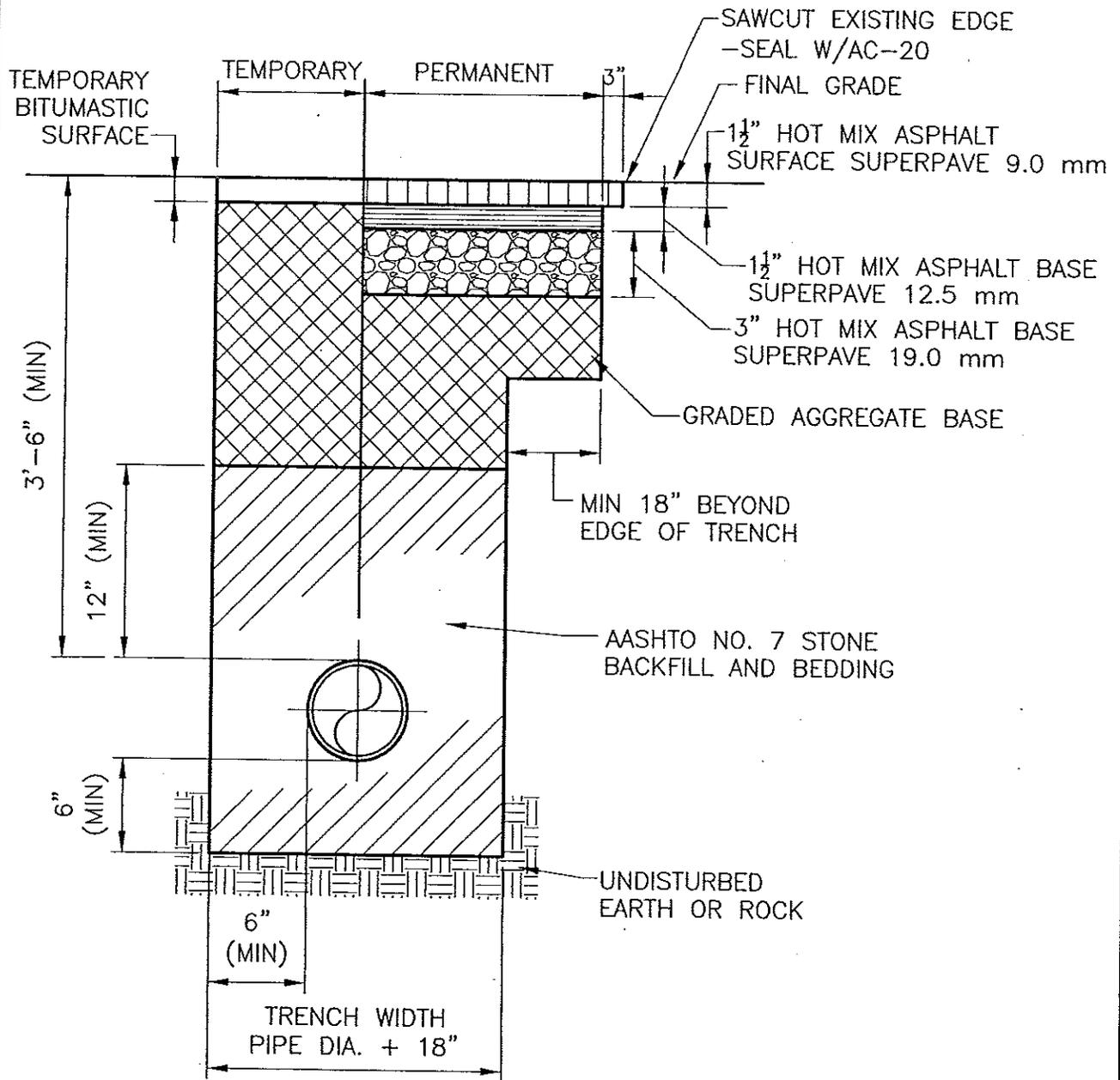


LAWN RESTORATION DETAIL

NO SCALE

Figure No. 3

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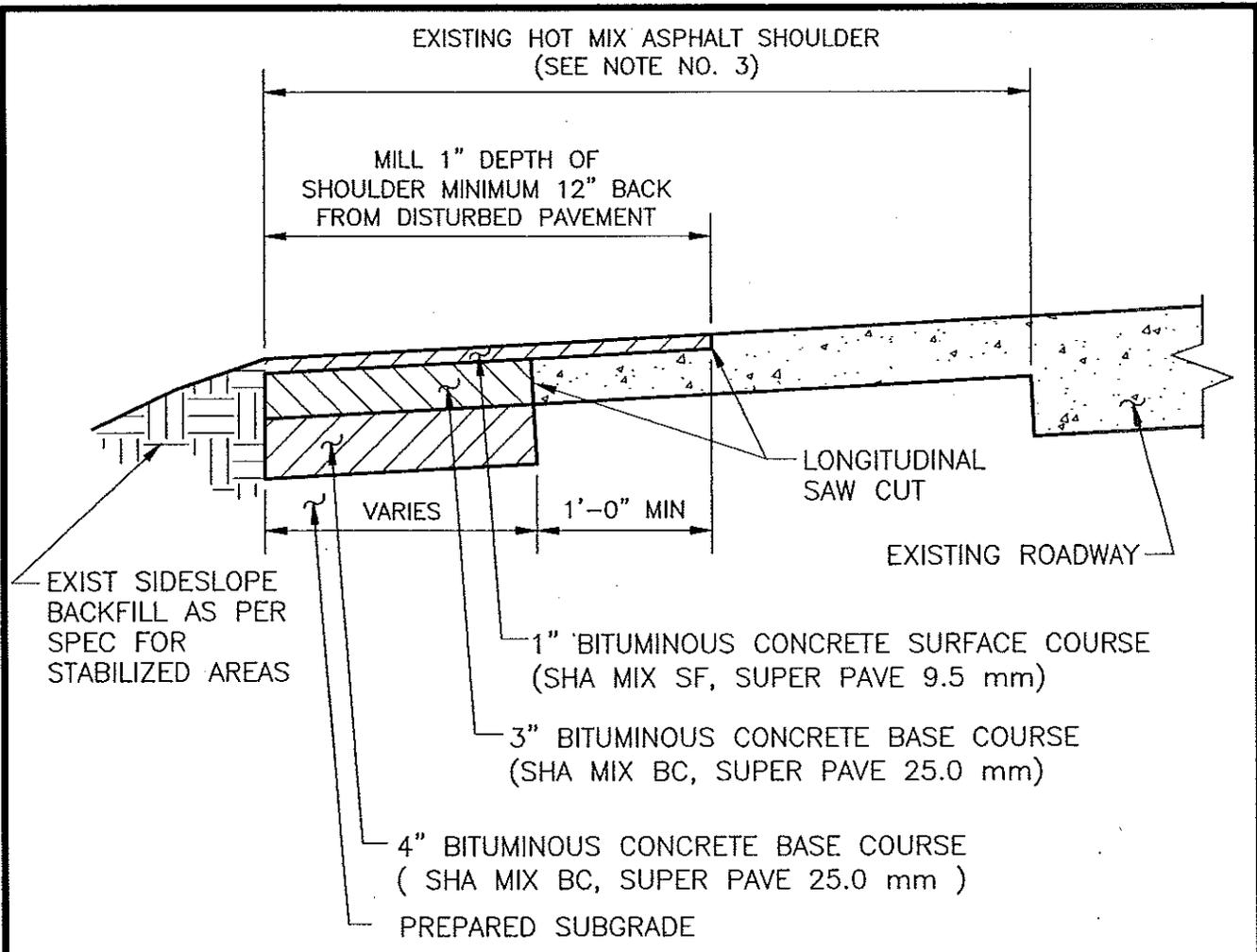


**STATE, COUNTY AND TOWN ROADS
PAVEMENT RESTORATION DETAIL**

NO SCALE

NOTE: FOR STATE ROADS DETAIL SUBJECT TO CONFIRMATION BY MD SHA.

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NOTES:

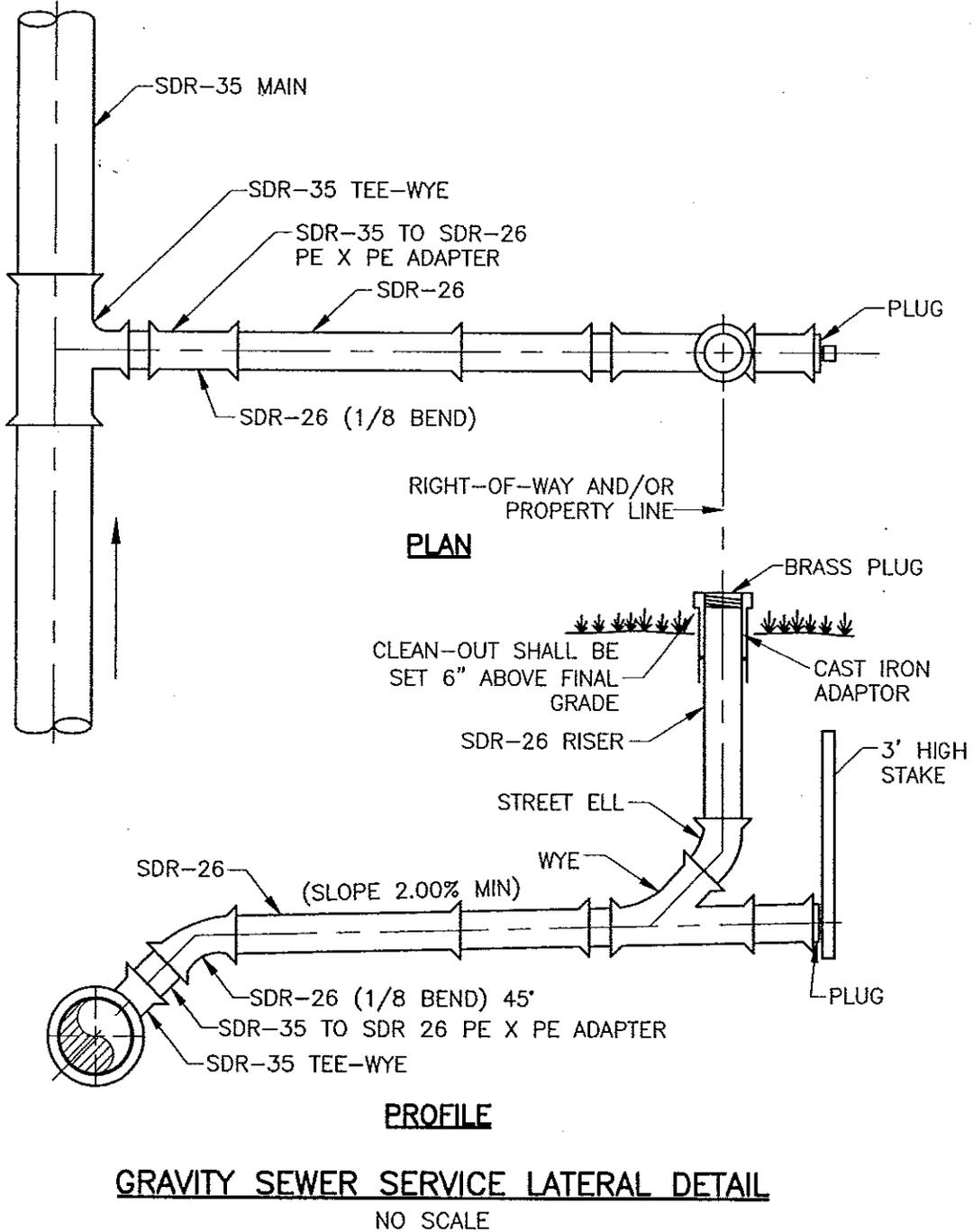
- 1. ALL MATERIALS AND METHODS SHALL COMPLY WITH MARYLAND STATE HIGHWAY ADMINISTRATION STANDARD SPECIFICATIONS OCTOBER, 1993 OR SUBSEQUENT.
- 2. MILLING SHALL BE UNIFORM IN WIDTH THE ENTIRE LENGTH OF THE REPAIR.
- 3. DOUBLE SURFACE TREATED SHOULDERS SHALL REQUIRE RECONSTRUCTION OF THE ENTIRE SHOULDER SURFACE.

**CUTTING AND REPAIRING IN
ROADWAY SHOULDER DETAIL**
NO SCALE

Figure No. 5

NOTES:

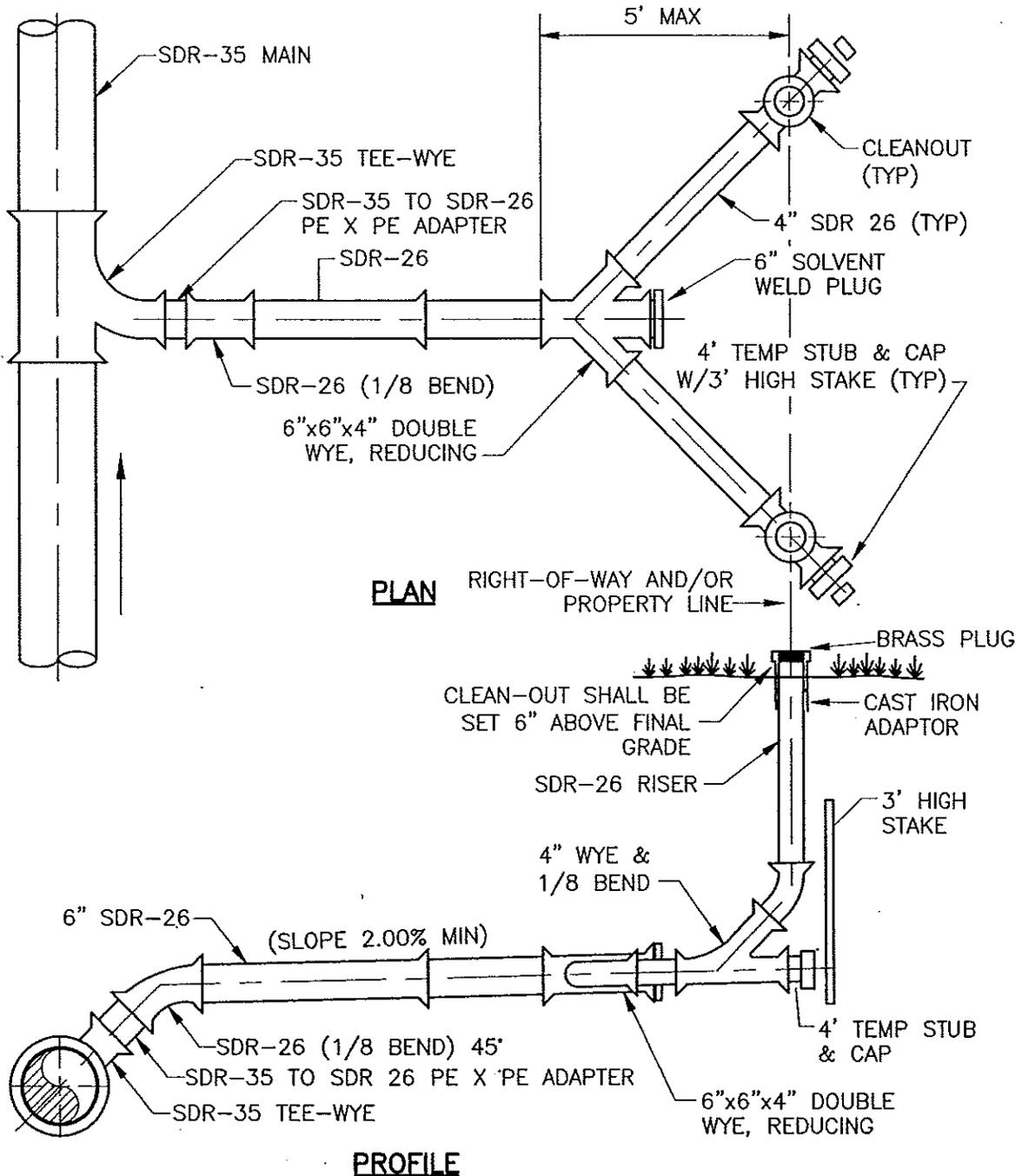
1. SDR-35 SPIGOT END OF ADAPTER SHALL HAVE A MINIMUM WALL THICKNESS EQUAL TO SDR-26.
2. TYPICAL SINGLE RESIDENTIAL SERVICE IS 4" DIA.
3. COMMERCIAL/INDUSTRIAL SERVICE SHALL BE 6" OR GREATER. MONITORING MANHOLE SHALL BE REQUIRED AS DIRECTED, IN LIEU OF CLEANOUT.
4. SDR-26 MAIN SHALL UTILIZE A STD SDR-26 TEE IN LIEU OF A TEE-WYE.



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NOTES:

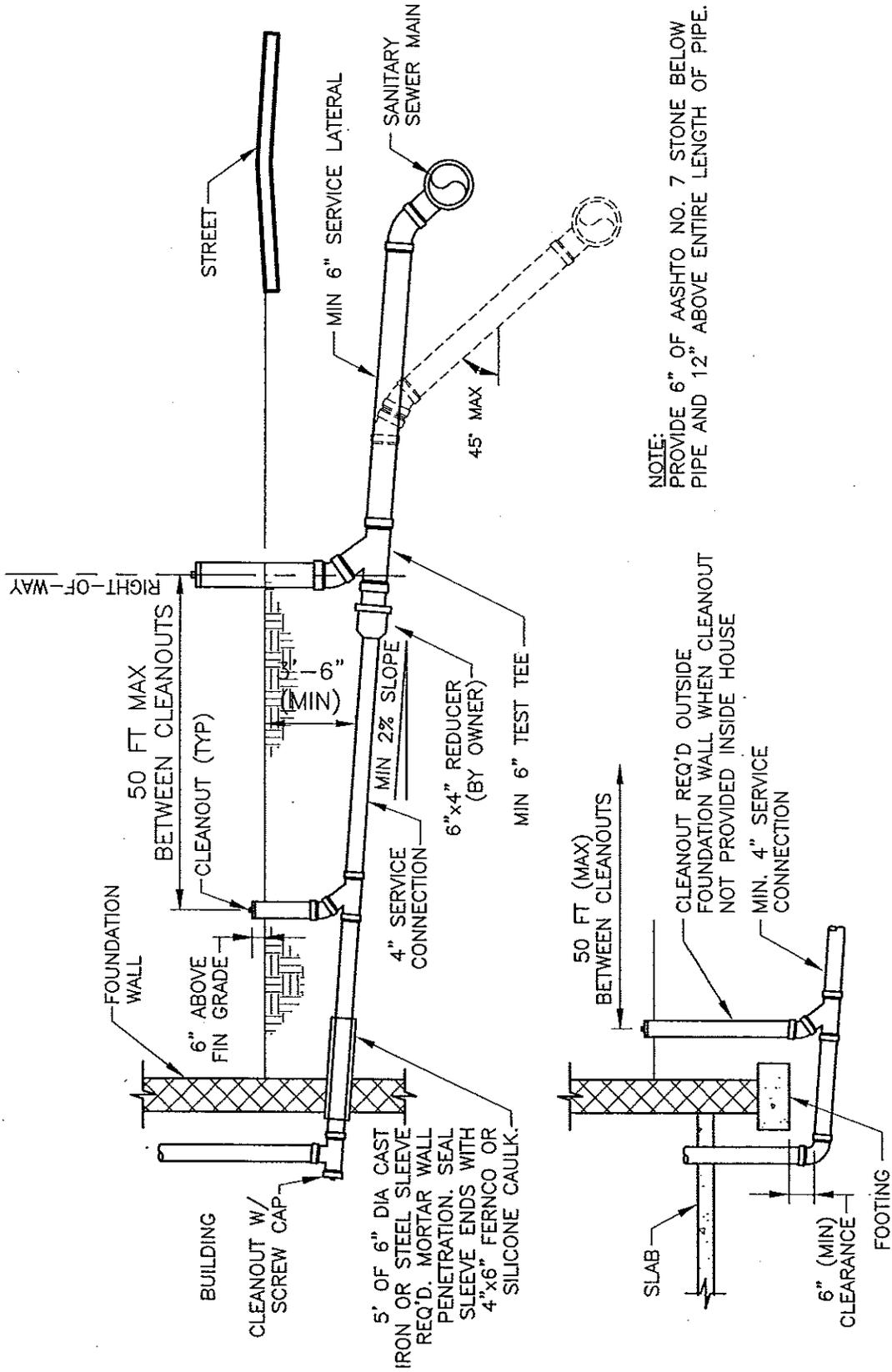
1. SDR-35 SPIGOT END OF ADAPTER SHALL HAVE A MINIMUM WALL THICKNESS EQUAL TO SDR-26.
2. SDR-26 MAIN SHALL UTILIZE A STD SDR-26 TEE IN LIEU OF A TEE-WYE.



GRAVITY DOUBLE SERVICE LATERAL DETAIL

NO SCALE

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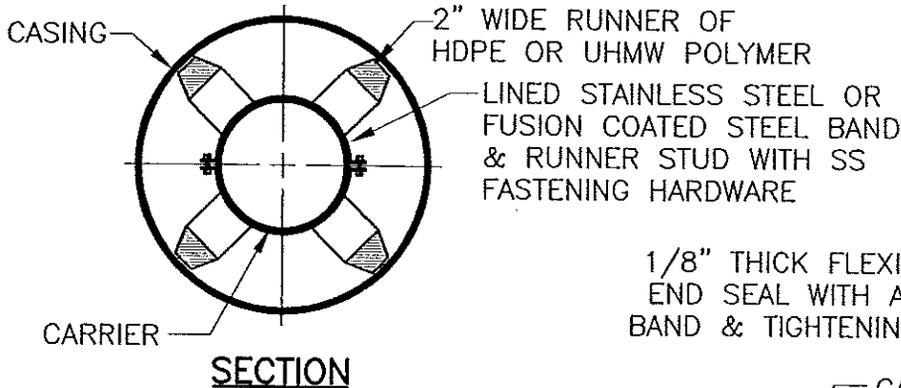
TYPICAL GRAVITY SERVICE CONNECTION DETAIL

NO SCALE

Figure No. 9

PIPE INSULATOR SHALL CENTER THE CARRIER PIPE & FIT TO RESTRAIN AGAINST MOVEMENT

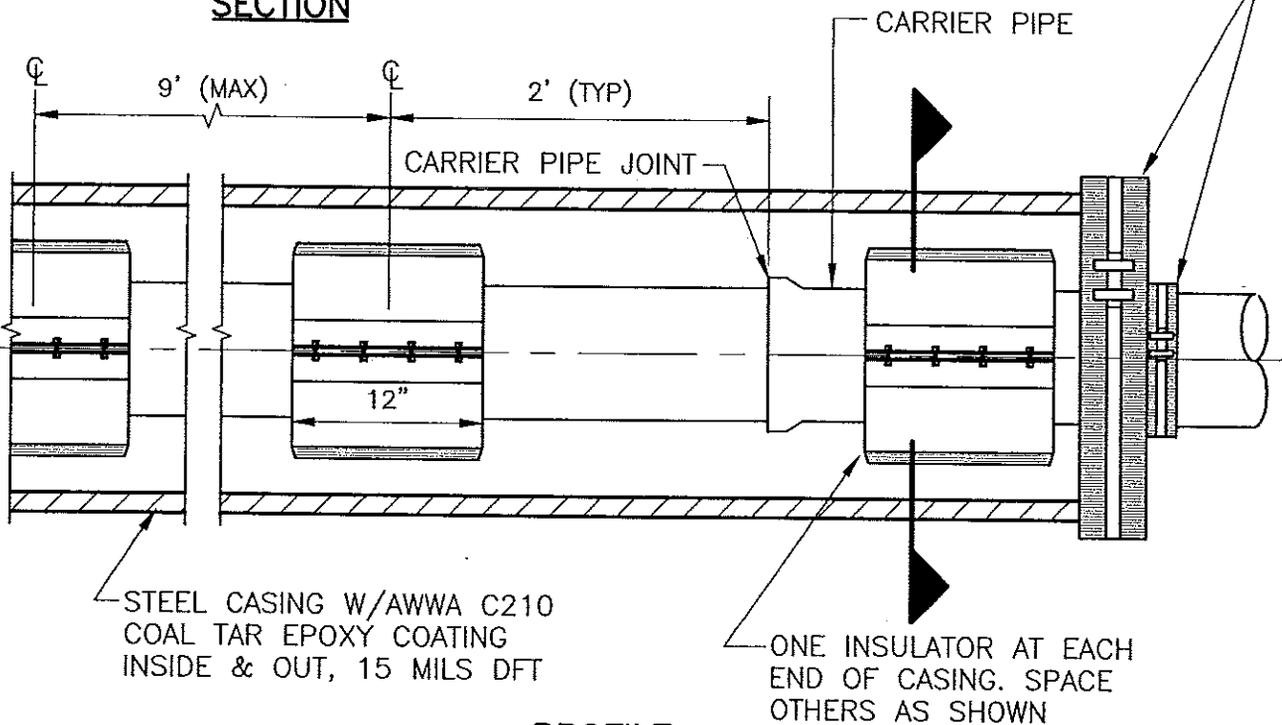
NOMINAL DIAMETER (INCHES)



CARRIER PIPE	CASING PIPE
8"	18"
10"	20"
12"	24"

1/8" THICK FLEXIBLE RUBBER CASING END SEAL WITH ALL STAINLESS STEEL BAND & TIGHTENING DEVICE HARDWARE

SECTION



PROFILE

NOTES:

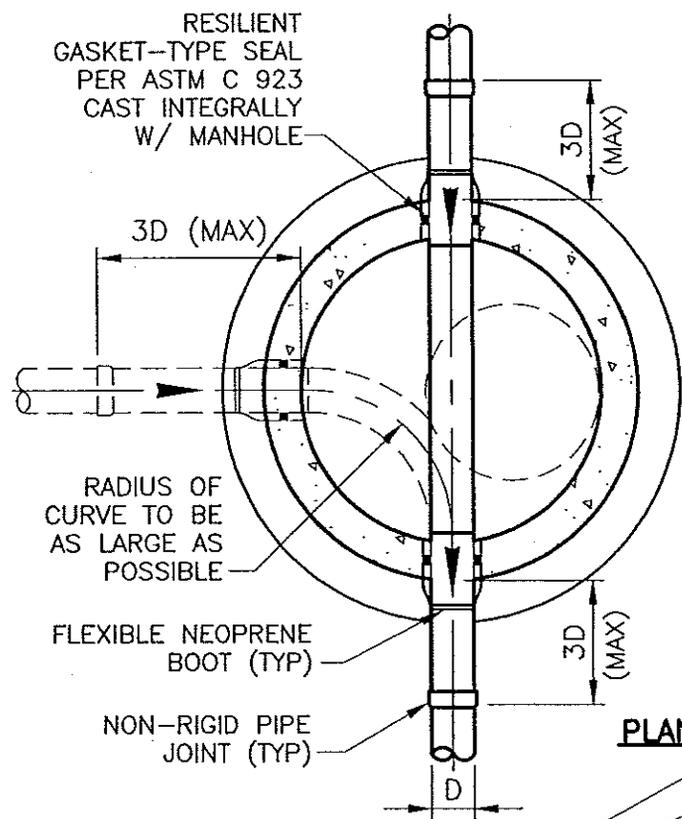
1. CASING PIPE SHALL CONFORM TO AWWA C200. WELD JOINTS SHALL BE CONTINUOUS & WATERTIGHT. PIPE SHALL BE A139 GRADE 36.
2. WALL THICKNESS FOR ALL CASING SIZES SHALL BE STANDARD 0.375 INCH MIN.
3. FOR PIPES CROSSING STATE ROADS OR RAILROADS ADDITIONAL REQUIREMENTS (IF ANY) IMPOSED BY HIGHWAY OR RAILROAD OWNER MUST BE MET.

STEEL PIPE ENCASEMENT FOR WATER AND SEWER MAINS DETAIL

NO SCALE

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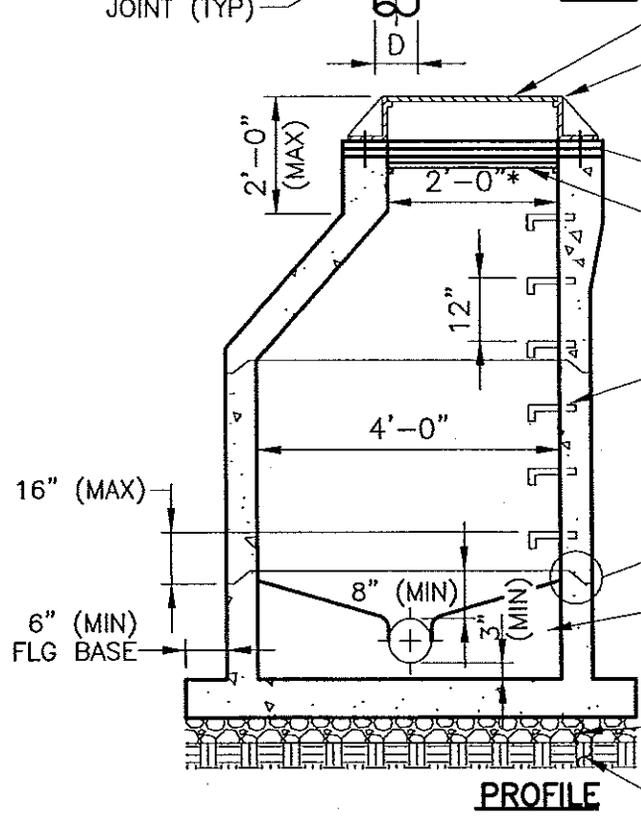
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NOTES:

1. ALL PRE CAST REINFORCED CONCRETE MANHOLE SECTIONS SHALL COMPLY WITH ASTM C-478.
2. CEMENT SHALL BE TYPE II OR III, AIR ENTRAINED, WITH 4,000 psi AT 28 DAYS.
3. REINFORCEMENT SHALL BE GRADE 60 PER ASTM A-615.
4. 24" DIA. CAST IRON FRAME AND COVER PER ASTM A-48, CLASS 30, FOR H-20 LOADING.
5. CAST IRON FRAME TO BE BOLTED TO MANHOLE WITH 5/8" ANCHOR BOLTS.
6. CASTING AND GRADE RINGS TO BE SEALED TO MANHOLE WITH PRE FORMED PLASTIC SEALING COMPOUND.
7. ALL JOINTS SHALL BE SEALED WITH TWO RINGS OF PRE FORMED PLASTIC SEALING COMPOUND.
8. COAT MANHOLE EXTERIOR WITH DAMP PROOFING:
 - A. PRO-MASTIC 900
 - B. HYDROCID 648
 - C. DEHYDRATINE 4
 - D. MEADOWS TYPE 3 TROWEL MASTRE
9. COAT MANHOLE INTERIOR WITH COAL TAR EPOXY:
 - A. PRO-GUARD COATINGS
 - B. PRO-POXY 3009
 - C. KOPPERS 300M

PLAN



PROFILE

PRECAST CONCRETE MANHOLE DETAIL

NO SCALE

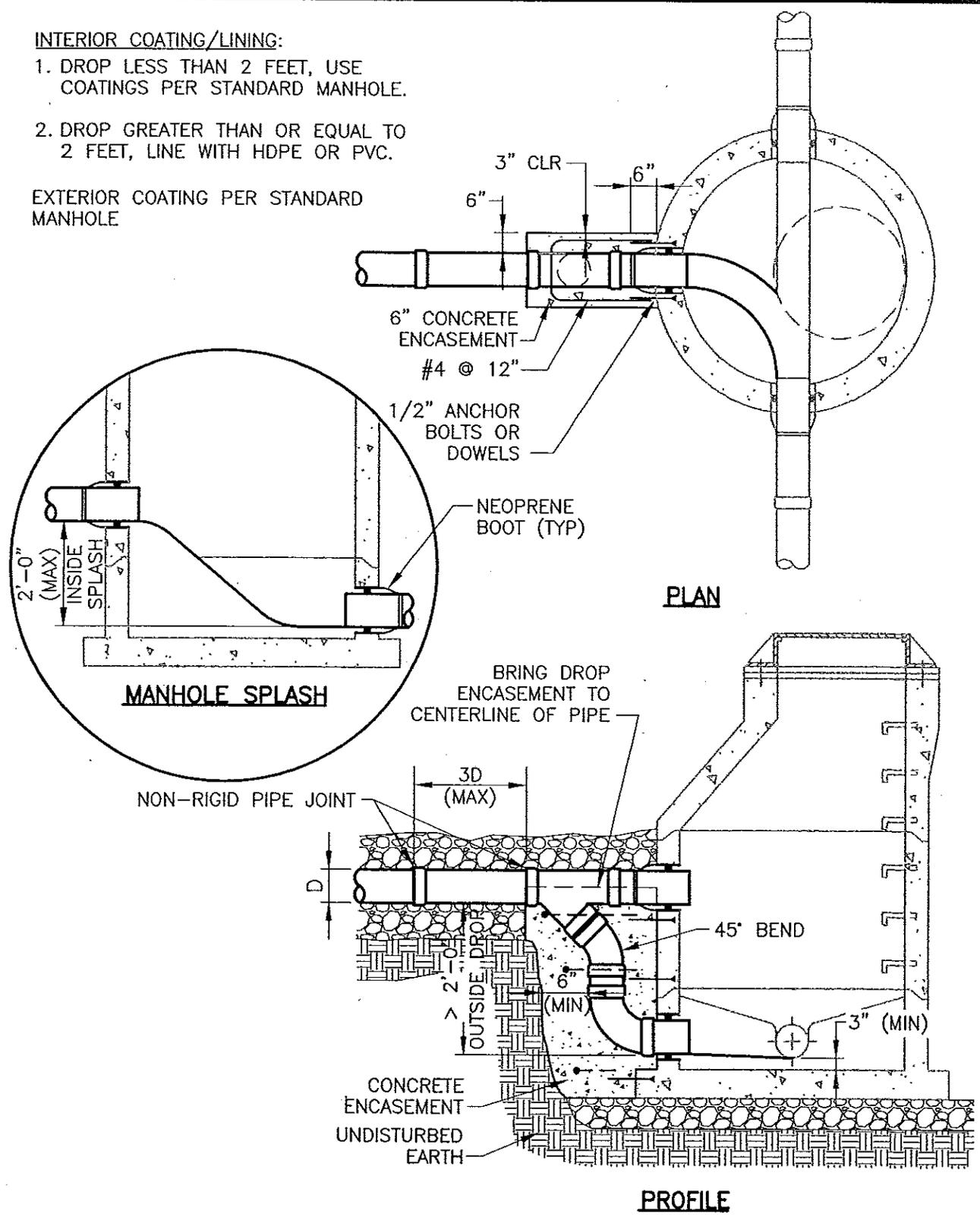
Figure No. 11

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INTERIOR COATING/LINING:

1. DROP LESS THAN 2 FEET, USE COATINGS PER STANDARD MANHOLE.
2. DROP GREATER THAN OR EQUAL TO 2 FEET, LINE WITH HDPE OR PVC.

EXTERIOR COATING PER STANDARD MANHOLE



DROP MANHOLE DETAIL
NO SCALE

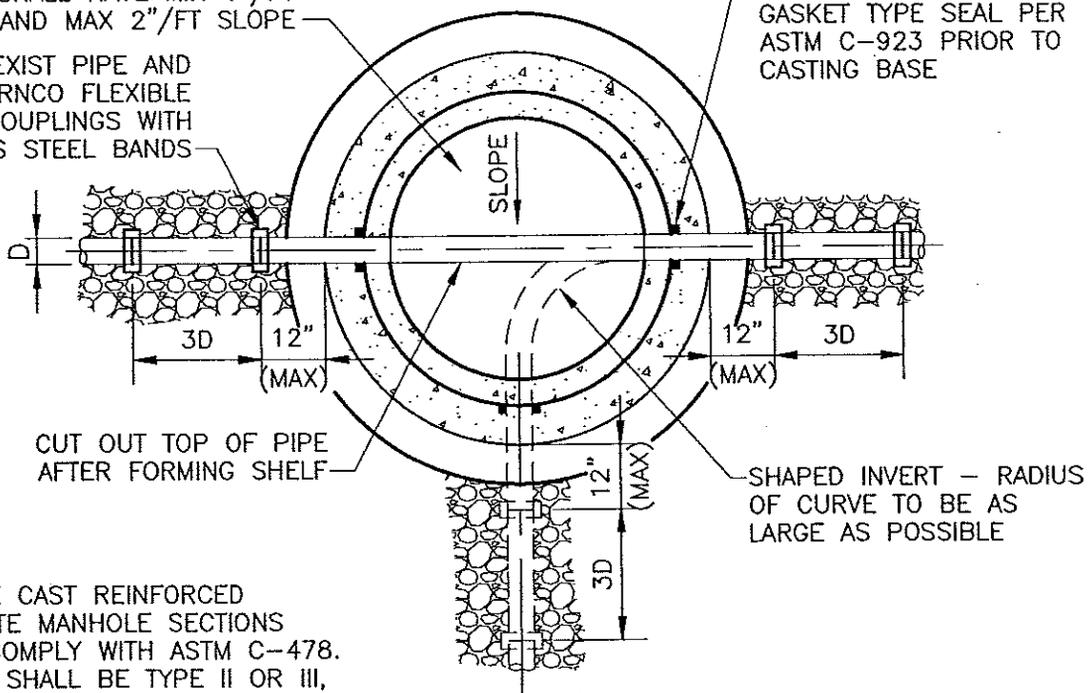
Figure No. 12

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FORM CHANNEL TO FULL DEPTH OF PIPE w/ CONCRETE AND PROVIDE SMOOTH FINISH. BENCH SHALL HAVE MIN 1"/FT AND MAX 2"/FT SLOPE

CUT EXIST PIPE AND INSTALL FERNCO FLEXIBLE COUPLINGS WITH STAINLESS STEEL BANDS

INSTALL RESILIENT GASKET TYPE SEAL PER ASTM C-923 PRIOR TO CASTING BASE

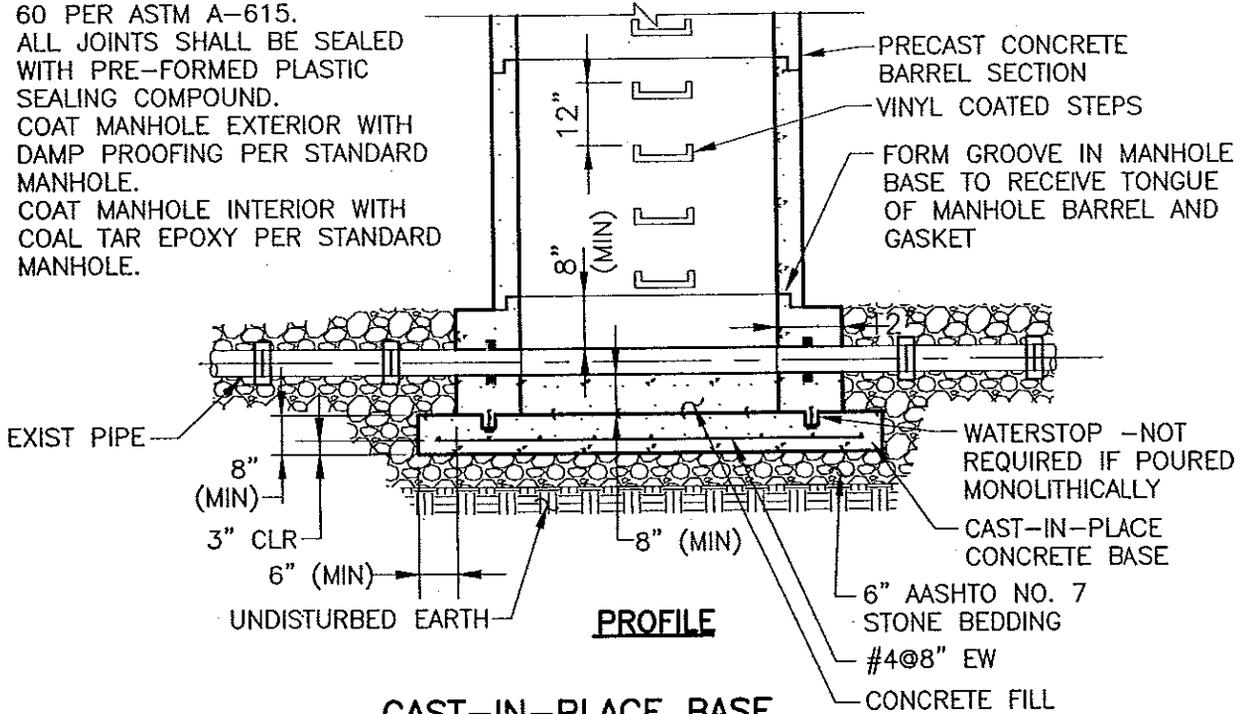


CUT OUT TOP OF PIPE AFTER FORMING SHELF

NOTES:

1. ALL PRE CAST REINFORCED CONCRETE MANHOLE SECTIONS SHALL COMPLY WITH ASTM C-478.
2. CEMENT SHALL BE TYPE II OR III, AIR ENTRAINED, WITH 4,000 psi AT 28 DAYS.
3. REINFORCEMENT SHALL BE GRADE 60 PER ASTM A-615.
4. ALL JOINTS SHALL BE SEALED WITH PRE-FORMED PLASTIC SEALING COMPOUND.
5. COAT MANHOLE EXTERIOR WITH DAMP PROOFING PER STANDARD MANHOLE.
6. COAT MANHOLE INTERIOR WITH COAL TAR EPOXY PER STANDARD MANHOLE.

PLAN

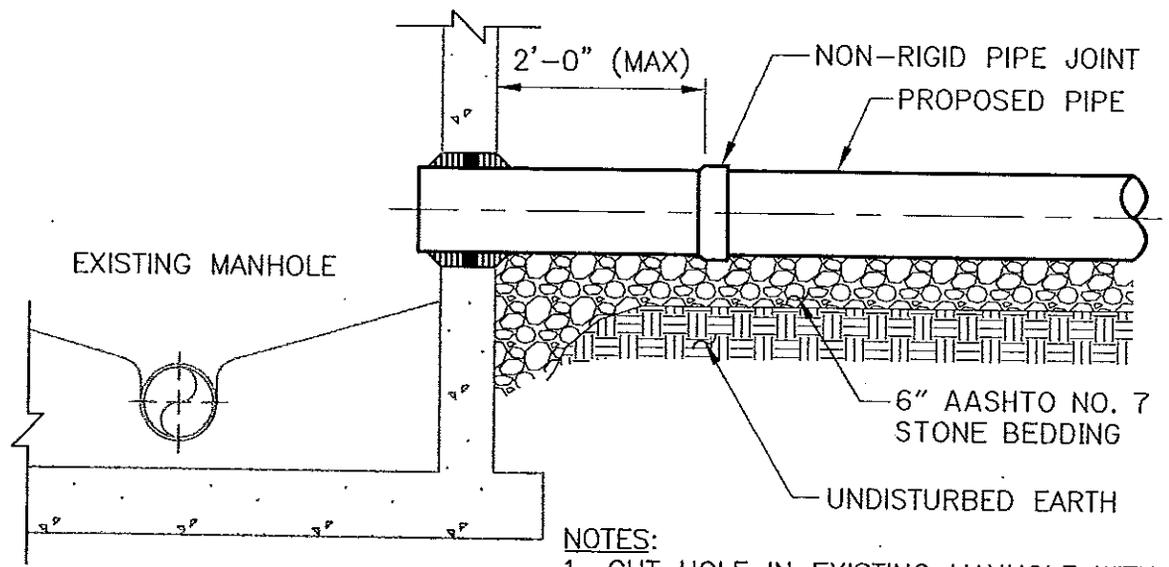


**CAST-IN-PLACE BASE
NEW MANHOLE OVER EXISTING SEWER DETAIL**

NO SCALE

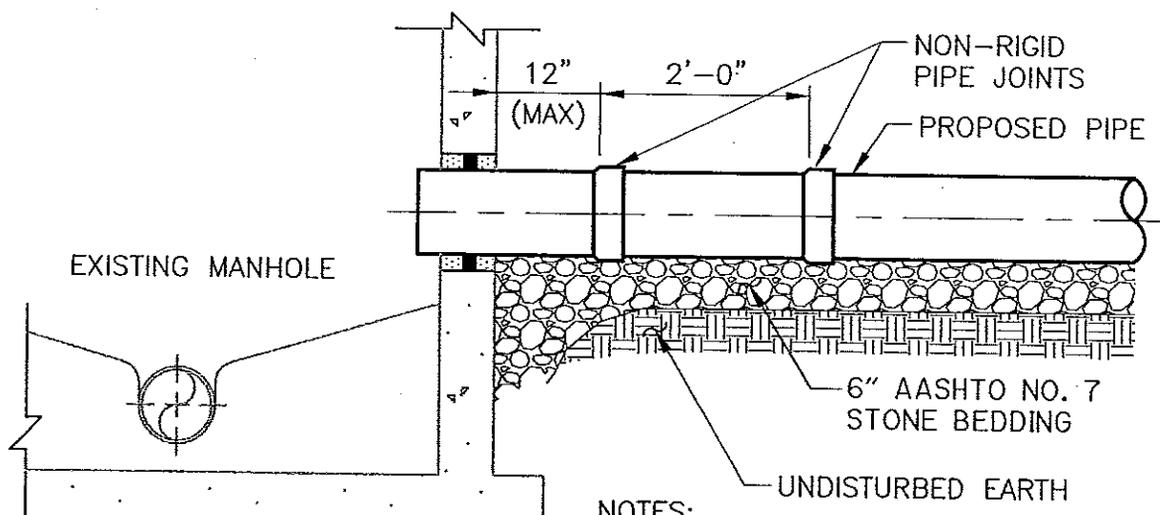
Figure No. 13

S:\22321\Details\Sewer\ BBCDTS14 01/12/05 14:59 millercs



- NOTES:
1. CUT HOLE IN EXISTING MANHOLE WITH CORING MACHINE.
 2. INSTALL RESILIENT GASKET TYPE SEAL PER ASTM C-923.
 3. CAULK ANNULAR SPACE WITH PREFORMED PLASTIC SEALING COMPOUND.

FLEXIBLE CONNECTION AT MANHOLE



- NOTES:
1. CUT HOLE IN EXISTING MANHOLE WITH CORING MACHINE.
 2. CAULK AROUND PIPE WITH PREFORMED PLASTIC SEALING COMPOUND.
 3. SEAL ANNULAR SPACE WITH NON-SHRINK GROUT.

RIGID CONNECTION AT MANHOLE

NEW SEWER TO EXISTING MANHOLE DETAIL

NO SCALE

Figure No. 14

S:\22321\Details\Sewer\BBCDTS15 01/12/05 14:59 millercs

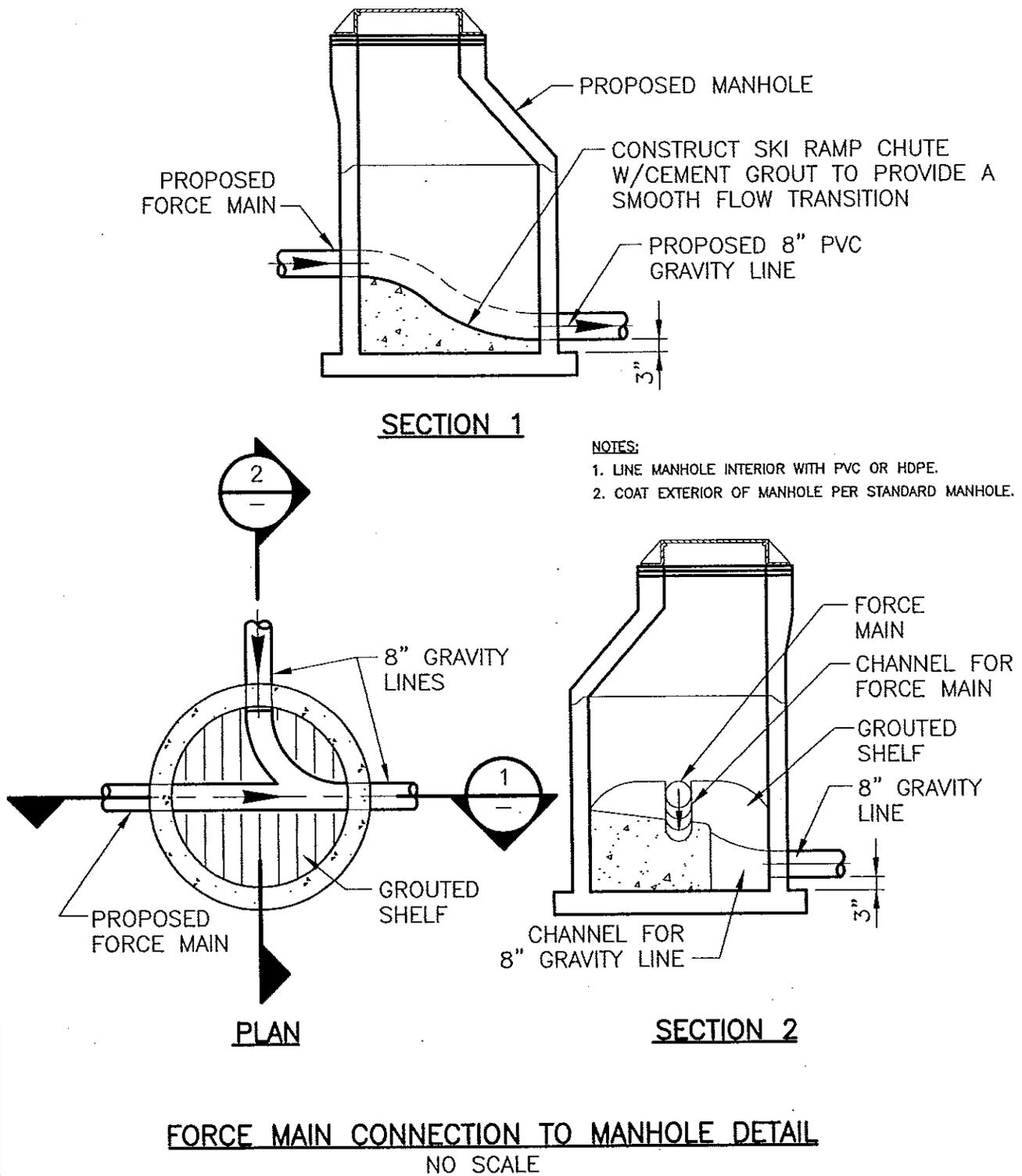
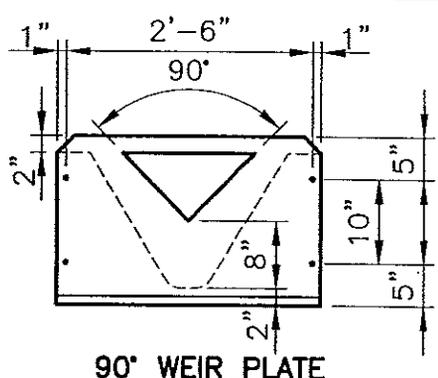


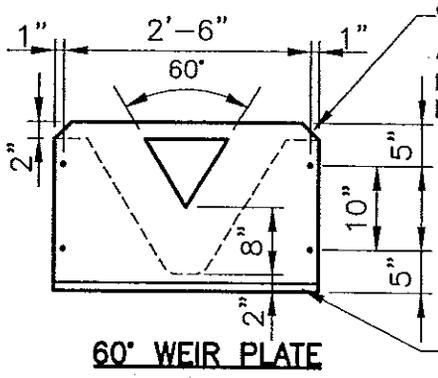
Figure No. 15

S:\22321\Details\Sewer\BBCDTS16 01/12/05 15:04 millercs



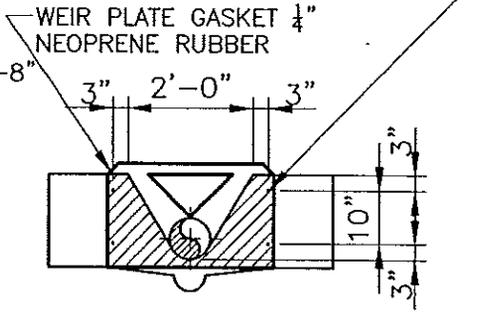
90° WEIR PLATE

NOTES:
 1. 90° WEIR PLATE SHALL BE USED FOR PEAK FLOWS UP TO 0.80 MGD. IF PEAK FLOW WILL EXCEED 0.80 MGD AN ALTERNATE WEIR PLATE MUST BE APPROVED BY THE ENGINEER.
 2. 60° WEIR PLATE SHALL BE USED FOR PEAK FLOWS LESS THAN 0.46 MGD.
 WEIR PLATE ANCHORS $\frac{3}{8}$ "
 316 SS ANCHOR BOLTS
 (TYP OF 4)

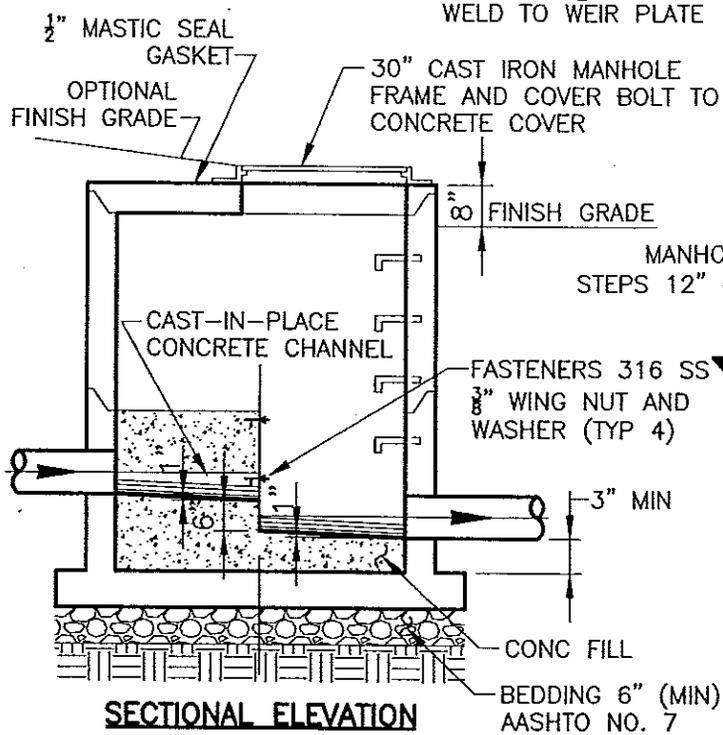


60° WEIR PLATE

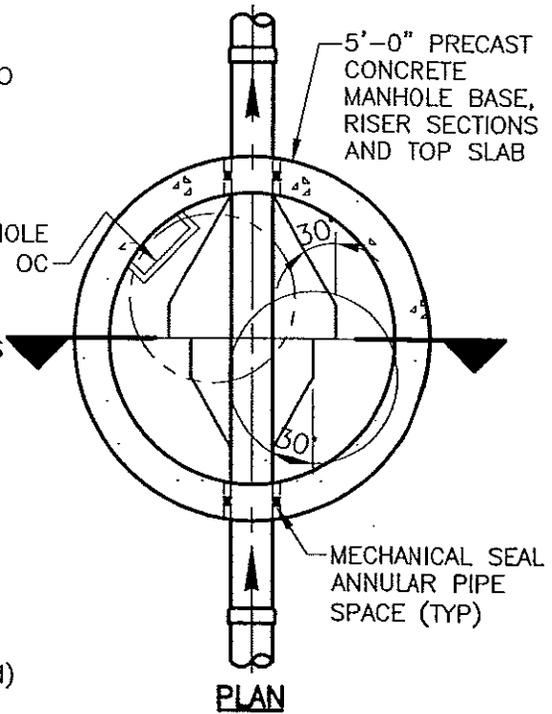
WEIR PLATE (TYP)
 ALUMINUM $\frac{1}{4}$ "x20"x2'-8"
 DRILL 4 - $\frac{1}{2}$ " DIA
 MOUNTING HOLES
 STIFFENER (TYP)
 ALUMINUM $\frac{1}{2}$ "x1"x2'-8"
 WELD TO WEIR PLATE



SECTION



SECTIONAL ELEVATION

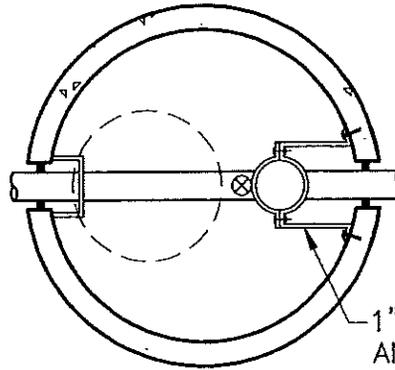


PLAN

PRECAST CONCRETE FLOW MONITORING MANHOLE DETAIL
 NO SCALE

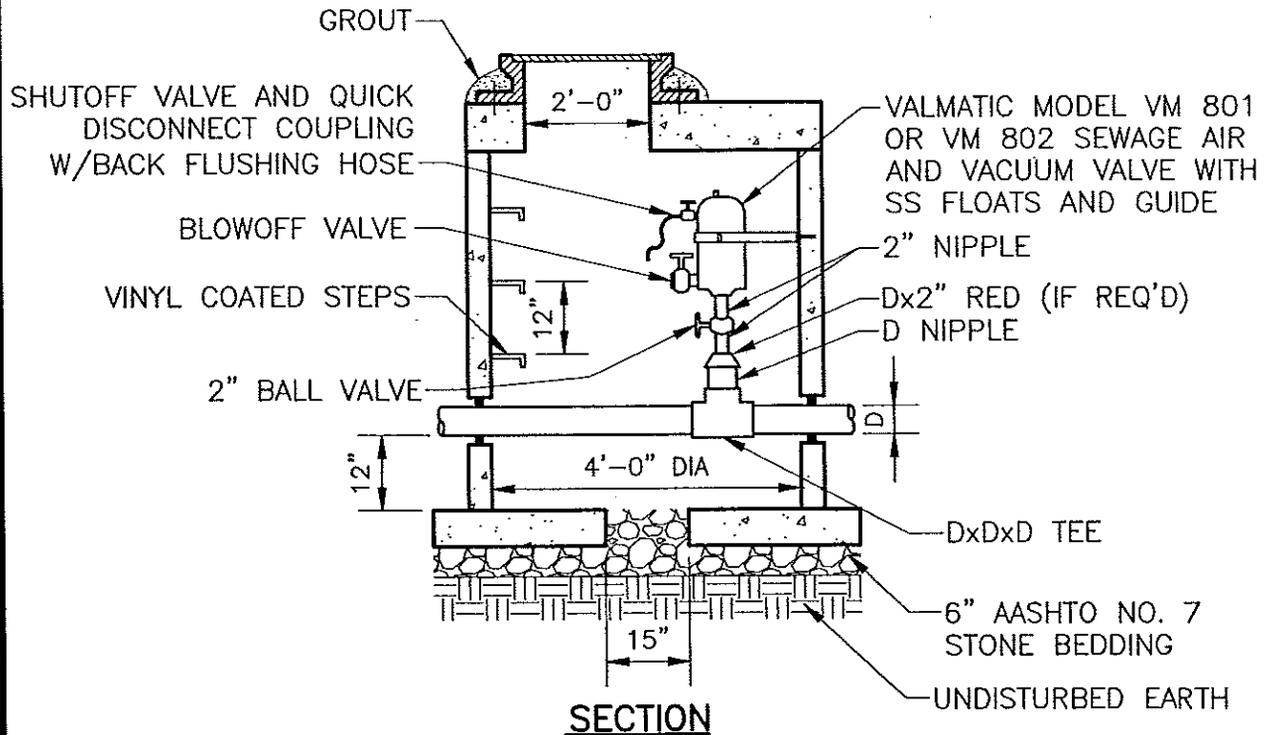
NOTES:

1. ALL PRECAST REINFORCED CONCRETE MANHOLE SECTIONS SHALL COMPLY WITH ASTM C-478.
2. CEMENT SHALL BE TYPE II OR III, AIR ENTRAINED, WITH $f'c=4,000$ psi AT 28 DAYS.
3. REINFORCEMENT SHALL BE GRADE 60 PER ASTM A-615.
4. 24" DIA. CAST IRON FRAME AND COVER PER ASTM A-48, CLASS 30, FOR H-20 LOADING.
5. CAST IRON FRAME TO BE BOLTED TO MANHOLE WITH 5/8" ANCHOR BOLTS.
6. CASTING AND GRADE RINGS TO BE SEALED TO MANHOLE WITH PREFORMED PLASTIC SEALING COMPOUND.
7. ALL JOINTS SHALL BE SEALED WITH PREFORMED PLASTIC SEALING COMPOUND.



1" x 1/4" SS STRAP
AND ANCHOR BOLTS

PLAN



SECTION

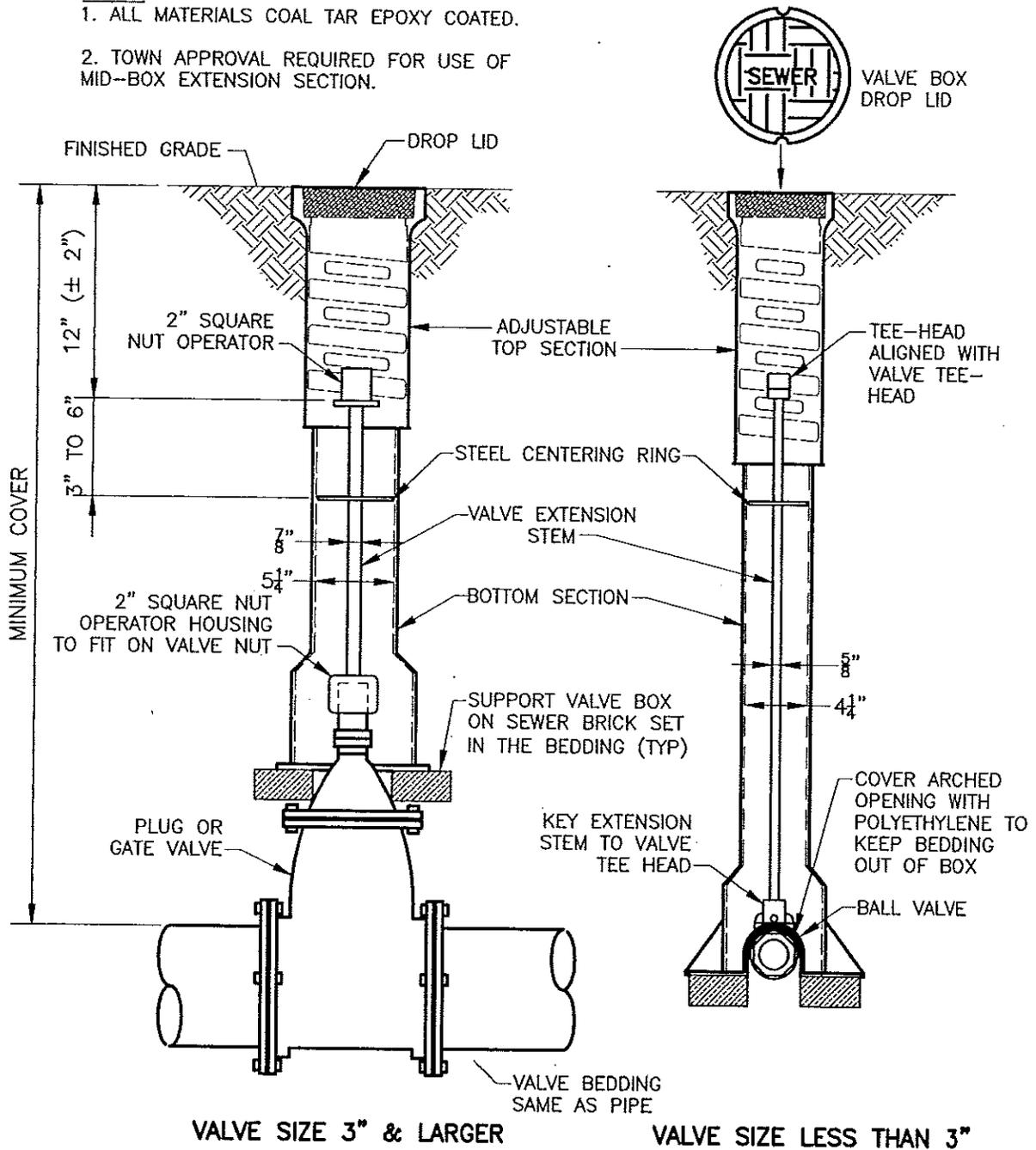
AIR RELEASE VALVE AND CHAMBER DETAIL

NO SCALE

S:\22321\Details\Sewer\BBCDTS17 01/12/05 15:05 millercs

NOTES:

- 1. ALL MATERIALS COAL TAR EPOXY COATED.
- 2. TOWN APPROVAL REQUIRED FOR USE OF MID-BOX EXTENSION SECTION.



VALVE SIZE 3" & LARGER

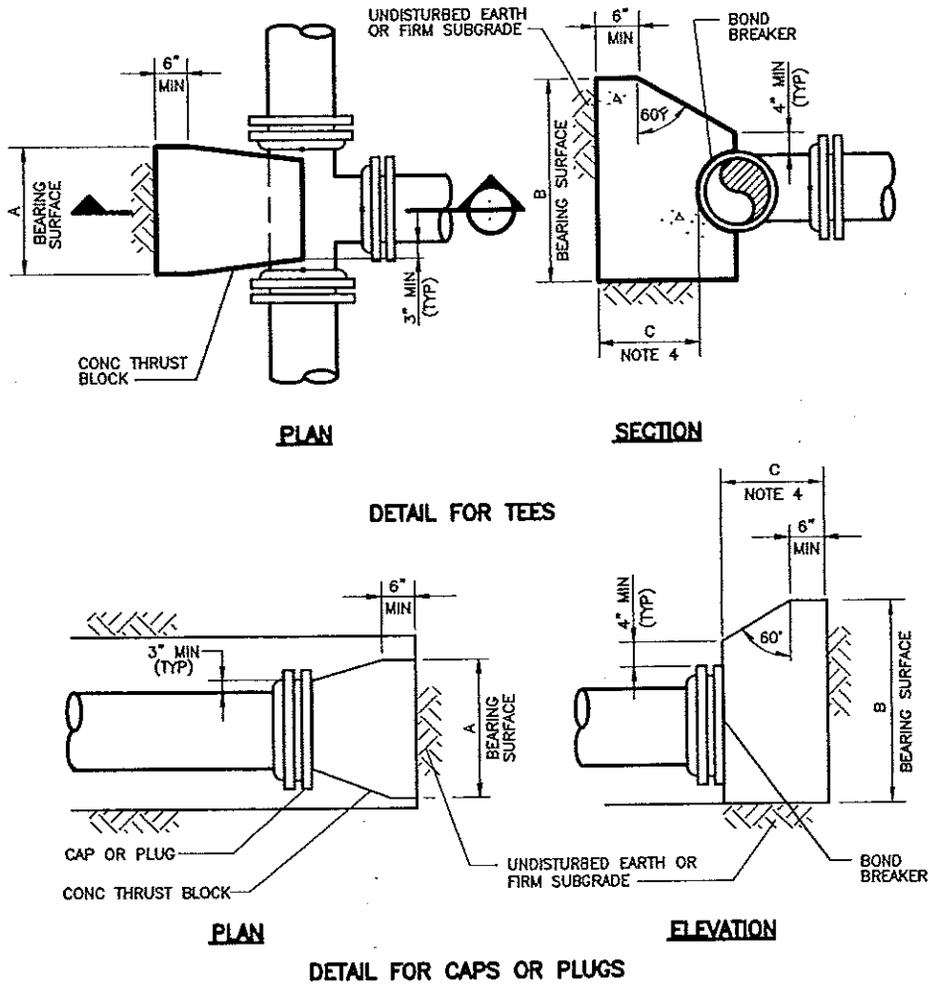
VALVE SIZE LESS THAN 3"

VALVE AND BOX INSTALLATION DETAIL

NO SCALE

S:\22321\Details\Sewer\ BCDTS18 01/12/05 15:06 millercs

S:\22321\Details\Sewer\ BCDTS19 01/12/05 15:07 millercs



NOMINAL PIPE SIZE (IN)	MAXIMUM PIPE OD (IN)	REQUIRED BEARING AREA (SQ FT)
3	3.96	1.4
4	4.80	2.0
6	6.90	4
8	9.05	7
10	11.10	11
12	13.20	15
14	15.30	21
16	17.40	27
18	19.50	34
20	21.60	41
24	25.80	59
30	32.00	90
36	38.30	130

NOTES:

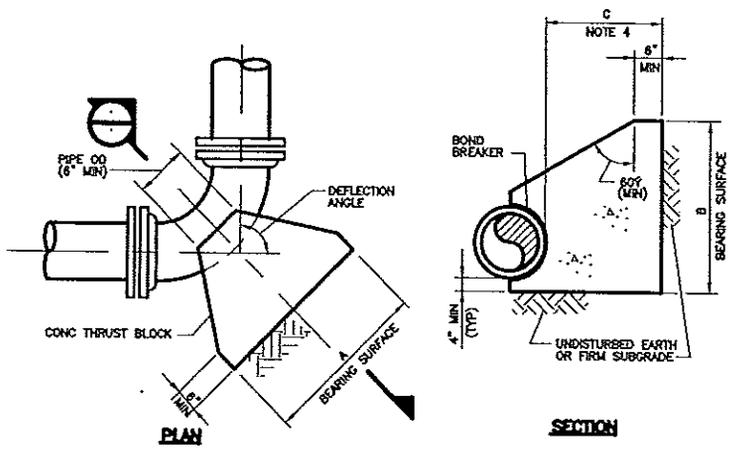
1. MAXIMUM TEST PRESURE = 1.50x150 PSI
2. MINIMUM ALLOWABLE SOIL BEARING PRESSURE = 2000 PSF
3. BEARING AREA = A x B
4. C SHALL BE GREATER THAN A/2 AND B/2.

**THRUST BLOCK FOR TEES,
CAPS AND PLUGS DETAIL**

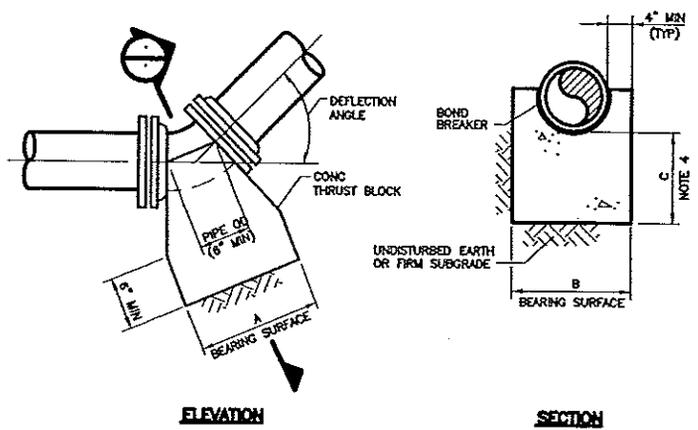
NO SCALE

Figure No. 19

S:\22321\Details\Sewer\BBCDTS20 01/12/05 15:07 millercs



DETAIL FOR HORIZONTAL BENDS



DETAIL FOR LOWER VERTICAL BENDS

NOMINAL PIPE SIZE (INCHES)	MAXIMUM PIPE OD (INCHES)	REQUIRED BEARING AREA (SQ FT)					
		90 DEG	60 DEG	45 DEG	30 DEG	22.50 DEG	11.25 DEG
3	3.98	2.0	1.4	1.1	0.7	0.5	0.3
4	4.50	2.9	2.0	1.6	1.1	0.8	0.4
6	6.90	6	4	3	2.2	1.6	0.8
8	9.05	10	7	6	4	3	1.4
10	11.10	15	11	8	6	4	2.1
12	13.20	22	15	12	8	6	3
14	15.30	29	21	16	11	8	4
16	17.40	36	27	20	14	10	5
18	19.50	46	34	26	17	13	7
20	21.60	56	41	32	21	16	8
24	25.80	83	59	45	30	23	12
30	32.00	128	90	69	47	35	18
36	38.30	183	130	99	67	51	25

- NOTES:
 1. MAXIMUM TEST PRESSURE = 1.5 x 150 PSI
 2. MINIMUM ALLOWABLE SOIL BEARING PRESSURE = 2000 PSF
 3. BEARING AREA = A x B
 4. C SHALL BE GREATER THAN A/2 AND B/2.

THRUST BLOCKS FOR HORIZONTAL BENDS AND LOWER VERTICAL BENDS DETAIL

NO SCALE

Figure No. 20

S:\22321\Details\Sewer\ BBCDTS21 01/12/05 15:08 millercs

MINIMUM RESTRAINED PIPE LENGTH (FT.) FOR VERTICAL BENDS
(without polyethylene encasement)

Diameter (in.)	Vertical Bend Angle (Degrees)		
	45	22-1/2	11-1/4
6	20	10	5
8	26	12	6
10	32	15	8
12	37	18	9
14	43	21	10
16	48	23	12
18	54	26	13
20	59	28	14
24	70	34	17

MINIMUM RESTRAINED PIPE LENGTH (FT.) FOR HORIZONTAL BENDS
(without polyethylene encasement)

Diameter (in.)	Horizontal Bend Angle (Degrees)			
	90	45	22-1/2	11-1/4
6	15	6	3	1
8	19	8	4	2
10	23	10	5	2
12	28	11	5	3
14	32	13	6	3
16	36	15	7	4
18	40	16	8	4
20	43	18	9	4
24	51	21	10	5

MINIMUM RESTRAINED PIPE LENGTH (FT.) FOR VERTICAL BENDS
(with polyethylene encasement)

Diameter (in.)	Vertical Bend Angle (Degrees)		
	45	22-1/2	11-1/4
6	29	14	7
8	37	18	9
10	45	22	11
12	53	26	13
14	61	29	15
16	69	33	16
18	77	37	18
20	85	41	20
24	100	48	24

MINIMUM RESTRAINED PIPE LENGTH (FT.) FOR HORIZONTAL BENDS
(with polyethylene encasement)

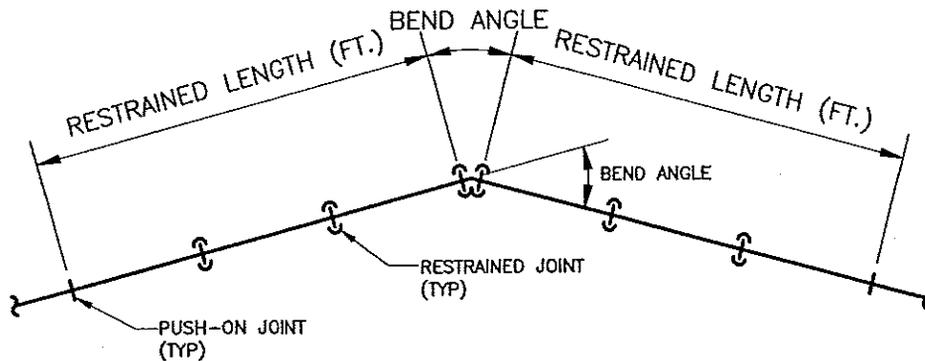
Diameter (in.)	Horizontal Bend Angle (Degrees)			
	90	45	22-1/2	11-1/4
6	16	7	3	2
8	21	9	4	2
10	26	11	5	3
12	30	13	6	3
14	35	14	7	3
16	39	16	8	4
18	44	18	9	4
20	48	20	9	5
24	56	23	11	6

Notes:

- 1 Design pressure = 150 psi
- 2 Depth of cover = 4 Feet
- 3 Safety Factor = 1.5
- 4 Soil Type = Cohesive Granular
- 5 Soil Internal Friction = 20 Degrees
- 6 Cohesion = 200 psf
- 7 Soil Density = 90 pcf

Notes:

- 1 Design pressure = 150 psi
- 2 Depth of cover = 4 Feet
- 3 Safety Factor = 1.5
- 4 Soil Type = Cohesive Granular
- 5 Soil Internal Friction = 20 Degrees
- 6 Cohesion = 200 psf
- 7 Soil Density = 90 pcf



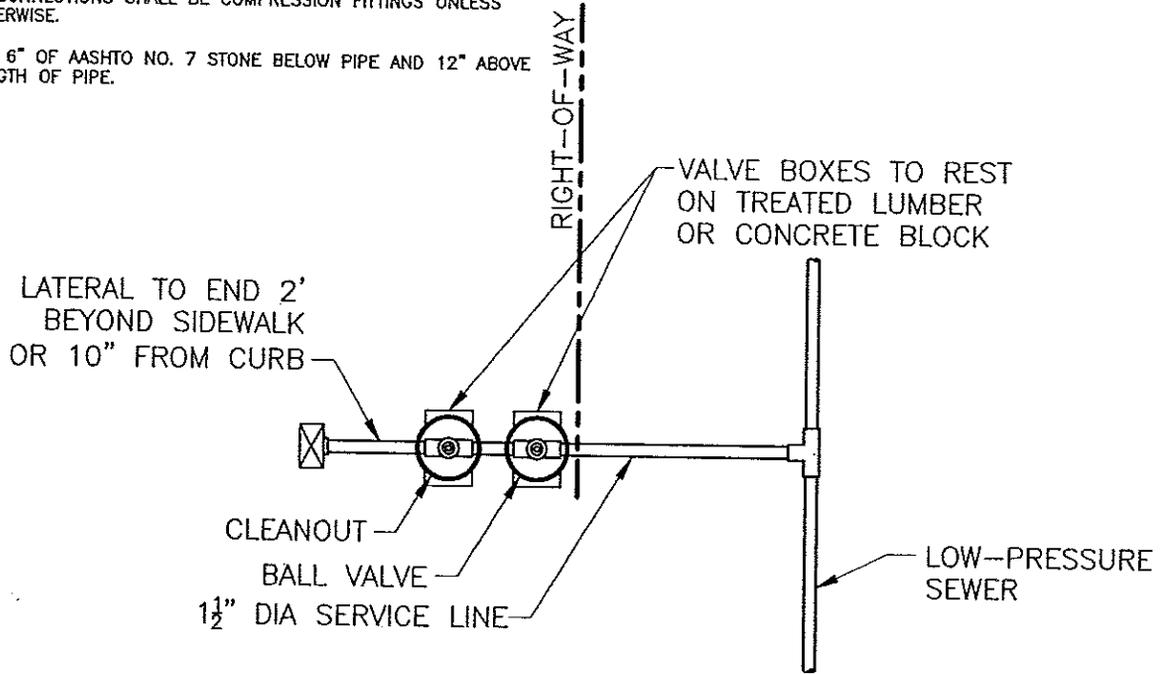
RESTRAINED DI PIPE LENGTH DETAIL
NO SCALE

Figure No. 21

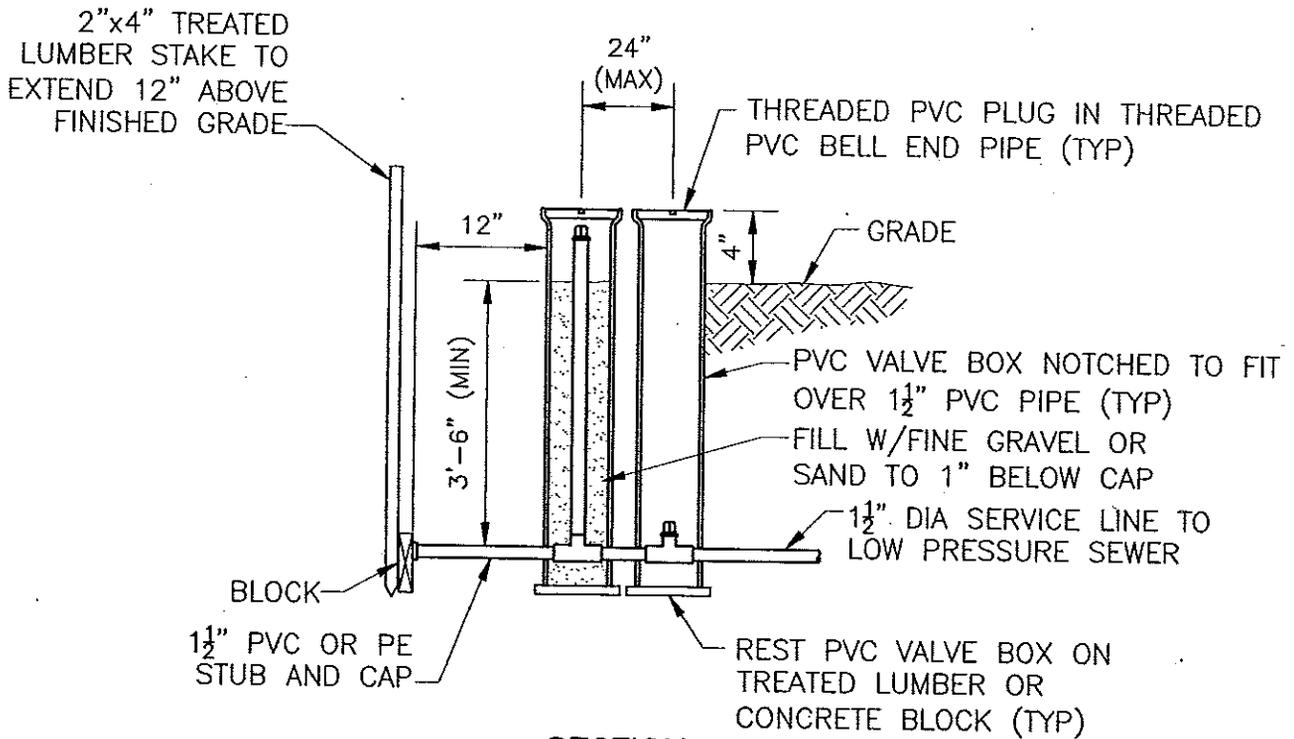
NOTE:

1. ALL PE CONNECTIONS SHALL BE COMPRESSION FITTINGS UNLESS NOTED OTHERWISE.

2. PROVIDE 6" OF AASHTO NO. 7 STONE BELOW PIPE AND 12" ABOVE ENTIRE LENGTH OF PIPE.



PLAN



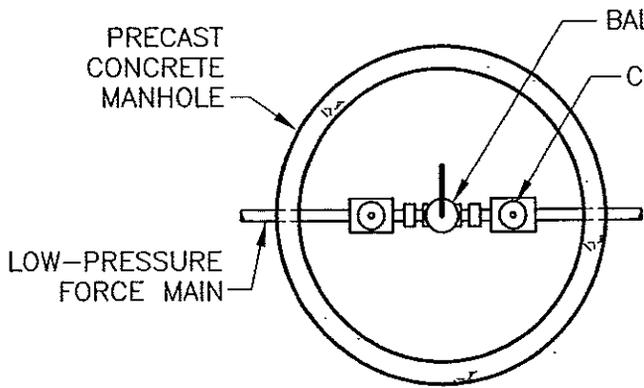
SECTION

**TYPICAL LATERAL CONNECTION TO
LOW-PRESSURE SEWER DETAIL**

NO SCALE

S:\22321\Details\Sewer\BBCDTS22 01/12/05 15:09 millercs

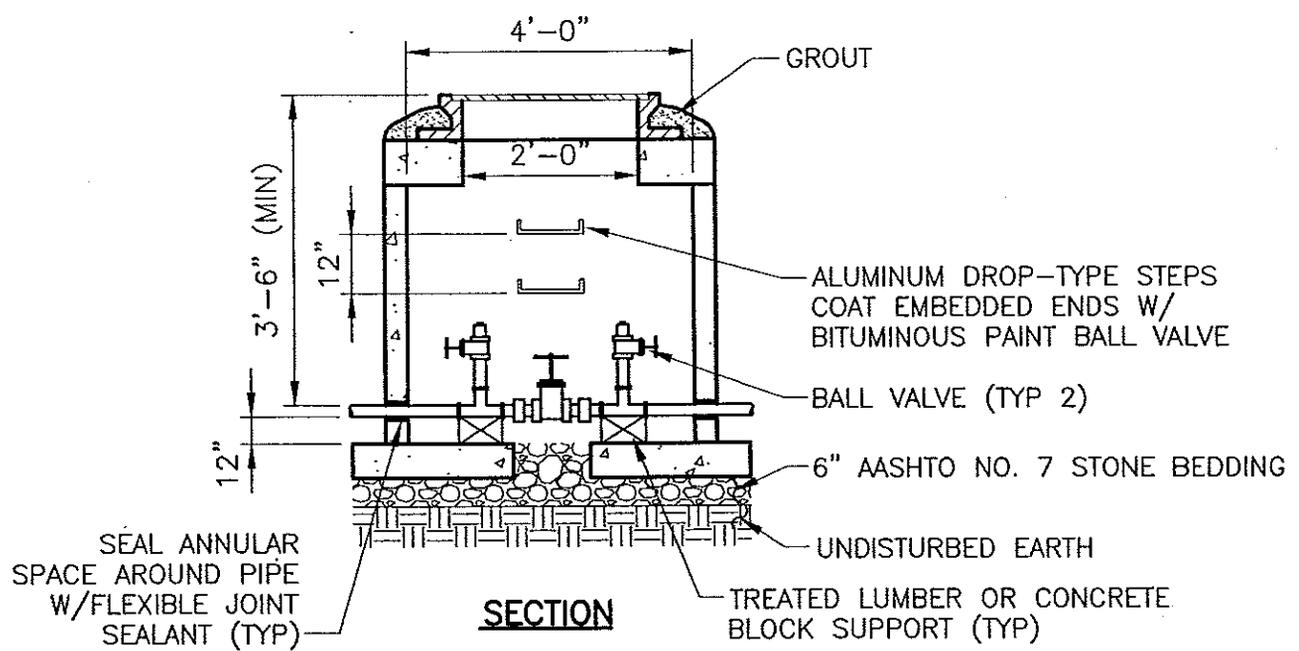
S:\22321\Details\Sewer\BBCDTS23 01/12/05 15:11 millercs



PLAN

NOTES:

1. ALL PRECAST REINFORCED CONCRETE MANHOLE SECTIONS SHALL COMPLY WITH ASTM C-478.
2. CEMENT SHALL BE TYPE II OR III, AIR ENTRAINED, WITH $f'c=4,000$ psi AT 28 DAYS.
3. REINFORCEMENT SHALL BE GRADE 60 PER ASTM A-615.
4. 24" DIA CAST IRON FRAME AND COVER PER ASTM A-48, CLASS 30, FOR H-20 LOADING.
5. CAST IRON FRAME TO BE BOLTED TO MANHOLE WITH $\frac{5}{8}$ " ANCHOR BOLTS.
6. CASTING AND GRADE RINGS TO BE SEALED TO MANHOLE WITH WATERPROOF MORTAR OR PREFORMED PLASTIC SEALING COMPOUND.
7. ALL JOINTS SHALL BE SEALED WITH PREFORMED PLASTIC SEALING COMPOUND.



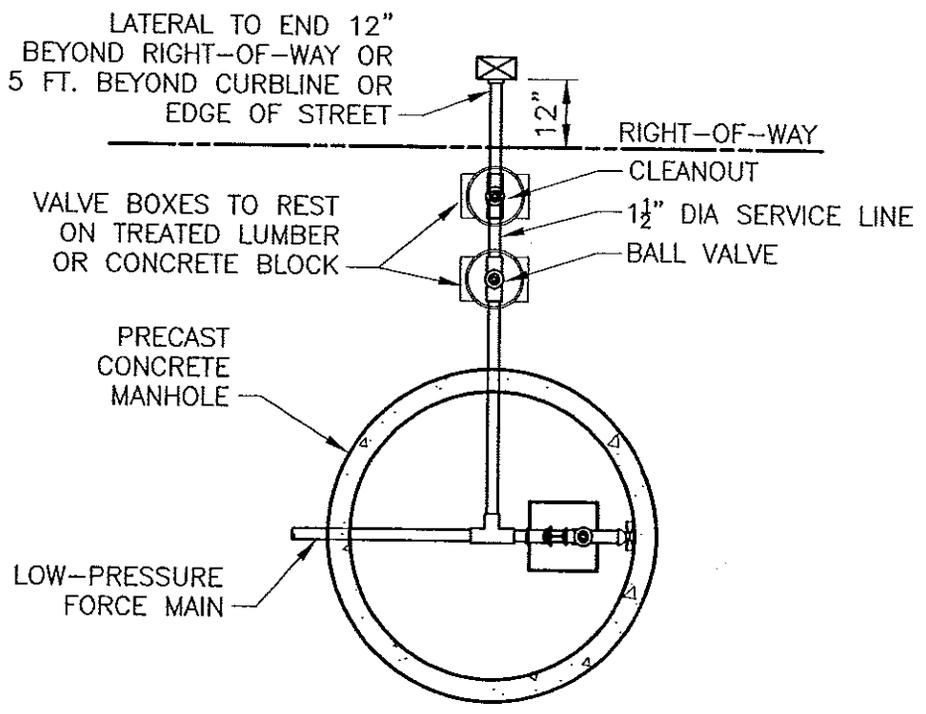
SECTION

LOW-PRESSURE SEWER VALVE AND CLEANOUT MANHOLE DETAIL

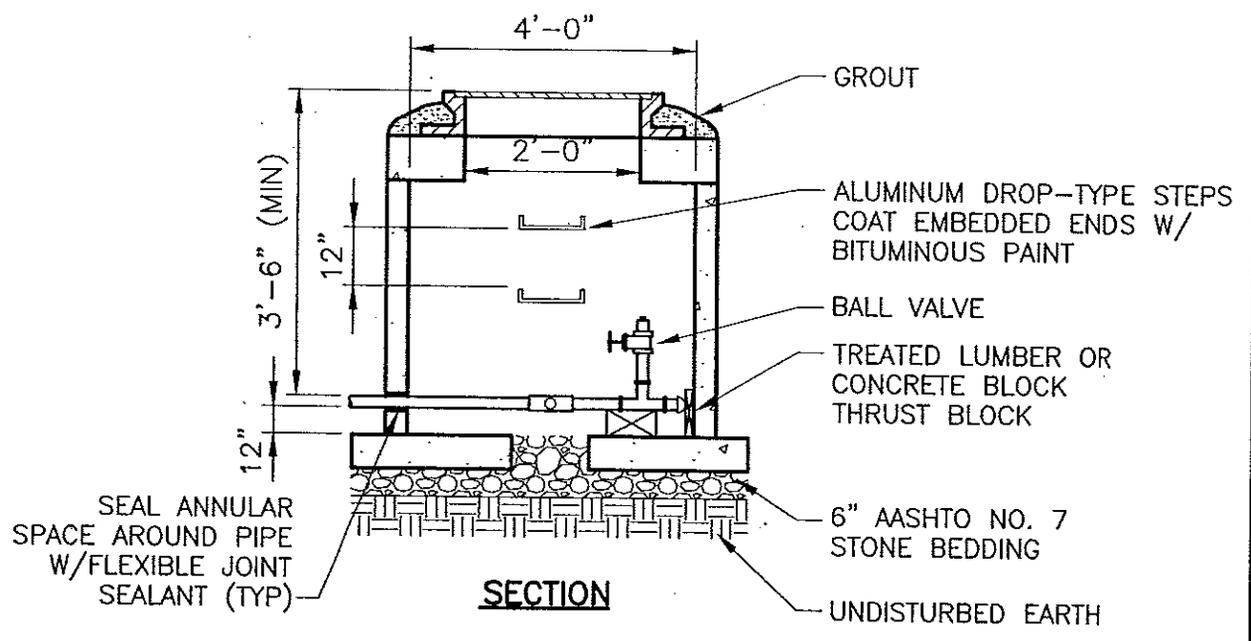
NO SCALE

Figure No. 23

S:\22321\Details\Sewer\BBCDTS24 01/12/05 15:12 millercs



PLAN



SECTION

**LOW-PRESSURE SEWER FORCEMAIN
TERMINAL CLEANOUT MANHOLE DETAIL**
NO SCALE

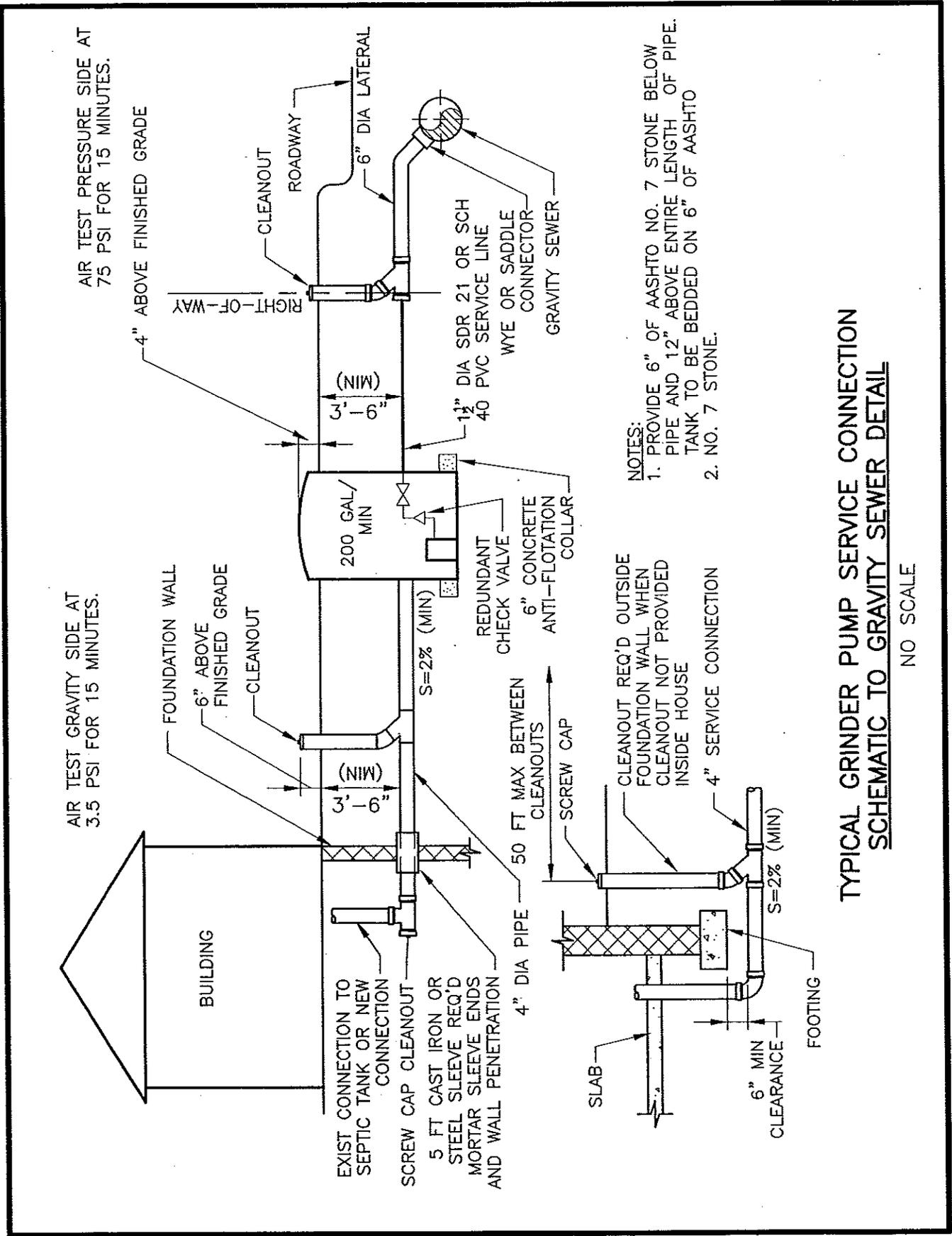
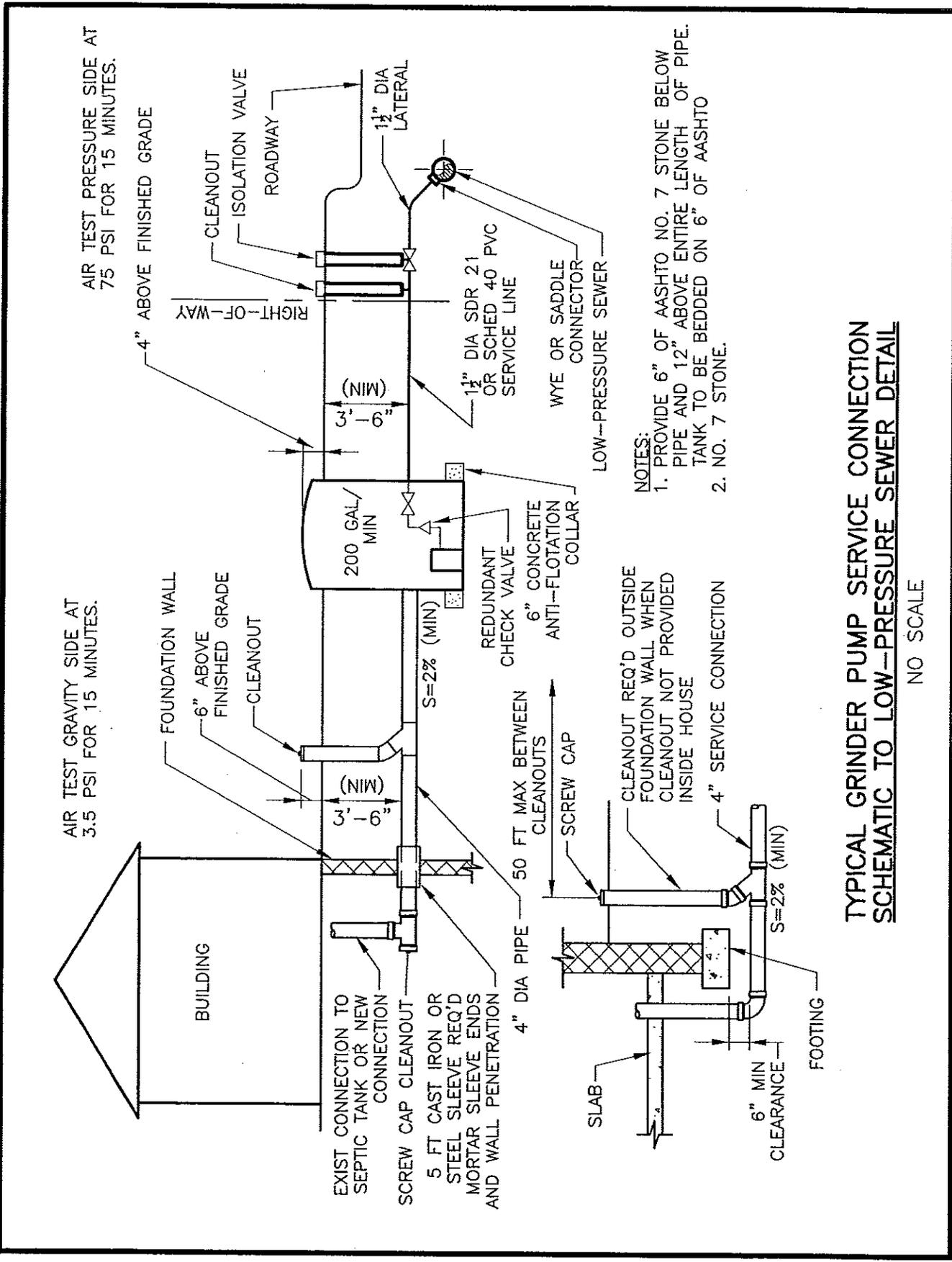


Figure No. 25



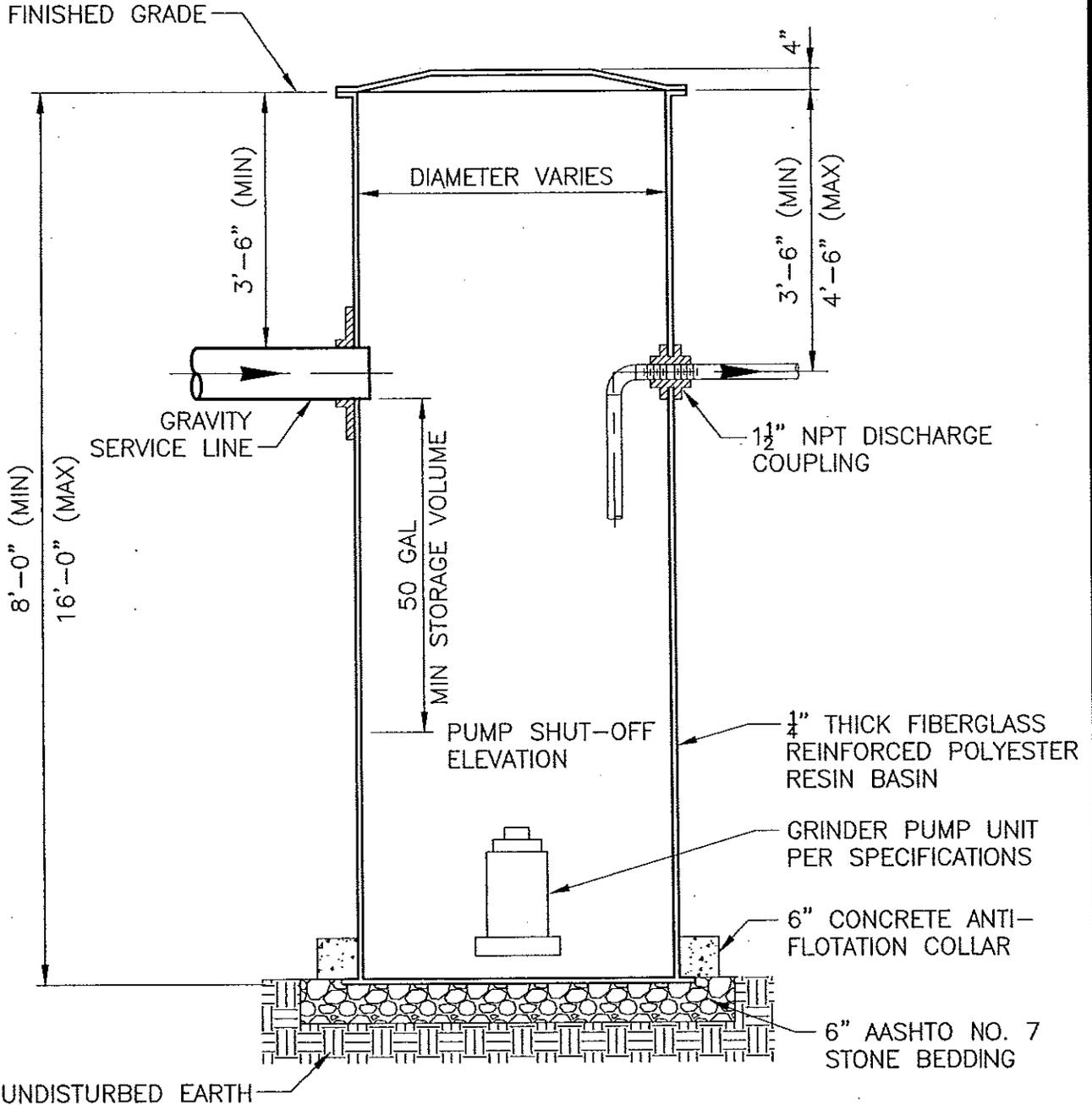
TYPICAL GRINDER PUMP SERVICE CONNECTION SCHEMATIC TO LOW-PRESSURE SEWER DETAIL

NO SCALE



NOTES:

1. FIBERGLASS BASINS MAY NOT BE USED IN AREAS SUBJECT TO TRAFFIC LOADING.
2. LOCATION OF BASIN TO BE DETERMINED BY PROPERTY OWNER OR DEVELOPER.
3. EXCAVATED AREA SHALL BE BACKFILLED TO 6" BELOW GRADE. BACKFILL MATERIAL SHALL BE EXCAVATED MATERIAL CONTAINING NO SOIL LUMPS, STONES, CONCRETE, OR FOREIGN OBJECTS LARGER THAN 1" MAX DIMENSION, OR AASHTO NO. 7 STONE.
4. 6" TOPSOIL AND SEED SHALL BE PLACED TO GRADE THE SURROUNDING EXCAVATED AREA.



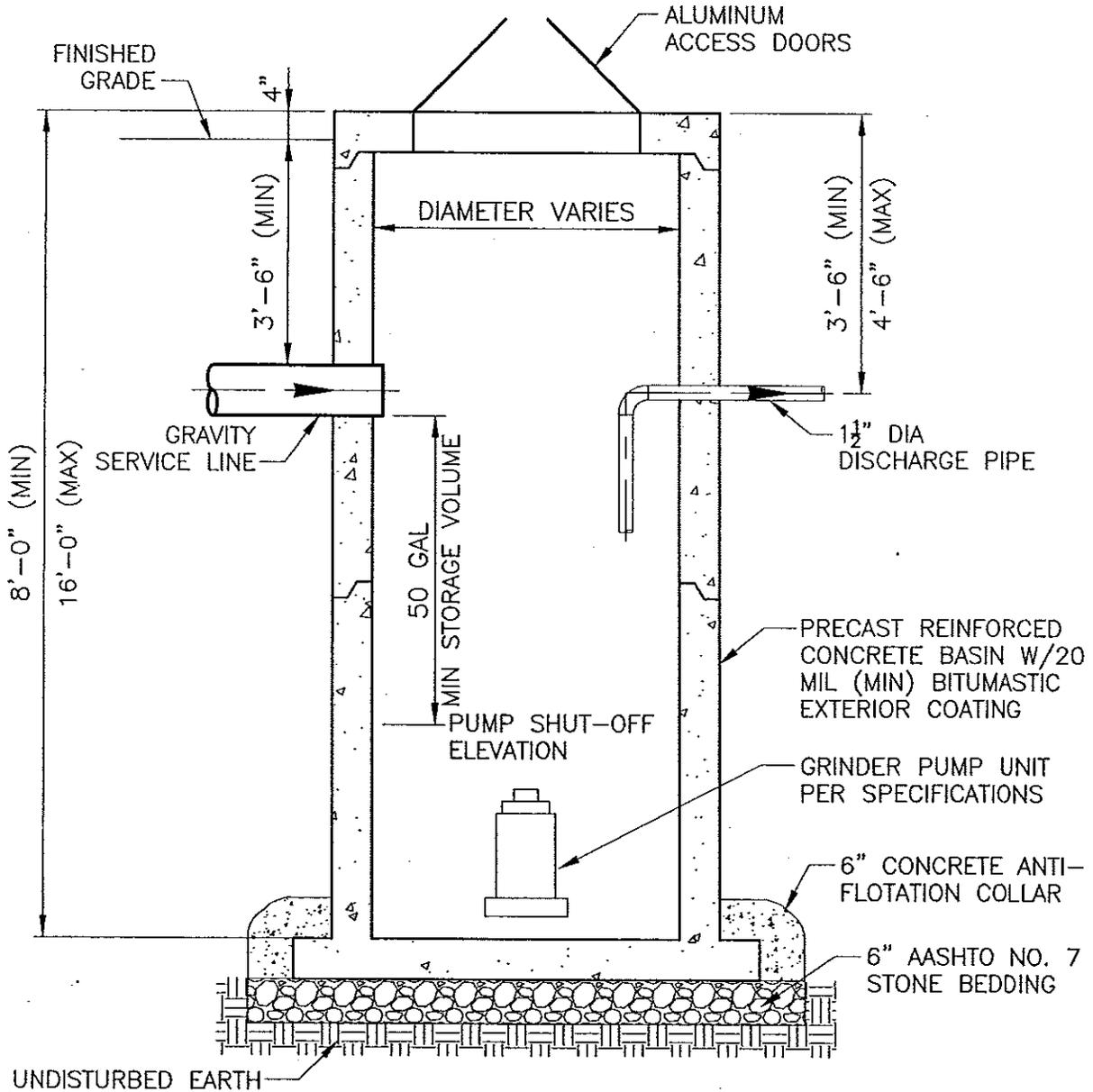
**FIBERGLASS BASIN FOR TYPICAL
INDIVIDUAL GRINDER PUMP DETAIL**
NO SCALE

S:\22321\Details\Sewer\BBCDTS27 01/12/05 15:14 millercs

Figure No. 27

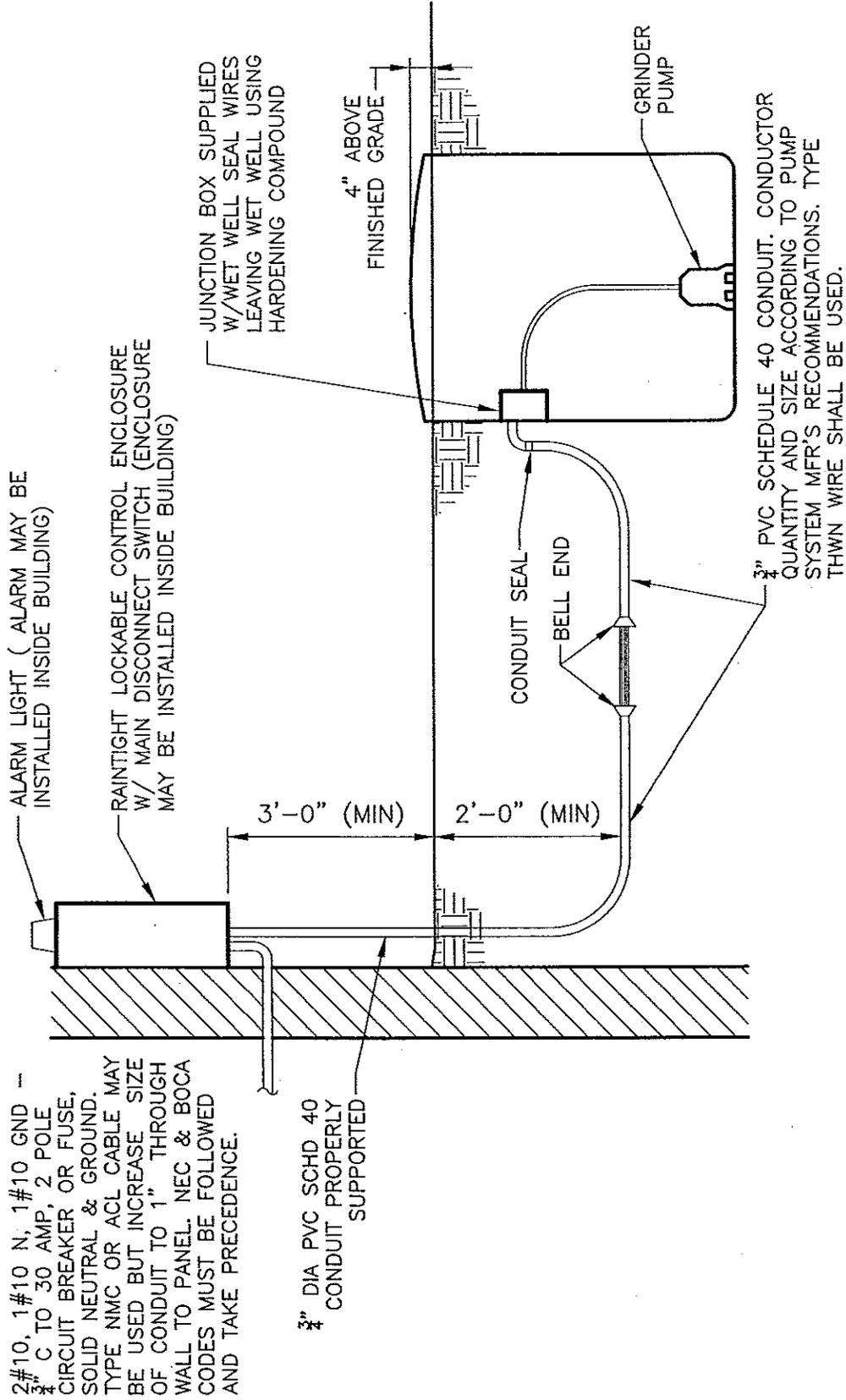
NOTES:

1. CONCRETE BASINS SHALL BE USED IN AREAS SUBJECT TO TRAFFIC LOADING.
2. CONCRETE BASINS SHALL COMPLY WITH ASTM C-478 AND SHALL BE WATERTIGHT.
3. JOINTS BETWEEN SECTIONS SHALL BE PROVIDED W/PREFORMED PLASTIC JOINT SEALING COMPOUND.
4. LOCATION OF BASIN TO BE DETERMINED BY PROPERTY OWNER OR DEVELOPER.
5. EXCAVATED AREA SHALL BE BACKFILLED TO 6" BELOW GRADE. BACKFILL MATERIAL SHALL BE EXCAVATED MATERIAL CONTAINING NO SOIL LUMPS, STONES, CONCRETE, OR FOREIGN OBJECTS LARGER THAN 1" MAX DIMENSION, OR AASHTO NO. 7 STONE.
6. TOPSOIL AND SEED SHALL BE PLACED TO GRADE THE SURROUNDING EXCAVATED AREA.



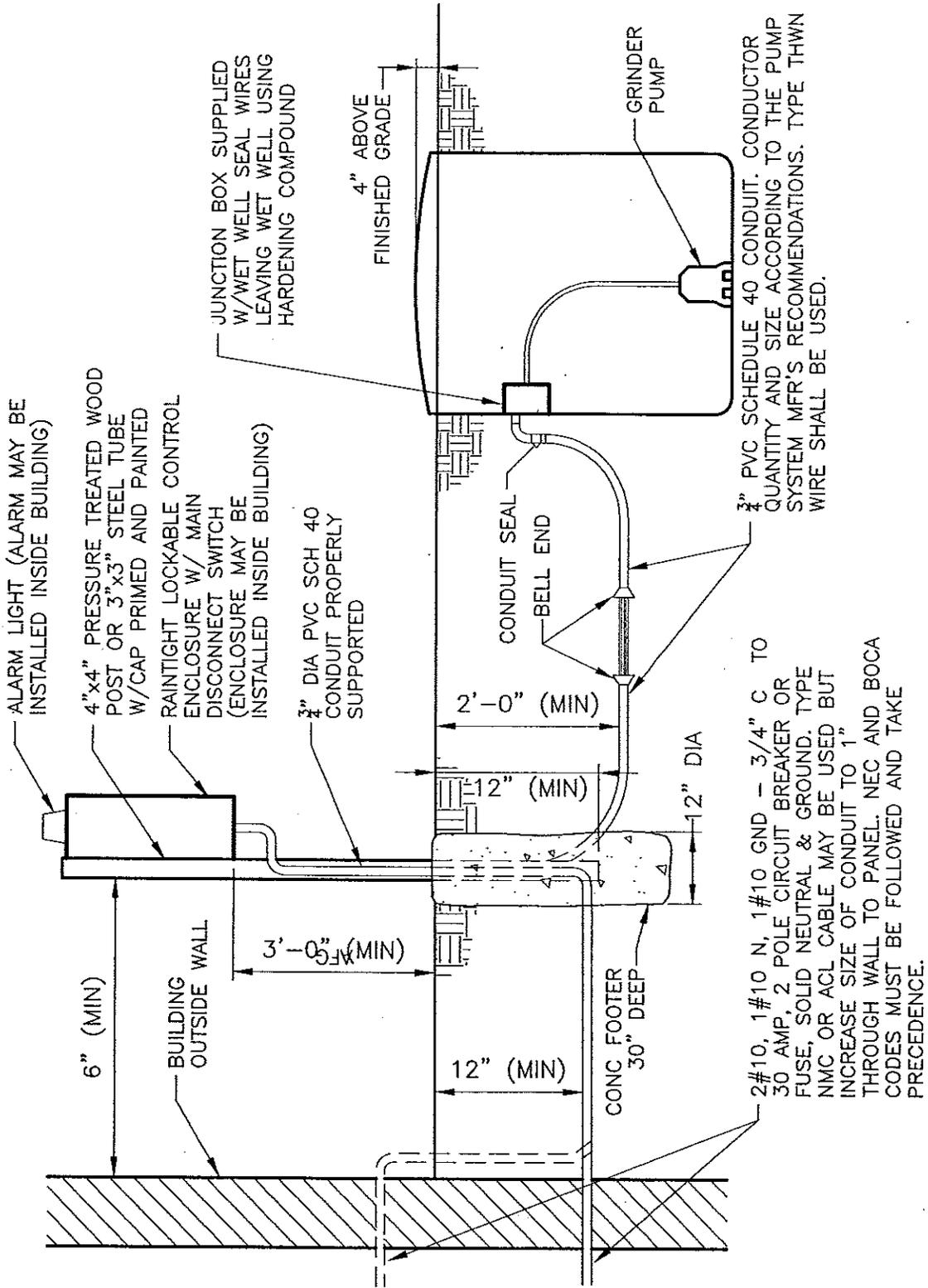
**CONCRETE BASIN FOR TYPICAL
INDIVIDUAL GRINDER PUMP DETAIL**
NO SCALE

S:\22321\Details\Sewer\BBCDTS28 01/12/05 15:15 millercs



**WALL MOUNTED CONTROL PANEL
 (EXTERNAL INSTALLATION) DETAIL**

NO SCALE



**POST MOUNTED CONTROL PANEL
(EXTERNAL INSTALLATION) DETAIL**

NO SCALE

Figure No. 30

