## SECTION 6

## SPECIFICATIONS FOR SANITARY SEWER

### 6.01 DESCRIPTION OF WORK

The work shall consist of installing sanitary sewer pipe of the specified size or sizes in a trench and shall include the construction of manholes, lateral connections to the abutting property and other appurtenant work. Excavating, trenching and backfilling shall be as specified in Section 2.

### 6.02 MATERIALS

All materials furnished by the contractor shall conform to the specifications which follow. Where reference specifications are used, they shall be considered as referring to the current edition or latest issue. Certified test reports for strength from the manufacturer shall be submitted to the Township when the pipe is delivered to the site.

#### 6.02.01 Sewer Pipe

All sewer pipe shall be of the materials and strengths shown on the Plans and as specified.

##### 6.02.01.01 Concrete Sewer Pipe (12" Diameter and Larger Only)

Nonreinforced concrete pipe shall conform to the requirements of ASTM Designation C-14, Class 3 or higher as determined by the Township.

Reinforced concrete sewer pipe shall conform to the requirements of the current specifications of the ASTM for reinforced concrete culvert, storm drain and sewer pipe, Designation C-76 for the various classes specified.

Special lining for corrosion resistance maybe required as determined by the Township.

Joints for concrete sewer pipe shall be premium rubber joints conforming to the requirements of ASTM Designation C-443, except the infiltration and exfiltration allowance shall be as specified herein.

##### 6.02.01.02 Polyvinyl Chloride (PVC) Solid-Wall Pipe

Polyvinyl chloride (PVC) solid-wall pipe shall conform to the requirements of ASTM Designation D-3034, with a standard dimension ratio of 35 (SDR-35).

Extra strength pipe shall conform to the requirements of ASTM Designation D- 3034, with a standard dimension ratio of 26 (SDR-26) and shall be used for depths over eighteen (18) feet based on the average depth of the manholes of each section of pipe.

Joints shall be flexible elastomeric sealed type joint in accordance with ASTM D-3212.

6.02.01.03 Ductile Iron Pipe

Ductile iron pipe shall conform to the requirements of AWWA C-151 (ANSI A21,51), and shall be Class 53, unless otherwise specified. All pipe and fittings shall have a cement mortar lining conforming to the requirements of AWWA C-104 (ANSI A21.4). Joints shall be rubber gasket joints conforming to the requirements of AWWA C-111 (ANSI A21.11). Joints on fittings shall be bolted mechanical joints.

Bolts shall be high strength, low alloy Cor-Ten steel bolts only conforming to ANSI/AWWA C111/A21-11. Bolt manufacturer's certification of compliance must accompany each shipment.

6.02.02 Sanitary Sewer Laterals

All PVC sewer laterals shall be extra strength pipe, and unless otherwise specified, shall conform to the requirements of ASTM Designation D3034 with a standard dimension ratio of 23.5 (SDR 23.5), or conform to the requirements of ASTM Designation D-1785 Schedule 40. Any specified bends or curves shall be smooth, long-radius type curves. No mitered or segmental type bends will be approved.

6.02.03 Wyes and Tees

Wyes and Tees may be cast fittings of the same material and joints as the main sewer, or may be an approved fabricated special fitting which provides a suitable connection for the lateral to the main sewer.

Details of special fittings and/or adaptors for connection laterals of a material different than the main sewer shall be approved by the Township before they are manufactured.

Wye and Tees will be required as follows:

6" Wyes on main sewer of 8" or 10" diameter
6" Wyes or Tees on main sewer of 12" in diameter or larger.

6.02.04 Plugs and Stoppers

Plugs or stoppers for plugging the ends of laterals or risers which are not extended shall make a water tight seal and shall be of such a design that they can be readily removed without damage to the pipe.

6.02.05 Cement Mortar

Mortar shall consist of one part Air Entraining Portland Cement, and two parts masonry sand. These proportions shall be measured by volume.

Exposed mortar (castings in non-traffic areas) shall consist of Air Entraining Portland Cement, two parts masonry sand and 1/4 part hydraulic cement.

The sand and cement shall be mixed dry in a clean tight box until a mixture of uniform color is produced, after which water shall be added until the required consistency is obtained. Mortar shall be mixed only in such quantities as needed for immediate use. The retempering of mortar will not be permitted.

6.02.05.01 Cement

Air Entraining Portland Cement shall conform to the requirements for Type 1A of the current MDOT Standard Specifications for Air Entraining Portland Cement, ASTM Designation C-175.

6.02.05.02 Masonry Sand

Masonry Sand shall conform to the requirements of "Natural Sand, 2 MS" of the current MDOT Standard Specification.

6.02.05.03 Water

Water for mixing mortar shall be obtained from the public water supply unless otherwise approved by the Township.

6.02.06 Manhole Materials

6.02.06.01 Adjusting Rings

Precast grade adjusting rings shall conform to the requirements of ASTM Designation C-478.

The joints and/or joining surfaces of the adjustment rings shall be sealed with concrete as shown in the sewer casting detail. See standard sanitary sewer casting detail.

The Township may at its discretion require, in lieu of sealing adjustment rings with concrete, that adjusting rings be sealed with a butyl rubber based tape. The use of the butyl rubber based tape will not be allowed unless first approved in writing by the Township.

The material shall be EZ-WRAP Rubber as supplied by PRESS-SEAL GASKET CORPORTATION, Fort Wayne, Indiana, or approved equal. The butyl component of the tape shall consist of 50% (min.) butyl rubber, shall contain 2% or less volatile matter, and shall be 1mm (0.40 in.) thick. The backing component shall be EDPM rubber. A release paper may be utilized.

For manholes, the tape width shall be 6" wide. The tape shall be overlapped at least twice its width. The tape shall not be stretched during application. Primer and/or adhesive as recommended by the tape supplier shall be employed for adverse, critical or other applications.

Installation requirements shall be conducted in strict conformance with the requirements of the sealant supplier.

6.02.06.02.01 Precast Units

Unless otherwise specified, all manholes shall be precast. Manholes shall be cast wet. Dry cast manholes will not be permitted.

Precast reinforced concrete manhole risers and precast reinforced concrete manhole cone sections shall conform to the requirements for reinforced concrete manhole risers and tops, ASTM C-478.

Joints for precast sections shall be premium rubber, butyl rubber composition seals, "ramneck", or approved equal.

6.02.06.02.02 Manholes with Corrosive Conditions

Where corrosive conditions due to septicity, forcemain connection or other causes are anticipated, polymer concrete manholes shall be installed. Manholes shall be similar to Amitech Polyorete manhole or approved equal.

If a forcemain connection is to be made to an existing manhole, the manhole shall be lined with a cured in place manhole liner as designed and manufactured by Terre Hill Composites or approved equal.

The Township reserves the right to request lining additional manholes downstream from the force main connections as they deem necessary to prevent corrosion.

6.02.06.03 Castings

Castings shall meet the requirements specified in the current Michigan Department of Transportation Standard Specifications Section 908. Manhole covers and rings and similar combinations of castings shall be machined to provide an even bearing.

Unless otherwise specified, manhole castings shall be East Jordan No. 1045 with 1040 solid cover stamped “Sewer”, or approved equal.

Where indicated on the plans, water-tight manhole covers and castings shall be installed. Sealing or grouting shall be as shown on the standard manhole details.

6.02.06.04 Steel Reinforcement

Steel Reinforcement shall conform to the requirements for steel reinforcement of the current MDOT Standard Specifications.

6.02.06.05 Flexible Manhole Connectors (Rubber Boots)

Flexible manhole connectors (also called rubber boots) shall be "Kor-N-Seal" by National Pollution Control Systems, Inc., "P.S.X." or "Press Wedge II" by Press Seal Gasket Corporation, "Lock Joint Flexible Manhole Sleeve" by Inter Place Corporation, "A-lok" by A-lok Products, Inc., or approved equal. Flexible manhole connectors shall conform to the requirements of ASTM Designation C-923, Resilient Connectors.

6.02.06.06 Manhole Steps

Unless otherwise specified, manhole steps shall be plastic coated steel steps conforming to the requirements of ASTM Designation C-478, or approved equal, spaced at 16" center to center.

## 6.03 INSPECTION OF MATERIALS BY CONTRACTOR

It shall be the responsibility of the Contractor to inspect all materials for cracks, flaws or other defects before they are incorporated into the work. Any materials found to be defective or damaged, shall be promptly removed from the job site.

## 6.04 LAYING PIPE

6.04.01 Alignment and Grade

6.04.01.01 Laser Alignment

The Contractor shall use the laser beam method of maintaining line and grade for sewer construction, unless otherwise approved by the Township. The Contractor

shall submit evidence to the Township that a qualified operator will handle the laser beam equipment during the course of construction.

The Owners Engineer shall place line and grade stakes at each manhole, or more often, as determined by the Township. The Contractor shall check the line and grade at every point at which a stake has been placed.

6.04.02 Handling

Pipe shall be protected during unloading and handling against impacts, shocks and free fall. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

Pipe shall be carefully lowered into the trench in such a way as to avoid danger to the workers or damage to the pipe.

6.04.03 Direction of Laying

Excavation of trenches and laying of pipe shall begin at the outlet for the sewer and proceed upgrade with the individual pipe being laid with the spigot end downstream.

6.04.04 Placing

The pipe shall be placed on the prepared sub-grade and held firmly in place during subsequent pipe jointing and embedment operations. Successive pipes shall be carefully positioned so that when laid, they form a sewer with a uniform invert true to line and grade.

Sufficient pressure shall be applied by an approved method to each pipe as it is laid to insure that the spigot is completely home in the bell. Care shall be exercised to prevent joints from opening as successive lengths of pipe are place. The Contractor shall take the necessary precautions when using a trench box to prevent joint separation when the box is pulled ahead.

6.04.05 Cleaning Sewer

The interior of the sewer shall be cleaned of all jointing material, dirt and debris as the work progresses.

In small sewers where cleaning after laying may be difficult, a swab or drag may be required in the pipe line to satisfactorily complete this work.

The Contractor shall place and maintain a plug in the downstream end of the newly constructed sewer to minimize dirt and debris from entering the existing system. The plug shall be maintained by the Contractor until the newly constructed sewer has been accepted by the Township.

## 6.05 PIPE JOINTS

Pipe joints shall be made in strict accordance with the pipe manufacturer's recommendations unless otherwise specified herein. All lubricants, gaskets, and other materials required to make the joints shall be supplied or recommended by the pipe manufacturer and approved by the Township.

Pipe layers shall be fully qualified and experienced in the work being performed and shall check each joint after it is completed to see that no part of the joint material is left on the inside of the pipe and that the joint is properly made.

## 6.06 LOCATION OF WYES AND TEES

The approximate locations of wyes or tees are shown on the plans. These locations may be adjusted where necessary to best serve the various properties. Exact locations will be determined by the Township before the wyes or tees are installed.

The Contractor shall keep an accurate record of measurements from the nearest downstream manhole to each wye or tee which is installed. These measurements shall be recorded on the record plans to be furnished by the Contractor.

## 6.07 SANITARY SEWER LATERALS

### 6.07.01 General

Installation of sanitary sewer laterals shall meet all requirements specified for sanitary sewers. All laterals shall be inspected by the Township before the trench is backfilled. Laterals shall not be connected to manholes.

### 6.07.02 Length

All sanitary sewer laterals shall be laid at right angles to the sanitary sewer mainline, and shall extend to a point one (1) foot outside the street right-of-way (property line) unless otherwise directed. No payment will be made for pipe laid beyond this point unless specifically ordered by the Owner.

The Contractor shall measure and record the horizontal length of the lateral from the main line sewer to the end of the lateral and provide this information to the Township.

### 6.07.03 Grade

It is intended that the ends of laterals at property lines will be deep enough to service the lowest floor of all existing or proposed buildings by gravity flow.

The minimum grade on the lateral shall be two (2%) percent (1/4 in/ft.). Where minimum depths as specified herein cannot be obtained, minimum grades may be reduced to one (1%) percent (1/8 in/ft.).

Where the elevation of the end of the lateral to serve an existing structure is not shown on the plans it shall be set at three (3) feet below basement grade for standard houses (eleven (11) feet below first floor) or four (4) feet below basement grade for houses with walkout basements (twelve (12) feet below first floor) where the set-back is fifty (50) feet or less.

In other cases the lateral may be set at two (2) feet below the basement elevation for standard houses (three (3) feet for walkouts) plus an additional depth of two (2%) percent multiplied by the set-back distance to the structure.

The minimum depth of the end of the lateral at the property line in all cases shall be 9'-0" below centerline of the street, excluding the property line risers.

6.07.04 Risers

Where the sanitary sewer is more than twelve (12) feet deep, a main line riser shall be constructed in accordance with the standard details or as shown on the plan. Backfill shall be carefully placed and compacted around the riser in an approved manner which will not damage the sewer or riser.

Property line risers shall be constructed on all laterals. Property line risers shall be constructed at the end of the lateral (at a point approximately five (5) feet from the right-of-way line unless otherwise specified). The property line riser shall consist of a six (6) inch sewer lateral pipe extended upward to a minimum of one (1) foot above the normal groundwater table, or to a depth of not less than four (4) feet below grade at the end, whichever is lower. (See Lateral and Property Line Riser Detail.)

6.07.05 Markers and Measurements

After installation of the service lateral, but prior to backfilling, the Contractor shall provide and install a 2" x 2" wood marker for each service. The wood markers shall be set vertically from the end of the lateral to twelve (12) inches *above* finish surface elevations. Also, a 1/2" diameter by 3′ long metal stake shall be placed vertically and adjacent to the wood marker with six (6) inches of cover. The Contractor shall assist the Construction Observer in locating the end of each lateral, and in recording the location by measuring to the nearest downstream manhole. Also, the Contractor shall provide the Construction Observer the depth of the lateral and property line riser relative to the street centerline elevation.

## 6.08 RULES FOR SEWER SERVICE ON PRIVATE PROPERTY

(See Rules and Regulations)

6.08.01 Connection and Use

Connection to the sewer system and use of the sewer system is governed by Section 34 of the Holland Charter Township Code. For regulations governing the use of the sewer system and penalties for violations see Section 34 of the Township Code.

6.08.02 Application for Connection

Application forms and permits for connection are available at the Township Office. These forms will provide for payment of an inspection fee, assessments, and charges at the time request is made for service.

6.08.03 Sewer Service Installation

A. Acceptable lateral materials are:

1. Cast iron soil pipe and fittings, ASTM A74.

2. PVC sewer pipe, ASTM D-2665, Schedule 40 with solvent welded joints.

B. Size and grade:

Four (4) inch minimum size for single and two-family residential laid at a minimum grade of 1/8 inch per foot from the lateral (stub) at the property line to the building.

PLEASE NOTE: A grade of 1/4 inch per foot is recommended.

C. Cleanouts:

1. A four (4) inch cleanout shall be placed within five (5) feet of the building. (A four (4) inch cleanout located just within the basement wall shall be sufficient.)

2. Four (4) inch cleanouts shall be placed at all bends totaling greater than 45 degrees and at every one hundred (100) feet.

D. Adaptors for size changes and/or types of pipe shall be approved by the Township. (6″ x 4″ Fernco adaptor by Hamilton/Kent or equal)

E. Inspection manholes may be required by the Township to monitor flows of industrial and/or commercial users before entering the public sewer system. (Manholes to be ASTM C-478 or equal)

## 6.09 MANHOLE CONSTRUCTION

Manholes shall be constructed in accordance with the standard details and as specified herein.

Unless specified otherwise, all manholes shall be precast.

Precast bases shall be installed on the subbase in such a way as to provide a uniform bearing under the manhole base.

Precast manholes with integral bottom and channel may be used, however, any changes to the structure due to minor field adjustments of alignment and grade required to meet construction conditions shall be made by the Contractor at no additional cost to the Owner.

Stubs shall be provided in manholes for future connections as shown on the plans or as directed by the Township. All such stubs shall be sealed with standard watertight, removable plugs.

All openings in manholes for the purpose of receiving pipes (including openings for future pipes) shall be fitted with a flexible type connector. Flexible connectors shall be factory installed. Openings for future connections shall be sealed by an approved prefabricated cap or plug. Bituminous waterproofing shall be applied to the outer surface of all manholes at the rate of one (1) gallon per 100 square feet.

## 6.10 CUT-INS

When cutting into an existing manhole, the opening shall be no larger than is necessary to admit the new sewer. The opening shall be made by a concrete drilling or coring machine, and shall have a mechanically compressed flexible joint connection installed. All broken or surplus material falling inside the structure shall be removed.

Flow channels and/or drop connections shall be constructed as specified or as directed to accommodate the sewer being cut-in. Pipe inverts higher than 2’ from the primary flow channel will require a drop connection to the primary flow channel.

No connections will be allowed between 6” and 2’ above the primary flow channel. The inlet pipe slope must be revised so that the pipe enters within 6” from the primary flow channel.

## 6.11 ACCEPTANCE TESTS

### 6.11.01 Alignment and Grade

Each section of sewer may be checked by the Township for alignment and grade using lights and mirrors, television inspection, or other similar means. The

Contractor shall assist the Township in the performance of these tests when necessary.

If a section of sewer is determined by the Township's Engineer or Township not to be acceptable for alignment or grade, the Contractor shall relay the sewer at no additional cost to the Owner.

The Contractor shall be responsible to maintain plugs in existing manholes to prevent any water, debris, etc. from entering the existing sewer. These plugs shall remain in place until the new sewer system is accepted by the Township.

6.11.02 Leakage Tests

The completed sewer shall be free from leaks either by infiltration or exfiltration. Manholes and sewer lines will be visually inspected for leakage.

The Contractor shall provide all necessary labor, equipment and supervision to perform infiltration, exfiltration and air tests in accordance with the requirements of the Township. All sewer shall be subjected to an air test unless otherwise specified below.

All sewer which is submerged by ground water to an average depth of greater than seven (7) feet above the crown of the sewer at the time of the test shall be subjected to an infiltration test.

The air test shall be performed on each section of pipe between manholes after laterals are installed. Testing shall conform to ASTM F1417 for plastic flexible pipe, ASTM C828 for clay pipe and ASTM C924 fro reinforced concrete pipe. The section of pipe being tested shall be sealed at each manhole using inflatable plugs or other approved devices. All plugs shall be adequately braced.

Where the expected water table level, as determined by the soil borings, is above the sewer elevation, the pressure testing limits for dry trench condition shall be as follows:

1. Where the expected water table level is zero (0) feet to seven (7) feet above the pipe, the test pressure limits will be 3.5 to 2.5 psig.

2. Where the expected water table level is over seven (7) feet above the pipe, the test pressure limits will be 4.5 to 3.5 psig.

   In a wet trench condition where the water table has risen above the pipe to a depth of less than seven (7) feet above the crown of the pipe prior to testing, the air testing limits shall be determined by adding to the original 3.5 psig. an additional 0.43 psig. for each foot the water table is above the crown of the pipe, or as determined in the dry trench condition, whichever is greater. Maximum test pressure shall be 6.0 psig.

The air pressure in the section under test shall be raised to an initial pressure of 0.5 psig. above the beginning test pressure and allowed to stabilize for a minimum of five (5) minutes. Air shall be added during this stabilization period as required to maintain the pressure at or above the beginning test pressure.

The rate of air loss shall be determined by measuring the time interval required for the internal pressure to decrease 1.0 psig. within the limits previously specified.

The Township will not witness or accept any air test until after the placement of all other utilities within the project area including but not limited to gas, electric, cable, fiber optics or phone has been completed and the site is graded to the final grades and elevations as shown on the drawings. The Contractor is encouraged to perform an air test upon completion of the installation of the sewer and laterals and prior to restoration or installation of utilities for his own benefit.

Minimum time interval for a satisfactory test shall be in accordance with the table following this section.

In the event the Township determines that the results of the air test are inconclusive because of visible infiltration, unsatisfactory or incomplete record, or improper application of testing methods or equipment, or other similar reasons, the Township may require either an exfiltration test or an infiltration test for the section or sections of sewer involved.

The allowable leakage as measured by either an infiltration test or an exfiltration test shall not exceed 100 gallons per day per inch of diameter per mile of sewer.

Sewers shall be tested for exfiltration by isolating a section or sections of the sewers between manholes by means of an approved temporary type of water-tight bulkhead. the isolated section of sewer shall then be filled with water to a level which is two and one-half (2-1//2) feet above the existing water-table but not less than two and one-half (2-1/2) feet above the crown of the sewer pipe at the high end of the isolated section under the test. The length of the section shall be such that, where possible, the water level at its lower end will not be more than five (5) feet above the crown of the pipe except as may be required by a high water table.

The length of time and the exfiltration test period shall be at the discretion of the Township. Determination of the amount of exfiltration shall be made by measurement of the loss of volume of water in the manholes. The amount of exfiltration over a 24 hour period will then be calculated from the measured loss of volume and time period.

On any section of sewer that the Township shall deem impractical to test by means of the exfiltration test specified above, as may be the case when local connections are involved, a suitable infiltration test will be required.

6.11.03 Pipe Deflection Tests (Flexible Pipe Only)

Flexible pipe is any pipe having a pipe stiffness of less than 115 psi. as defined under the requirements of ASTM Designation D-2412.

The completed installation of flexible pipe shall at no point have out-of-round deflections in the main sewer pipe greater than five (5%) percent of the pipe's actual original inside diameter. Go/no go gauging tests, using an approved pointed mandrell with nine (9) points, shall be performed by the Contractor in the presence of the Township, or his authorized representative after the trench is backfilled, and before the surface restoration is begun. Pipe with deflections greater than five (5%) percent shall be excavated and relaid by the Contractor at no additional expense to the Owner. Vibratory rerounding of failed sections is prohibited.

The pipe shall have been in place a minimum of 30 days prior to the mandrell test. When sanitary sewer is installed within a paved street, the street shall be paved prior to the mandrell testing when required by the Ottawa County Road Commission or the Township.

## TABLE 1 – PVC and DI Pipe

| Pipe Diameter, in. | Minimum Time, min:s | Length for Minimum Time, ft | Time for Longer Length, s | Specification Time for Length (L) Shown, min:s | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 100 ft | 150 ft | 200 ft | 250 ft | 300 ft | 350 ft | 400 ft | 450 ft |
| 4 | 3:46 | 597 | 0.380 L | 3:46 | 3:46 | 3:46 | 3:46 | 3:46 | 3:46 | 3:46 | 3:46 |
| 6 | 5:40 | 398 | 0.854 L | 5:40 | 5:40 | 5:40 | 5:40 | 5:40 | 5:40 | 5:42 | 6:24 |
| 8 | 7:34 | 298 | 1.520 L | 7:34 | 7:34 | 7:34 | 7:34 | 7:36 | 8:52 | 10:08 | 11:24 |
| 10 | 9:26 | 239 | 2.374 L | 9:26 | 9:26 | 9:26 | 9:53 | 11:52 | 13:51 | 15:49 | 17:48 |
| 12 | 11:20 | 199 | 3.418 L | 11:20 | 11:20 | 11:24 | 14:15 | 17:05 | 19:56 | 22:47 | 25:38 |
| 15 | 14:10 | 159 | 5.342 L | 14:10 | 14:10 | 17:48 | 22:15 | 26:42 | 31:09 | 35:36 | 40:04 |
| 18 | 17:00 | 133 | 7.692 L | 17:00 | 19:13 | 25:38 | 32:03 | 38:27 | 44:52 | 51:16 | 57:41 |
| 21 | 19:50 | 114 | 10.470 L | 19:50 | 26:10 | 34:54 | 43:37 | 52:21 | 61:00 | 69:48 | 78:31 |
| 24 | 22:40 | 99 | 13.674 L | 22:47 | 34:11 | 45:34 | 56:58 | 68:22 | 79:46 | 91:10 | 102:33 |
| 27 | 25:30 | 88 | 17.306 L | 28:51 | 43:16 | 57:41 | 72:07 | 86:32 | 100:57 | 115:22 | 129:48 |
| 30 | 28:20 | 80 | 21.366 L | 35:37 | 53:25 | 71:13 | 89:02 | 106:50 | 124:38 | 142:26 | 160:15 |
| 33 | 31:10 | 72 | 25.852 L | 43:05 | 64:38 | 86:10 | 107:43 | 129:16 | 150:43 | 172:21 | 193:53 |
| 36 | 34:00 | 66 | 30.768 L | 51:17 | 76:55 | 102:34 | 128:12 | 153:50 | 179:29 | 205:07 | 230:46 |

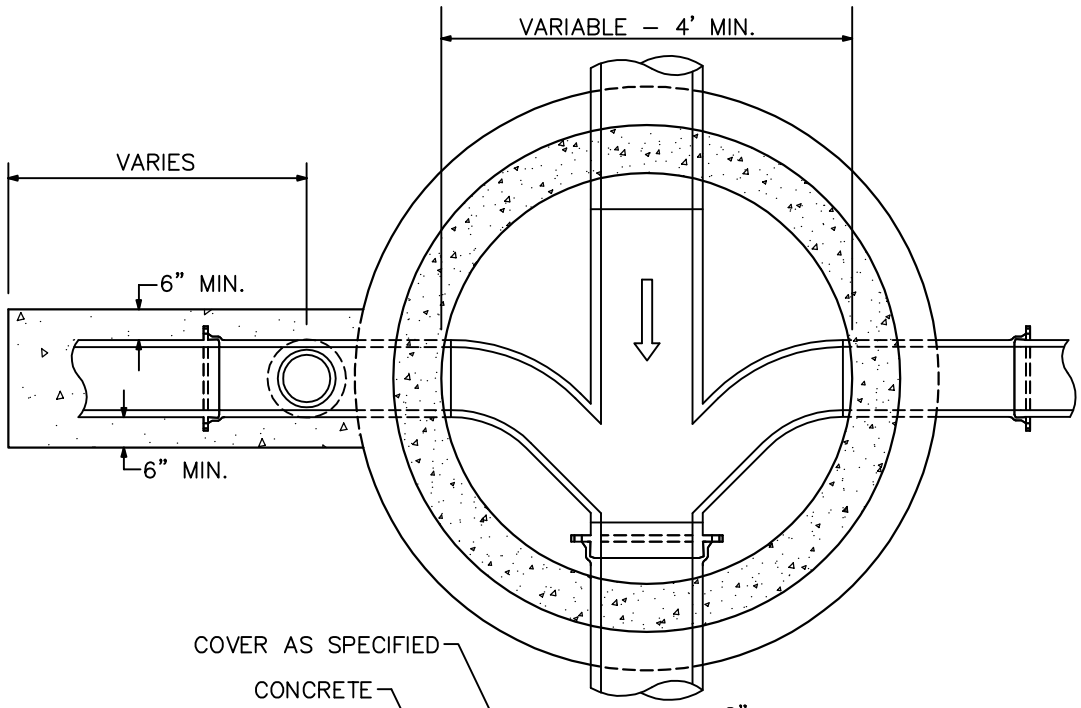
## TABLE 2 – VCP and Concrete Pipe

| Pipe Diameter, in. | Minimum Time, min:s | Length for Minimum Time, ft | Time for Longer Length, s | Specification Time for Length (L) Shown, min:s | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 100 ft | 150 ft | 200 ft | 250 ft | 300 ft | 350 ft | 400 ft | 450 ft |
| 4 | 1:53 | 597 | 0.190 L | 1:53 | 1:53 | 1:53 | 1:53 | 1:53 | 1:53 | 1:53 | 1:53 |
| 6 | 2:50 | 398 | 0.427 L | 2:50 | 2:50 | 2:50 | 2:50 | 2:50 | 2:50 | 2:51 | 3:12 |
| 8 | 3:47 | 298 | 0.760 L | 3:47 | 3:47 | 3:47 | 3:47 | 3:48 | 4:26 | 5:04 | 5:42 |
| 10 | 4:43 | 239 | 1.187 L | 4:43 | 4:43 | 4:43 | 4:57 | 5:56 | 6:55 | 7:54 | 8:54 |
| 12 | 5:40 | 199 | 1.709 L | 5:40 | 5:40 | 5:42 | 7:08 | 8:33 | 9:58 | 11:24 | 12:50 |
| 15 | 7:05 | 159 | 2.671 L | 7:05 | 7:05 | 8:54 | 11:08 | 13:21 | 15:35 | 17:48 | 20:02 |
| 18 | 8:30 | 133 | 3.846 L | 8:30 | 9:37 | 12:49 | 16:01 | 19:14 | 22:26 | 25:38 | 28:51 |
| 21 | 9:55 | 114 | 5.235 L | 9:55 | 13:05 | 17:27 | 21:49 | 26:11 | 30:32 | 34:54 | 39:16 |
| 24 | 11:20 | 99 | 6.837 L | 11:24 | 17:57 | 22:48 | 28:30 | 34:11 | 39:53 | 45:35 | 51:17 |
| 27 | 12:45 | 88 | 8.653 L | 14:25 | 21:38 | 28:51 | 36:04 | 43:16 | 50:30 | 57:42 | 64:54 |
| 30 | 14:10 | 80 | 10.683 L | 17:48 | 26:43 | 35:37 | 44:31 | 53:25 | 62:19 | 71:13 | 80:07 |
| 33 | 15:35 | 72 | 12.926 L | 21:33 | 32:19 | 43:56 | 53:52 | 64:38 | 75:24 | 86:10 | 96:57 |
| 36 | 17:00 | 66 | 15.384 L | 25:39 | 38:28 | 51:17 | 64:06 | 76:55 | 89:44 | 102:34 | 115:23 |

Note: Table to be used when testing one diameter only.

When testing two sizes of pipe simultaneously, time shall be computed by the ratio of lengths involved.

$$\text{Time} = \frac{\text{Length 1} \times \text{Time1} + \text{Length 2} \times \text{Time 2}}{\text{Length 1} + \text{Length 2}}$$



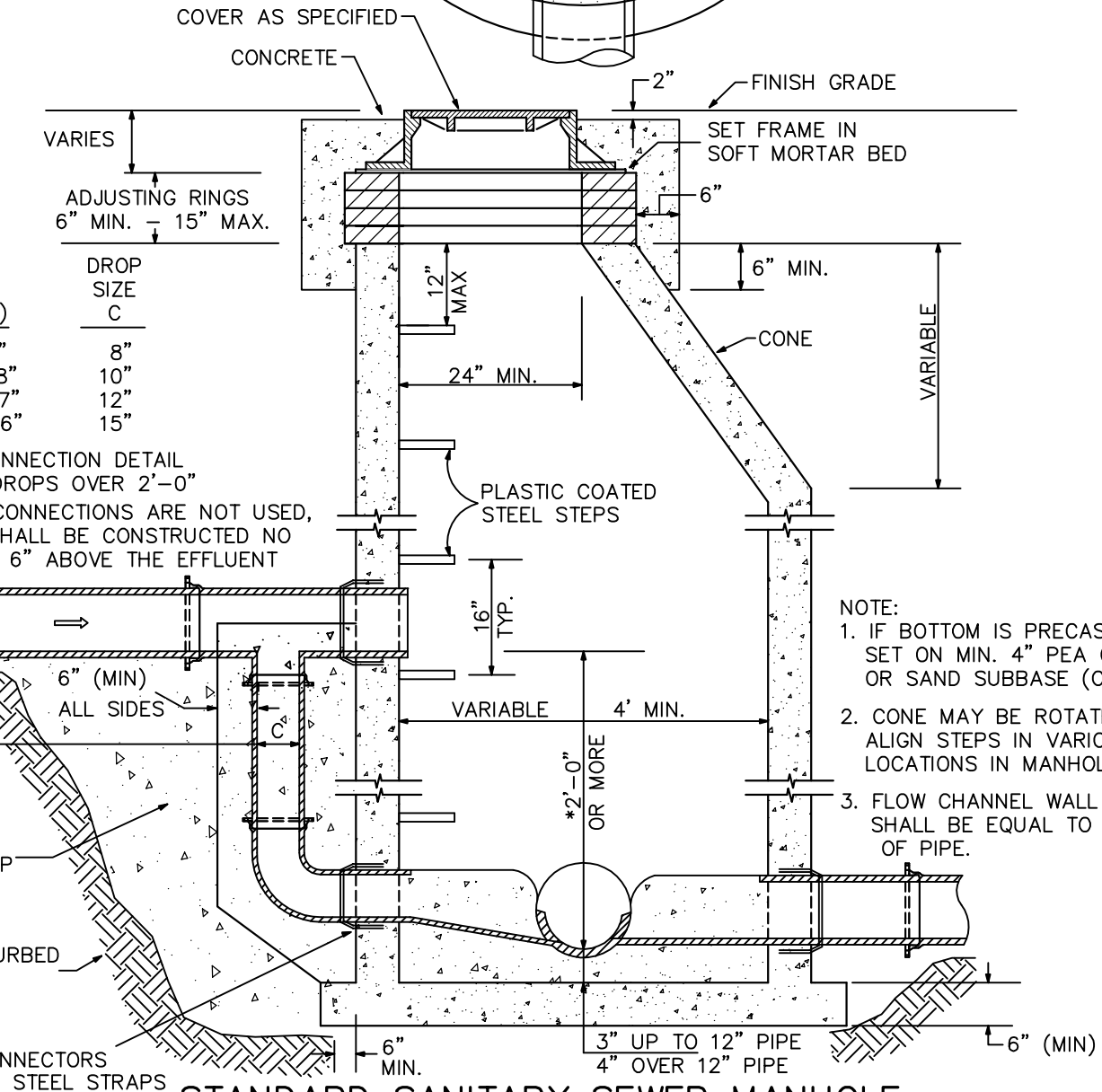




TABLE A

| SEWER SIZE (INCOMING) | DROP SIZE C |
|---|---|
| 8" THRU 12" | 8" |
| 15" THRU 18" | 10" |
| 21" THRU 27" | 12" |
| 30" THRU 36" | 15" |

* USE DROP CONNECTION DETAIL FOR INVERT DROPS OVER 2'–0"

* WHEN DROP CONNECTIONS ARE NOT USED, THE SEWER SHALL BE CONSTRUCTED NO HIGHER THAN 6" ABOVE THE EFFLUENT INVERT.

NOTE:
1. IF BOTTOM IS PRECAST CONC., SET ON MIN. 4" PEA GRAVEL. OR SAND SUBBASE (CIP)
2. CONE MAY BE ROTATED TO ALIGN STEPS IN VARIOUS LOCATIONS IN MANHOLE.
3. FLOW CHANNEL WALL HEIGHT SHALL BE EQUAL TO CROWN OF PIPE.

# STANDARD SANITARY SEWER MANHOLE

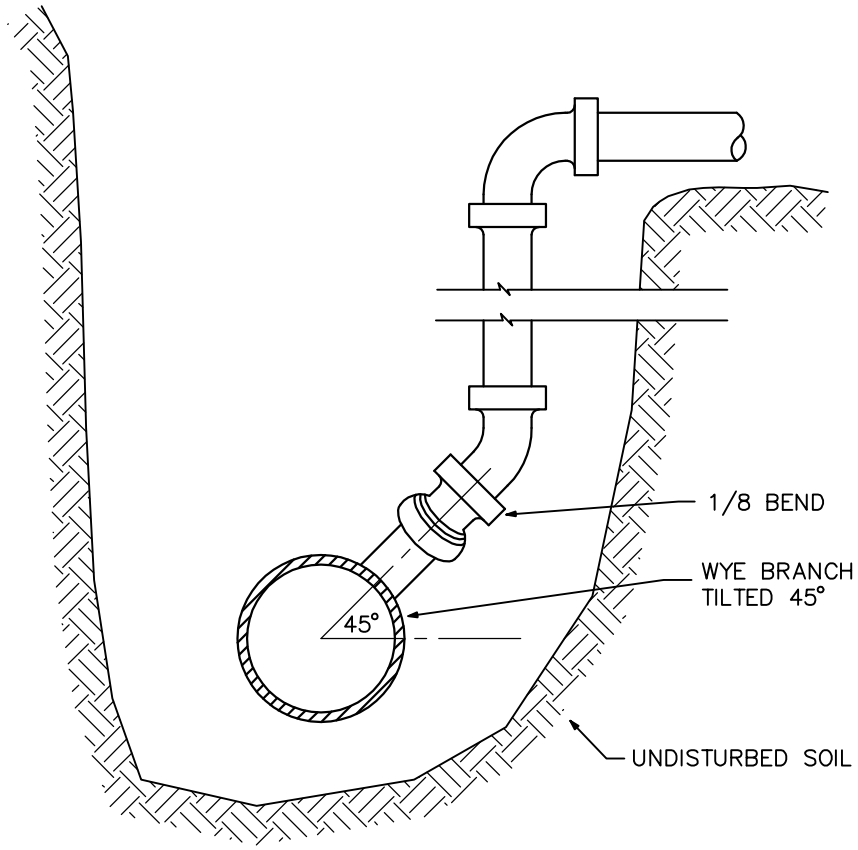
(PRECAST CONCRETE)

PREIN & NEWHOF
CONSULTING ENGINEERS

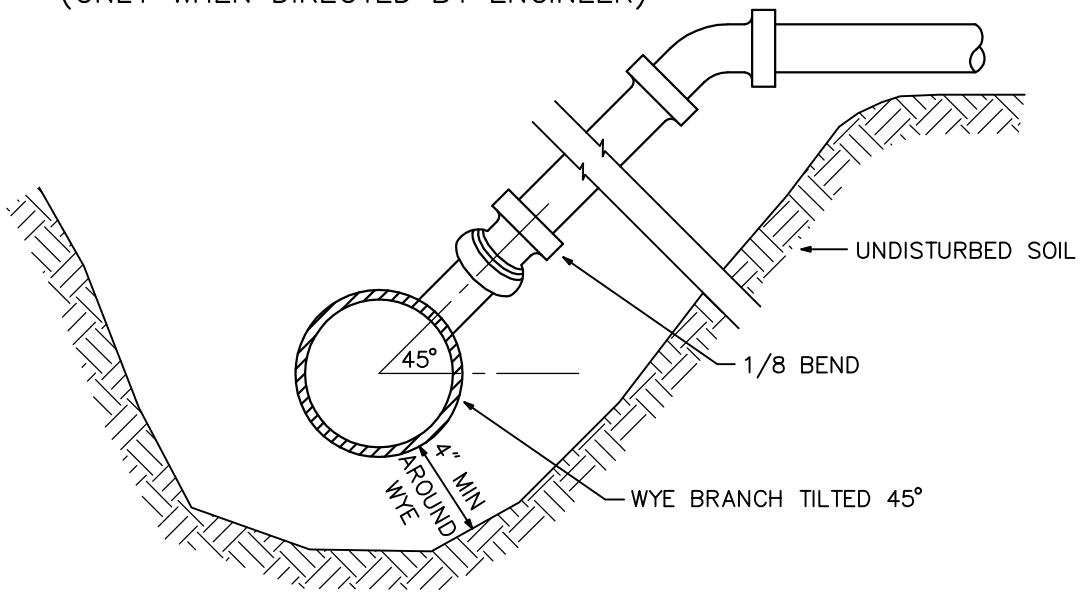


01/2006
SANMH1
PN–HOL

SEE DRAWINGS OR SPECS FOR
SIZE AND DEPTH OF LATERAL



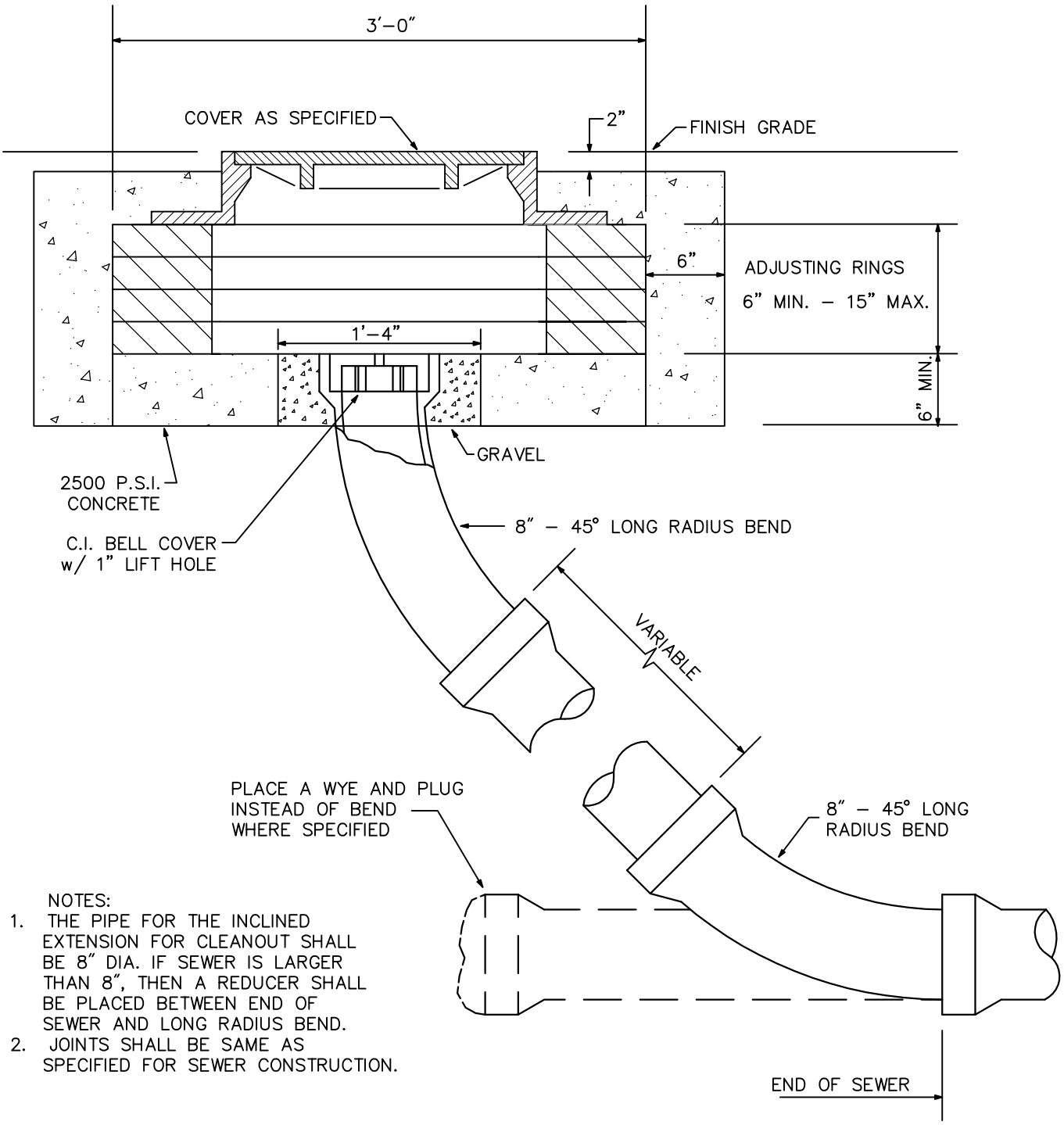

VERTICAL TRENCH
(ONLY WHEN DIRECTED BY ENGINEER)




SLOPING TRENCH
(STANDARD)

# STANDARD RISER DETAILS FOR SEWERS OVER 12' DEEP

PREIN & NEWHOF
CONSULTING ENGINEERS




NOTES:

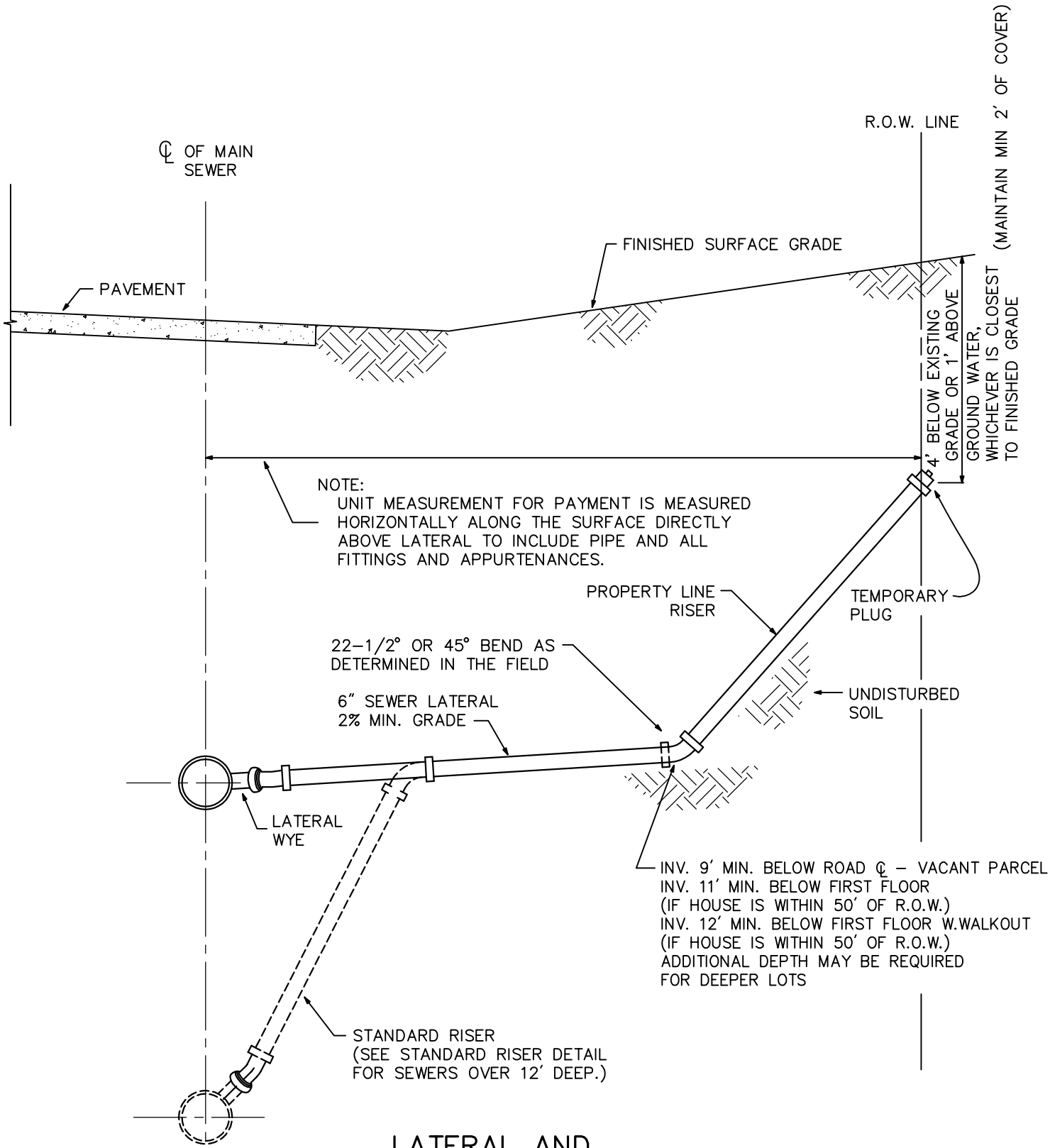
1. THE PIPE FOR THE INCLINED EXTENSION FOR CLEANOUT SHALL BE 8" DIA. IF SEWER IS LARGER THAN 8", THEN A REDUCER SHALL BE PLACED BETWEEN END OF SEWER AND LONG RADIUS BEND.
2. JOINTS SHALL BE SAME AS SPECIFIED FOR SEWER CONSTRUCTION.

# SEWER CLEANOUT

PREIN & NEWHOF
CONSULTING ENGINEERS



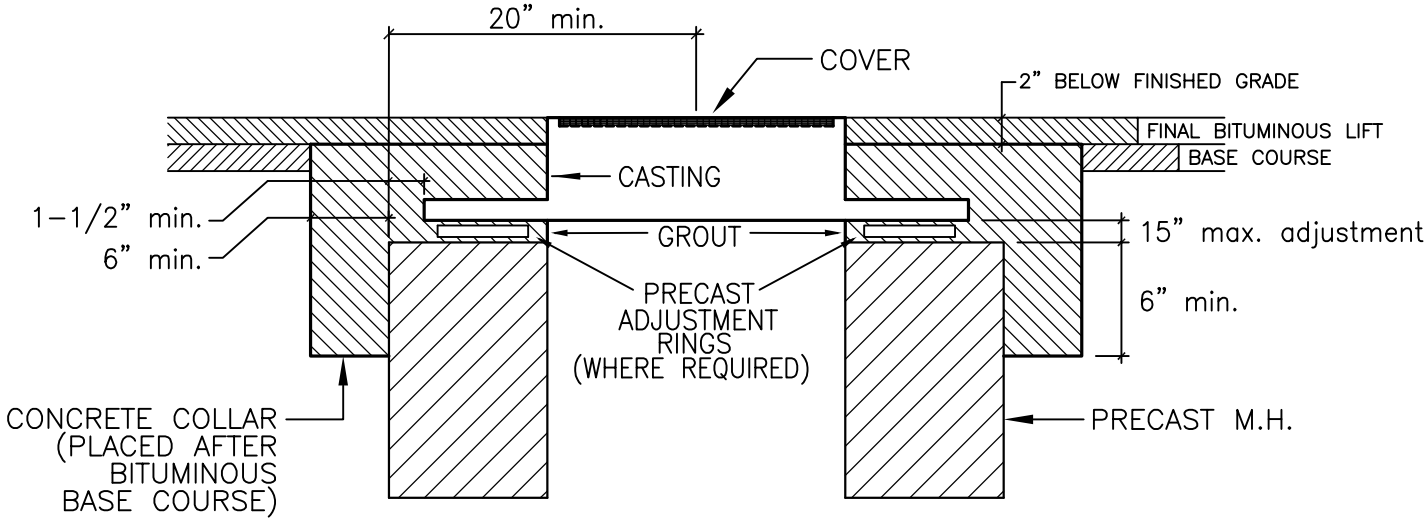
01/2006
SEWERCO
PN–HOL




# LATERAL AND PROPERTY LINE RISER DETAIL

PREIN & NEWHOF
CONSULTING ENGINEERS

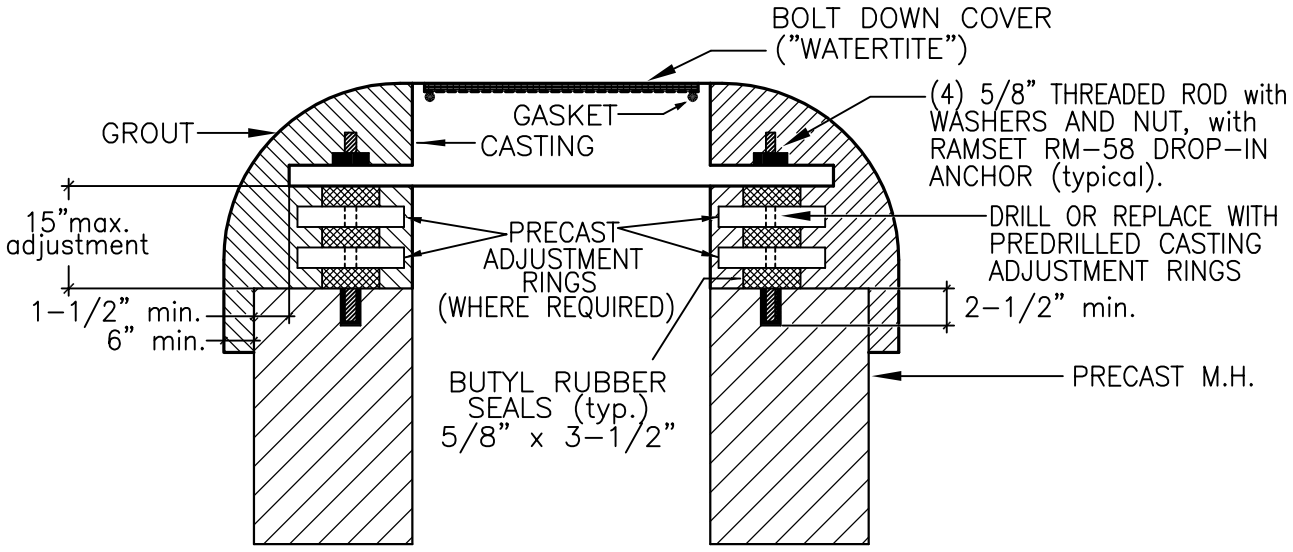
01/2006
PLRISER
PN-HOL




CASE I: MANHOLE IN ROADWAY

NOTE:
EZ-WRAP RUBBER BY PRESS-SEAL OR APPROVED EQUAL MAY BE USED

---




CASE II: MANHOLE IN EASEMENT – OUTSIDE OF ROADWAY

Bolt down Casting with Rubber Gasket Seal.

NOTE:
EZ-WRAP RUBBER BY PRESS SEAL OR APPROVED EQUAL MAY BE USED IF NO SURFACE WILL REMAIN EXPOSED (I.E. DITCH LINES)

# STANDARD SANITARY SEWER CASTING DETAILS