

PROJECT MANUAL
Technical Specifications
CITY OF SPRING HILL, TENNESSEE
STANDARD SPECIFICATIONS
FOR
SEWAGE ADDITIONS



MAY 28, 2024

PREPARED BY:
**THOMAS
&
HUTTON**

WPN24.0458

APPROVED

THE DOCUMENT BEARING THIS STAMP HAS BEEN RECEIVED AND REVIEWED BY THE

**TENNESSEE DEPT. OF ENVIRONMENT & CONSERVATION
DIVISION OF WATER RESOURCES**

AND IS HEREBY APPROVED FOR CONSTRUCTION BY THE COMMISSIONER

06/26/2024

THIS APPROVAL SHALL NOT BE CONSTRUED AS CREATING A PRESUMPTION
OF CORRECT OPERATION OR AS WARRANTING BY THE COMMISSIONER THAT
THE APPROVED FACILITIES WILL REACH THE DESIGNED GOALS.

APPROVAL EXPIRES **FIVE YEARS** FROM ABOVE DATE

CITY OF SPRING HILL, TENNESSEE

**STANDARD SPECIFICATIONS
FOR
SEWAGE ADDITIONS**

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**UTILITY DIRECTOR
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CITY OF SPRING HILL, TENNESSEE

Approved By:

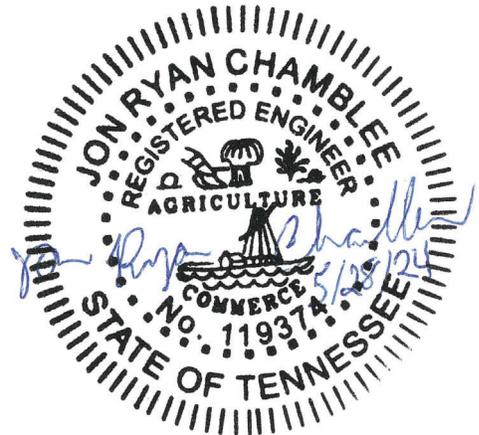
Pamela S. Caskie

Title:

City Administrator

Date:

6-4-2024



INDEX TO PROJECT MANUAL

These specifications give the minimum requirements for installation of water and sewer additions in the City of Spring Hill, Tennessee. Any special construction problems or conditions not covered under these specifications shall be submitted in writing to the City of Spring Hill for approval.

The Standard Drawings are part of these specifications, and all construction shall conform to the details shown on these drawings.

General Specifications

DESCRIPTION

DIVISION 1: GENERAL REQUIREMENTS

01010	Design Covering the Installation of Sewer Facilities and Appurtenances
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01090	Reference Standards
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01568	Erosion Control
01620	Storage and Protection

Technical Specifications

Division 2: SPECIFICATIONS

02221	Excavation, Bedding, and Backfill for Sewer Pipe
02485	Seeding
02575	Pavement Repair
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DRAWING NUMBER DRAWING NAME

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FM-1	Force Main Air Release / Air Vacuum Valve Detail (2 Sheet)
FM-2	Standard Force Main To Manhole Connection
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GS-3	Manhole Step Detail
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GS-5 Standard Precast Manhole Detail - Flat Slab Top

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GS-10 Sanitary Sewer Service Line Connection To Existing Main

GS-11 Flexible Pipe To Manhole Connector

GS-12 Drop Manhole Detail (Up To 12" Diameter Pipe)

GS-13 Concrete Cap

GS-14 Concrete Encasement For Sewer Lines

GS-15 Concrete Encasement For Utility Lines At Arap Creek Crossings (2 Sheets)

GS-16 Sewer Line Trench And Backfill

GS-17 Concrete Waterstop For Gravity Sewer Lines

GS-18 Casing Pipe W/DIP Carrier Pipe

GS-19 Casing Pipe W/PVC Carrier Pipe

GS-20 Sewer Line Casing Pipe Marker

GS-21 Sewer Manhole Location Sign

GS-22 Pavement Replacement Detail (Bituminous Base With Surface)

CITY OF SPRING HILL
UTILITIES DEPARTMENT

DESIGN POLICIES COVERING THE
INSTALLATION OF SEWER FACILITIES
AND APPURTENANCES

(Revised May 2024)

A. **GENERAL GUIDELINES**

The purpose of these guidelines is to provide a guide to the Developers and their engineers and contractors in order to achieve an acceptable installation for furnishing of utility service to subdivisions and other developments. The words "A/E," "Owner," "City of Spring Hill," and "Superintendent of Water and Sewer Systems" are to be used interchangeably. Summarized below are requirements and conditions that apply to the granting of utility service by the City of Spring Hill.

1.1 Prior to the design of any utility line extension or expansion, the design engineer should first confer with the City of Spring Hill Planning Commission in regard to growth potential and density that may be expected in the general area of the extension being planned. A conference with the Superintendent of Water and Sewer Systems should follow to discuss system standards and requirements, as well as any problems related to the mains being extended.

1.1.1 Construction of utility lines, including individual service connections, may not begin prior to approval by the City of Spring Hill.

1.2 No connection to an existing utility shall be made until all lines have been completely tested and the tie-in is approved by the Project Inspector.

1.3 The City of Spring Hill will not accept utility lines that were not approved in accordance with the City Code and constructed in accordance with these specifications.

1.4 The City of Spring Hill requires the following bonds (or certified cashier's check):

1.4.1 Performance Bond - Contractor/Developer will post a performance bond at the time of the application for final approval in an amount of 110% of construction cost until

final asphalt topping. The date of final asphalt topping the bond will be reduced to 30% and kept by the city at a minimum of one (1) year.

1.4.2 Maintenance Bond - The Maintenance Bond shall be 30% of the actual construction cost of all public improvements and amenities. The maintenance bond shall be continuous until a minimum of one (1) year after the 80% build out has been complete. The release of the maintenance bond shall be contingent upon the completion of the above and, in the case of road construction and/or improvements, acceptance of the dedication by the Spring Hill Board of Mayor and Alderman.

1.5 Service connection and service line construction to property line or right-of-way (only) is covered herein. Service line constructed from property line or right-of-way to structure is covered in the latest edition of the Standard Plumbing Code.

1.6 Under the terms of the Spring Hill Municipal Code, water service may be denied to structures connected to a sewer line or service not accepted by the City.

1.7 All utility lines and services (to property line or right-of-way only) constructed utilizing these specifications become the property of the City of Spring Hill upon acceptance by the City. Utility lines and services (to property line or right-of-way only) will not be accepted by the City unless and until they are in strict conformance with these specifications.

1.8 Three (3) sets of plans and specifications, including a vicinity map, shall be submitted for the initial review. If the plans are in order, with no major changes, the Developer or the Engineer will submit the number of additional sets of plans needed for the project for approval.

1.9 Five (5) sets of drawings including a vicinity map shall be submitted for approval. Submittals shall be at least fourteen (14) days prior to a scheduled meeting in order to be considered at that meeting. Contractor's developers, and others are asked to submit drawings as far in advance as possible in order to conserve time at planning and commission meetings. After approval, four (4) sets of drawings shall be submitted to the Tennessee Department of Environment and Conservation for their approval.

Approval of the plans and specifications by the Tennessee Department of Environment and Conservation, Tennessee Department of Transportation, Railroads, Corps of Engineers, Tennessee Valley Authority, and any other agency having jurisdiction is required before beginning construction. One (1) state approved set of drawings and one (1) copy of the State approval letter shall be provided to the Superintendent of Water and Sewer Collections Systems prior to beginning construction.

Prior to acceptance of lines by the City, one set of reproducible "'Record Drawings"' showing all work, changes, service locations, and other data not shown on the original set shall be given to the Superintendent of Water and Sewer Collections Systems after each project or phase of a project is completed.

1.10 Detail drawings and specifications shall be submitted by the A/E employed by the Developer for any special condition or structures such as pump stations, creek crossings, etc., and approved by the City before beginning any construction.

1.11 Easements required across private property or in roads are to be acquired by the Developer in the name of the City. Easements shall have a minimum width of 20 feet. Wider easements may be required for sewer lines over 12 feet deep.

1.12 All applicable Federal and State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the construction throughout.

1.13 Sizes and locations of all water and sewer lines and appurtenances, and all construction shall be in accordance with the plans approved by the City.

1.14 Permits for pavement cuts or crossing of public roads, including any special backfill and pavement repair as required by the agency having jurisdiction, are the responsibility of the Developer. A bond is required from the Developer to cover all costs of repair and maintenance for a period of one (1) year from the date of acceptance of the project for all work performed in existing rights-of-way of all roads.

1.15 If construction has not started within one (1) year from the

date of approval, utility plans shall be resubmitted to renew approval. Renewal is not guaranteed.

1.16 The Contractor's name, project cost, and estimated working time for each project shall be submitted to the City.

1.17 Laboratory test reports shall be provided on all pipe to assure that it meets the requirements of the City's specifications.

1.18 Shop drawings for utility materials shall be submitted to the City of Spring Hill for review after being thoroughly checked by the Contractor and stamped with his approval.

1.19 The City reserves the right to relocate water and sewer lines on the construction plans to facilitate maintenance.

1.20 All utility construction shall be in accordance with specifications of the City of Spring Hill.

1.21 All grading work shall be completed and all roads constructed to subgrade and lot corners are to be marked prior to the installation of utility lines.

1.22 The contractor shall be responsible for locating and verifying the elevations of existing utilities prior to construction.

1.23 The Developer's Engineer shall provide a complete set of Record Drawings; one compatible electronic digital copy, including CAD files; one set of reproducible and two sets of blue line/black line drawings, upon completion of construction and they shall include actual field angles between lines, all actual service lines and tee locations, the distance of the end of service lines to property corners and lines, the depth to top of the end of the service line, and shall reflect all alignment and grade changes. This item must be completed and submitted prior to acceptance of the sewers or water mains into the public system and any connections being made thereto.

1.24 The Contractor shall provide a set of construction cut sheets prior to the preconstruction meeting and the cut sheets shall include the stations of all proposed service connections.

1.25 A one (1) year warranty period will begin upon the date of acceptance of the project by the City.

1.26 Any special requirements shall be transmitted as a part of the approval.

1.27 All plans shall be stamped by a Tennessee Licensed Professional Engineer.

2. Initial Plan Submittals: The plans must be submitted at least twenty-one (21) days prior to the date on which action is desired. The initial submittal should include, but not be limited to the following:

2.1 Three (3) copies of the plan.

2.2 Specifications.

2.3 Engineering reports including design criteria used in sizing mains, and/or pumping stations.

3. Easements

3.1 When utility lines are constructed outside a public right- Of-way, easement must be a minimum of 20 feet in width.

3.2 Easements for utility line extensions may be provided in either of two (2) ways.

3.2.1 Easement Document on form, approved by the City, which must include legal description of the easement(s), legal owner's name and Book and Page where deed is recorded, and must be signed by the Owner, and then notarized.

3.2.2 Record with Subdivision Plat - If this method of recording easements is chosen, a preliminary plat of the subdivision must be provided at the time of plans submittal, which clearly defines the easements to be recorded, along with a letter of intent from the Licensed Engineer or Licensed Surveyor who will stamp the final subdivision plat, assuring that easements will be recorded as shown on the preliminary plat.

3.3 All easements must be obtained and recorded in developed areas before construction can begin. In new subdivisions the letter of intent and preliminary plat showing the easements will be sufficient to start construction. However, the Final Plat must be recorded prior to final acceptance of the new facilities.

3.4 Special easements such as Railroad Crossings, T.V.A. crossings and State Highway crossings must be prepared by the Developer's Engineer.

4. Pre-Construction Meeting

4.1 Before beginning any construction, the Developer shall contact the City and execute a contract with them paying all tapping privilege fees as required. After this contract is executed and before beginning any construction, the Developer or his Engineer shall schedule a pre-construction conference to be held between the Contractor, Developer, Developer's Engineer, and the City and their Engineer. At this meeting, the Contractor will be informed of the City's policies and any special requirements. Listed below is a CHECKLIST of items relating to the project:

4.2 BEFORE Pre-Construction Conference:

- 4.2.1 Developer is to coordinate conference.
- 4.2.2 Developer, or the Engineer, is to have project plans approved by all agencies.
- 4.2.3 Developer is to have a contract with the utility contractor prior to the preconstruction meeting.
- 4.2.4 Contractor is to have shop drawings approved by the City.
- 4.2.5 When submitting plans and shop drawings to the City's Engineers, they will retain one (1) copy and the City will retain two (2) copies. Shop drawings will not be reviewed unless they have been checked by the Contractor and stamped by him to indicate that they meet the specifications.

4.2.6 6 Developer is to have at conference: Approved Plans

4.2.7 Copy of Contractor's contract (both off-site and on-site).

4.2.8 Tap fees and Impact fees. All fees are subject to final approval by the City of Spring Hill Board of Aldermen.

4.3 To Attend Conference:

4.3.1 Developer.

4.3.2 Developer's Engineer.

4.3.3 Developer's Contractor.

4.3.4 Representative from the City's Engineer.

4.3.5 Representative of the City of Spring Hill and the Project Inspector

B. SANITARY SEWER GENERAL SPECIFICATIONS

1. Sewer Extension and/or Service Connection: The following are guidelines for the preparation of sanitary sewer plans and should not be construed as being the total requirements. The City may at its option require additions to be made in the plans **where circumstances warrant**.

2. Plans shall be drawn on a standard 24" x 36" sheet.

3. A cover sheet shall be made a part of all plans and shall incorporate a location map on an approximate scale not less than 1" = 1,000', the name of the project and, the names, addresses and telephone numbers of the Developer and the Engineer.

4. Include a key map indicating sheet numbers for each sewer line.

5. Sewer plans must be on plan and profile sheets, with contour lines shown in the plan portion and the lowest elevation of the sewer line beginning on the left side of the sheet in the profile.

6. All plans must show the locations of the existing and proposed utilities including, but not limited to, gas lines, underground telephone conduits, power and telephone poles, water mains, sanitary sewer lines, storm sewers, etc.

7. The scale of the plan/profile sheet will be: Plan 1" = 50' horizontal, Profile 1" = 5' or 1" = 10' vertical.

8. All sewer plans shall include at least one (1) benchmark based on U.S.G.S. Datum. Additional benchmarks shall be shown at approximately 1,500 feet intervals. The use of a manhole invert elevation or an assumed elevation will not be approved.

9. Show all topographic features, such as driveways, pavement, rights-of-way, property lines, storm drainage structures, etc.

10. The direction of North should be clearly shown on all plans.

11. All property lines should be shown on the plans and each parcel should show the map and parcel number, lot number and/or house number. Whenever possible, sewer lines shall be installed near center of roadway with manholes located at top of crown to help prevent storm water from crossing over manhole lids.

12. A connection must be provided for each parcel or proposed lot. The connection will be shown as an SDR 26 PVC tee wye (machine made only) and a four (4) inch residential or six (6) inch commercial SDR 26 PVC service line extension therefrom where applicable. Handmade tees and "Y" connections are not acceptable. When sewers are constructed by private developers to serve proposed developments and are to be construed as public mains within the public right-of-way, the Developer will provide a 4" by 8" wye with schedule 40 PVC to serve all parcels of property which lie along the sewer main extension. When laying the mains in private property, a wye and ten (10) feet of 4-inch service line shall be provided for each existing parcel. Commercial properties require 6" by 8" wye and service lines. All service lines shall be perpendicular to the sewer main 90 degrees. Service lines shall be extended to the property line and capped. The end of the service line shall be marked appropriately above ground. After the sewer main and service lines are tested, the builder shall be responsible for installing the cleanout at the end of the sewer service line and extending the service to the building. If the distance is greater than 75 feet the builder shall install another cleanout before tying into the building sewer.

13. A maximum of only two (2) service lines will be allowed only into permanent end manholes, and a minimum 45-degree alignment differential must be maintained between them. At no time will an angle less than 90 degrees be permitted between them and the out or downstream sewer main. The service lines must enter the manhole within 1.9 feet of the base of the manhole and the invert must be properly shaped for them. The maximum length of a service line from the sewer main to property line shall be seventy-five (75) feet.

14. All cleanouts shall be installed within a utility box whether within or outside of pavement as shown on the standard details.

15. Special pipe considerations are as follows where Class 350 Ductile iron Pipe will be installed in place of SDR 26 PVC Pipe, unless noted otherwise on the plans:

15.1 In areas which have been filled and the proposed pipe will be within the fill, Class 350, ductile iron must be specified. See section 02221.

15.2 If ductile iron pipe is specified for any part of a sewer, then it must be specified from manhole to manhole; jointing of two different type pipes between manholes will not be permitted.

15.3 Due to maintenance considerations, it will be City's policy to require that all mainline sewers proposed at depths greater than twenty (20) feet be constructed of Class 350 ductile iron pipe and any service line risers from this depth also be ductile iron pipe. This condition should be avoided whenever possible, and first consideration given to other routes.

15.4 All sanitary sewers shall have a minimum of 30 inches cover in private property and 48 inches in paved areas subject to vehicular traffic. Across drains and areas where cover is less than 30 inches, ductile iron pipe or concrete encasement will be required.

15.5 Lining for all ductile iron pipe shall be PROTECTO 401 Ceramic Epoxy.

16. Manholes shall be installed at the upper end of each line, at all changes in grades, size or alignment, at all intersections, and at distances not greater than 350 feet for sewer 15 inches in diameter or less, 400 feet for sewers 18 inches and larger.

17. When sewers are proposed along drains and lie within a potential flood plain or lie adjacent to a drainage ditch or drainage structure in which there is a potential problem of storm water entering the sanitary sewer, the City will require approved watertight frames and covers be installed on the manholes.

18. A vent stack assembly will be required on watertight manholes at 1,000 feet intervals.

19. When sewers are proposed to serve new subdivisions, contour elevations must be shown on the sewer plans. At least one (1) copy of the subdivision grading and drainage plan and a copy of the road plans must be submitted with the sewer plan for review and must contain a typical section of the proposed roadway. A statement should be incorporated into the letter for transmittal for plans designating which roads are to be public and which are to be private, as well as designating which sewer lines are to be public.

20. Smaller lines shall not be connected to larger lines by utilizing a concrete collar. Only an approved compression or rubber O-ring style coupling will be acceptable. The practice of "hammer tapping" a sewer line is not in conformance with the Standard Plumbing Code and is not an acceptable method of connecting a service line to a new or existing sewer line. In all cases, a tee, wye, or tapping saddle shall be used. Contractors and/or plumbers caught or suspected of utilizing either illegal practice hereinbefore discussed will be required to remove and replace the sewer line, including the mainline or manhole if damaged has occurred.

21. Any time sewer lines are proposed to serve property where the "serviceability" of a lot or residence is questionable, the lot or residence must be identified with the following note: The service tee is to be placed at the lowest possible elevation on the main line and the service line is to be laid on a minimum slope. The home builder is responsible for locating the elevation of the end of the service line and setting the building finished floor elevations such that gravity service is available. This note is also to be put on the recorded plat identifying critical lots.

22. The profiles of all drains adjacent to and crossing proposed sewers must be shown on the sewer plan profile. Concrete protection must be provided on sanitary sewers across drains where there will be less than 2.5 feet of cover.

C. DESIGN CRITERIA

1. Design Factors: In determining the required capacities of sanitary sewers, the following factors must be considered:

1. Maximum hourly quantity of wastewater.
2. Additional maximum wastewater from industrial plants.
3. Ground water infiltration.

2. Design Basis

Per capita flow: Sewer systems serving residential development should be designed on the basis of an average daily per capita flow of wastewater of not less than 100 gallons per day when no water use information is available. This amount of flow is assumed to cover nominal infiltration, but an additional allowance should be made where conditions are unfavorable.

Generally, the sewers should be designed to carry, when running full, not less than the following daily per capita contributions of wastewater, exclusive of wastewater from industrial plants:

1. Laterals and sub-main sewers: 400% of average design flow.

2. Main, trunk & outfall sewers: 250% of average design flow.

3. Minimum Size

No sewer collection line shall be less than eight (8) inches in diameter.

4. Depth

In general, sewers should be deep enough to drain basements and to prevent freezing. Where practical, a minimum depth of five (5) feet should be maintained.

5. Slope

All sewers shall be designed and constructed to give mean velocities, when flowing half full, of not less than 2.0 feet per second. The minimum required slopes for 8 inches through 12 inches sewer mains are shown below. However, these slopes should be used only when required. All sewers shall be laid with uniform slope between manholes.

<u>Sewer Size</u> (inches)	<u>Minimum Slope</u> (feet per 100 feet)
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.05
42	0.042

6. Alignment

Sewers shall be designed with straight alignment between manholes.

7. Increased Size

When a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An acceptable approximate method for securing these results is to place the 0.8 depth point of both sewers at the same elevation.

8. High Velocity Protection

Ductile iron pipe shall be used when slopes are greater than:

<u>SEWER SIZE INCHES</u>	<u>SLOPE (FT/100 FT)</u>
8	18
10	13
12	9
18	6

9. Pipe Bedding

All sewers shall be designed to prevent damage from superimposed loads. Proper allowance for loads on the sewer shall be made because of the width and depth of trench. Backfill material from one (1) foot above the pipe should not exceed six (6) inches in diameter at its greatest dimension. As a general rule, in roadways where cover is less than four (4) feet, or in open areas where cover is less than 2 1/2 feet, ductile iron pipe or concrete encasement shall be used. Ductile iron pipe shall be required when sewer installation occurs in areas of non-virgin soil (i.e. areas of "fill"). Piers shall be provided for when necessary for support. An impermeable barrier of compacted clay or concrete encasement shall be used at the transition from fill to virgin soil to prevent piping of water through the crushed stone bedding.

For structural reasons, ductile iron pipe, concrete encasement, or relocation shall be required when culverts or other conduits are laid such that the top of the sewer is less than 18 inches below the bottom of the culvert or conduit. Special care shall be used in placing bedding in the haunching region.

1. Ductile Iron Pipe: Each sewer pipe section shall be laid on six (6) inch bed of size no. 67 crushed stone and shall be backfilled on the both sides and top to 12-inch above the top of the pipe with size no. 67 compacted crushed stone.
2. PVC Pipe: Each sewer pipe section shall be laid on six (6) inch bed of size no. 67 crushed stone and shall be backfilled on the both sides and top to 12-inch above the top of the pipe with size no. 67 compacted crushed stone.
3. Backfill material above the pipe envelopes shall consist either of fine, loose earth like sandy soil or loam or of granular material that is free from clods, vegetable matter, debris, stone, and/or objectionable materials and that has a size of no more than 6 inches. Place this backfill simultaneously on either side of the trench in even layers that before compaction are no more than 8 inches deep. Thoroughly and completely tamp each layer into place before placing additional layers.
4. Backfill shall, at locations beneath or closely adjacent to pavement, consist of No. 67 (TOOT) crushed stone, from six (6) inches below the pipe and extend to 12-inches below finished grade. Compaction of backfill material layers shall be at 98% by standard proctor test. Where adjacent to and within paved areas the top 12 inches of the trench at subgrade shall consist of crusher-run stone compacted at 98% by standard proctor test. Compaction testing shall be at intervals not greater than 500 feet along the trench and/or at spacing as directed by the site inspector.
5. Within unpaved areas, from 1 foot above the pipe upward, the backfill material may contain broken stones that make up approximately 3/4 of the backfill total volume. However, if this type of backfill is used, there must be enough spalls and earth materials to fill all voids completely. The maximum dimension of individual stones in such backfill shall not exceed 6 inches, and the backfill material shall be placed and spread in even layers not more than 12 inches deep.
6. At locations beneath or closely adjacent to pavement or at locations of improvements subject to damage by displacement, tamp and thoroughly compact the backfill in layers that, before compaction, are 6 inches deep. In other areas, the backfill for

the upper portion of the trenches may be placed without tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling equipment from causing any damage to the pipe.

10. Joints and Infiltration

Sewer joints should be designed to minimize infiltration and to prevent the entrance of roots. Standard laying lengths for PVC pipe shall not exceed 13.5 feet.

11. Air Pressure Testing

Low pressure air exfiltration testing of all pipes shall be as specified in ASTM C828-80. See Section 02722 for testing procedures.

12. Manholes

(a) Location: Manholes shall be installed at the upper end of each collection sewer line, at all changes in grade, at points of changes in size, and at all pipe intersections.

(b) Drop Manholes: A drop pipe shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert should be u-shaped to prevent deposition of solids.

(c) Diameter: The minimum diameter of manholes shall be 48 inches. The entrance tube shall be at least 24 inches in diameter. Distance from Top Casting to 1st step shall not exceed 24 inches.

13. Protection of Water Supplies

(a) Water Supply Interconnections: There shall be no physical connection between a potable water supply line and a sewer or appurtenance thereto which would permit the passage of any wastewater or polluted water into the potable supply.

(b) Relation to Water Mains:

1. Horizontal Separation: Whenever possible, sewers should be laid at least ten (10) feet horizontally from any existing or proposed water pipe. Should local conditions prevent a lateral

separation of ten (10) feet to the water main if it is laid in a separate trench and if the elevation of the top of the sewer pipe is at least 18 inches below the bottom of the water pipe.

2. Vertical Separation: Whenever a sewer must cross under a water main, the sewer shall be laid at such elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirement, the water main shall be relocated to provide the separation or reconstructed with ductile iron pipe for a minimum distance of ten (10) feet on each side of the sewer. At least one (1) full length of water main should be centered over the sewer so that both joints shall be as far from the sewer as possible.
3. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both the water main and the sewer shall be constructed of ductile iron pipe and shall be pressure-tested to assure watertightness.

14. Force Mains

- (a) Velocity: At design flow, velocity in excess of two (2) feet per second shall be maintained.
- (b) Air Release Valve: An automatic air release valve shall be placed at high points in the force main to prevent air-locking and at locations and intervals as recommended for the hydraulic system design.
- (c) Termination: Force mains shall terminate in the invert of a manhole.
- (d) Pipe Diameter: Force mains are to be a minimum of four (4) inches in diameter.
- (e) A maximum Hazen and Williams "C" factor used should not be greater than 130 regardless of that actually determined for the pipe.
- (f) Force mains using minimum four (4) inch ductile iron, cement-mortar lined, Class 350, slip-on type joint meeting the latest requirements of AWWA Standard C151

with a minimum of three (3) feet of cover will be acceptable to the City of Spring Hill.

(g) For detection purposes, a 14-gage solid strand copper tracing wire (shielded) and an approved metallic tape shall be identified as "sewer" and be installed as per the manufacturer's instructions. Bury tape 12 inches below subgrade. Connections between wires shall be soldered or connected with wire nut fasteners and wrapped.

(h) Force mains burial depth to match gravity sewer depth. 36 inches for non-paved and 48 inches for paved.

15. Wastewater Lift Stations

Wastewater lift station design criteria is not provided under these Standards. However, lift stations shall be of the wet well/dry sump configuration. Construction of the lift station shall include a paved (asphalt or concrete) driveway, minimum eight (8) feet high chain-link fence enclosing the site, minimum 12 feet wide gate for access, and a permanent potable water supply.

The City will evaluate separately the materials and criteria proposed for use in the design of wastewater lift stations. Plans and specifications must be submitted to the City for approval. Once approval has been given by the City, plans and specifications must be submitted to the Tennessee Department of Environment and Conservation, Division of Water Pollution Control, for approval.

16. Means of Detecting PVC pipe

When PVC pipe is installed a minimum size 12-gauge solid strand (shielded) copper wire shall be installed along the pipe. Tracer wire shall be suitable for buried applications and designed specifically for use as a utility tracer wire. Tracer wire shall also be installed for Ductile Iron force mains. The ends of the wire shall terminate in a valve box or other acceptable location whereby detection equipment may be attached. Tracer wire shall be joined by approved wire connectors rated for direct bury, corrosion proof and waterproof and pre-filled with non-hardening silicon for maximum protection.

17. Separation of Water Mains and Sewers

(a) General:

The following factors should be considered in providing adequate separation:

1. Materials and type of joints for water and sewer pipes.
2. Soil conditions.
3. Service and branch connections into the water main and sewer line.
4. Compensating variations in the horizontal and vertical separations.
5. Space for repair and alterations of water and sewer pipes.
6. Off-setting of pipes around manholes.
7. Water mains and sanitary or storm sewers shall not be laid in the same trench.
8. Water and sewer services shall maintain the same separation as mains.

(b) Parallel Installation:

1. Normal conditions, water mains shall be laid at least ten (10) feet horizontally from any sanitary sewer, storm sewer or sewer manhole. Whenever possible; the distance shall be measured edge-to-edge.
2. Unusual conditions, when local conditions prevent a horizontal separation of ten (10) feet, a water main may be laid closer to a storm or sanitary sewer provided that:
 - i. The bottom of the water main is at least 18 inches above the top of the sewer.
 - ii. Where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to water main standard of construction and shall be pressure tested to assure watertightness prior to backfilling.

(c) Crossing:

1. Normal conditions, water mains crossing house sewers, storm sewers, or sanitary sewers will be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer, whenever possible.
2. Unusual conditions, when local conditions prevent a vertical separation as described hereinbefore, the following shall be used.
 - i. Sewers passing over or under water mains should be constructed of ductile iron.
 - ii. Water mains passing under sewers shall, in addition, be protected by providing a vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main; adequate structural support for the sewers to prevent excessive deflection of joints and settling on the breaking the water mains; that the length of water pipe be centered at the point of crossing so that the joints will be equidistant as far as possible from the sewer. Both the sewer and the water main shall be constructed of water pipe and tested in accordance with these Standards.

(d) Sewer Manholes:

No water pipe shall pass through or come into contact with any part of sewer line or sewer manhole.

18. Surface Water Crossings

Surface water crossings, both under and over water, present special problems which should be discussed with the City of Spring Hill; the Tennessee Department of Environment and Conservation, Division of Water Supply and Division of Water Pollution Control; and the U.S. Army Corps of Engineers before plans are prepared.

All surface water crossings shall be in accordance with the requirements of the General Permit for an

Aquatic Resource Alteration Permit.

- (a) Above Water Crossings-The pipe shall be:
 - 1. Adequately supported.
 - 2. Protected from damage and freezing.
 - 3. Accessible for repairs and replacement.

- (b) When Crossing Water Courses which are greater than 15 Feet in Width:
 - 1. The pipe shall be of special construction, having flexible, watertight joints;

END OF SECTION

SECTION 01031

SPECIAL PROJECT PROCEDURES

1. SMOKING AND FIRE PRECAUTIONS

1.1 No smoking, fire or use of any fire or explosion-producing tools or equipment will be permitted on the properties of oil companies or other concerns prohibiting same on their premises or at any locations where such may endanger said premises or the current operations thereon.

2. MANUFACTURERS' QUALIFICATIONS

2.1 The manufacturers of all materials and equipment used must be reputable and regularly engaged in the manufacture of the particular material or equipment for the use and service to which it will be subjected.

3. DEVELOPER SHALL PAY FOR ALL LABORATORY INSPECTION SERVICE

3.1 All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be selected by the Developer and approved by the Owner and A/E. The Developer shall pay for all laboratory inspection services as a part of the Contract. Submit all material test reports to the A/E in triplicate.

4. COMPLIANCE WITH STATE AND LOCAL LAWS

4.1 Comply with all applicable requirements of state and local laws and ordinances to the extent that such requirements do not conflict with federal laws or regulations.

5. MARKERS

5.1 Preserve all Corps of Engineers, USGS, TVA, State of Tennessee, and private markers; do not remove or disturb any such markers without prior approval from the A/E. Any removal and replacement of such markers shall be at the expense of the Developer.

6. PAVEMENT REPAIR AND/OR REPLACEMENT

6.1 Open cut pavement is not allowed, and roadway bores are required for roadway crossings.

6.2 If the City of Spring Hill allows an open cut due to special approved circumstances, pipe trenches shall be cut across or along existing pavement or shoulders, backfill same and restore traffic over the cuts as quickly as possible by constructing a temporary twelve-inch (12") surface of Class A, Grade D crushed stone. Add material and otherwise maintain such surface until the permanent pavement is restored or until the entire project is accepted. Temporary pavement may be required if open cut trench is not properly maintained until permanent pavement can be installed.

7. APPROVED CHEMICALS

7.1 All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA. The use of all such chemicals and the disposal of residues shall be in strict conformance with all applicable instructions and regulations.

8. DEPARTMENT OF TRANSPORTATION PERMITS

8.1 The Owner will assist in securing any permits and provide bond as required by the Tennessee Department of Transportation for the installation of permanent facilities on State highway rights-of-way. The costs for such bonds and/or permits, shall be paid by the Developer. All such work shall be coordinated with and be subject to the approval of the Tennessee Department of Transportation, in addition to the approval of the A/E.

8.2 The Developer will secure any permits as required by the local highway department for the installation of water lines within the rights-of-way of county roads. The Developer shall be responsible for complying with the requirements of the local highway department, and all such work shall be coordinated with and be subject to the approval of the local highway department, in addition to the approval of the Owner.

9. INSTALLATIION, TESTING, AND GUARANTEE

9.1 The completely installed system shall be guaranteed against any and all defects of manufacture, materials, workmanship, or installation for a period of one year from the date of acceptance.

10. DRAWINGS OF RECORD

10.1 The Developer shall provide and keep up-to-date a complete record set of blue-line prints, which shall be corrected daily to show every change, and the approved shop drawings. Keep this set of prints at the job site, and use only as a record set. This shall not be construed as authorization for the Developer to make changes in the approved layout without definite instructions in each case. Turn the set over to the Owner upon completion of the project.

11. DETECTION WIRE

11.1 For detection purposes, a 12-gage solid strand copper tracing wire (shielded) shall be installed as per the manufacturer's instructions. Connections between wires shall be joined by approved wire connectors rated for direct bury, corrosion proof and waterproof and pre-filled with non-hardening silicon for maximum protection. Also, metallic tape marked "sewer" shall be provided 12" below grade directly above the force main shall be provided.

12. UTILITIES

12.1 The Developer shall contact the owner of all underground utilities before beginning construction in the area. Carefully protect from damage all utilities in the vicinity or the work at all times. If it is necessary to repair, remove, and/or replace any such utility in order to complete the work properly, do so in compliance with the rules and regulations of the particular utility involved. Any such work shall be considered incidental to the construction of the project, and no additional payment will be allowed therefore.

13. INSURANCE

The Contractor shall procure, maintain, and furnish an Owner's protective policy as hereinafter specified:

Owner's General Public Liability and Property Damage Insurance including vehicle coverage issued to the Owner and protecting the Owner from all claims for personal injury, including death, and all claims for destruction of or damage to property, arising out of or in connection with any operations under the Contract Documents, whether such operations be by the Contractor or by any Subcontractor employed by the Contractor or anyone directly or indirectly employed by the Contractor or by a Subcontractor employed by the Contractor. Insurance shall be written with a limit of liability of not less than \$1,000,000 for all damages arising out of bodily injury, including death, at any time resulting therefrom, sustained by any one person in any one accident; and a limit of liability of not less than \$1,000,000 aggregate for any such damages sustained by two or more persons in any one accident. Insurance shall be written with a limit of liability of not less than \$500,000 for all property damage sustained by any one person in any one accident; and a limit of liability of not less than \$500,000 aggregate for any such damage sustained by two or more persons in any one accident.

This requirement for an Owner's protective policy shall be in addition to any and all other insurance requirements as set forth in the Contract Documents, if applicable.

END OF SECTION

SECTION 01090
REFERENCE STANDARDS

PART 1. GENERAL

1.1 REQUIREMENTS INCLUDED

- A. Applicability of Reference Standards.
- B. Provision of Reference Standards at site.
- C. Acronyms used in Contract Documents for Reference Standards. Source of Reference Standards.

1.2 QUALITY ASSURANCE

- A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. The date of the standard is that in effect as of the Bid date, or date of Owner-Contractor Agreement when there are bids, except when a specific date is specified.
- C. When required by individual Specification sections, obtain copy of standard. Maintain copy at jobsite during submittals, planning, and progress of the specific work, until Substantial Completion.

1.3 SCHEDULE OF REFERENCES

AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W. Washington, DC 20001
ACI	American Concrete Institute P.O. Box 19150 Reford Station Detroit, MI. 48219
AGC	Associated General Contractors of America 1957 E. Street. N.W. Washington, DC 20006

AI Asphalt Institute
Asphalt Institute Building
College Park, MD 20740

AISC American Institute of Steel Construction
400 North Michigan Avenue Eighth Floor
Chicago, IL 60611

AISI American Iron and Steel Institute
1000 16th Street, N.W. Washington,
DC 20036

ANSI American National Standards Institute
1430 Broadway
New York, NY 10018

ASHRAE American Society of Heating, Refrigerating
and Air Conditioning Engineers
1791 Tullie Circle, N.E.
Atlanta, GA 30329

ASME American Society of Mechanical Engineers
345 East 47th Street
New York, NY 10017

ASTM American Society for Testing and Materials
1916 Race Street
Philadelphia, PA. 19103

AWWA American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235

AWPA American Wood-Preservers Association
7735 Old Georgetown Road
Bethesda, MD 20014

AWS	American Welding Society 550 LeJeune Road Miami, FL 33135
CLFMI	Chain Link Fence Manufacturers Institute 1101 Connecticut Avenue, N.W. Washington, DC 20036
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Road Schaumburg, IL 60195
EJCDC	Engineers Joint Contract Documents Committee American Consulting Engineers Council 1050 15th Street, N.W. Washington, DC 20005
EJMA	Expansion Joint Manufacturers Association 707 Westchester Avenue White Plains, NY 10604
FM	Factory Mutual System 1151 Boston-Providence Turnpike Norwood, MA 02062
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407
GA	Gypsum Association 1603 Orrington Avenue Evanston, IL 60201
IEEE	Institute of Electrical and Electronics Engineers 345 East 47th Street New York, NY 10017
IMI	International Masonry Institute 815 15th Street, N.W. Washington, DC 20005

MIL Military Specification
Naval Publications and Forms Center
5801 Tabor Avenue
Philadelphia, PA 19120

ML/SFA Metal Lath/Steel Framing Association
221 North LaSalle Street
Chicago, IL 60601

NAMM National Association of Architectural Metal
Manufacturers
221 North Lasalle Street
Chicago, IL 60601

NEEB National Environmental Balancing Bureau
8224 Old Courthouse Road
Vienna, VA 22180

NEMA National Electrical Manufacturers
Association
2101 L Street, N.W.
Washington, DC 20037

NFPA National Forest Products Association
1619 Massachusetts Avenue, N.W.
Washington, DC 20036

NSWMA National Solid Waste Management Association
1120 Connecticut Avenue, N.W.
Washington, DC 20036

NTMA National Terrazzo and Mosaic Association
3166 Des Plaines Avenue
Des Plaines, IL 60018

PCA Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

PCI Prestressed Concrete Institute
201 North Wacker Drive
Chicago, IL 60606

PS Product Standard
U. S. Department of Commerce Washington,
DC 20203

SDI Steel Deck Institute
P.O. Box 3812
St. Louis, MO 63122

SIGMA Sealed Insulating Glass Manufacturers
Association
111 East Wacker Drive
Chicago, IL 60601

SJI Steel Joist Institute
1703 Parham Road Suite 204
Richmond, VA 23229

SMACNA Sheet Metal and Air Conditioning Contractors
National Association
8224 Old Court House Road
Vienna, VA 22180

SSPC Steel Structures Painting Council
4400 Fifth Avenue
Pittsburgh, PA 15213

TAS Technical Aid Series
Construction Specifications Institute
601 North Madison Street
Alexandria, VA 22314

TCA Tile Council of America, Inc.
P.O. Box 326
Princeton, NJ 08540

UL Underwriters Laboratories, Inc.
333 Pfingsten Road
Northbrook, IL 60062

PART 2. PRODUCTS
2.1 Not Used.
PART 3. EXECUTION
3.1 Not Used.

END OF SECTION

01090-5

SECTION 01400
QUALITY CONTROL

PART 1. GENERAL

1.1 REQUIREMENTS INCLUDED

- A. General Quality Control.
- B. Workmanship.
- C. Manufacturers' Instructions.
- D. Manufacturers' Certificates.
- E. Mockups.
- F. Manufacturers' Field Services.
- G. Testing Laboratory Services.

1.2 RELATED REQUIREMENTS

- A. General Conditions: Inspection and testing required by governing authorities.
- B. Section 01090 - Reference Standards: Applicability of specified reference standards.
- C. Section 01300 - Submittals: Submittal of Manufacturers' Instructions.
- D. Section 03301 - Concrete Work: Tests required for concrete.

1.3 QUALITY CONTROL, GENERAL

- A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

1.4 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

- B. Perform work by utilizing only persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1.5 MANUFACTURERS' INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from A/E before proceeding.

1.6 MANUFACTURERS' CERTIFICATES

- A. When required by individual Specification Sections, submit manufacturers' certificate, in duplicate, that products meet or exceed specified requirements.

1.7 MOCKUPS

- A. When required by individual Specifications Section, erect complete, full-scale mockup of assembly at Project site. Tests will be performed in accordance with Section 01400, if applicable. Remove mockup at completion when approved by A/E.

1.8 MANUFACTURER'S FIELD SERVICES

- A. When specified in respective Specification Sections, require supplier or manufacturer to provide qualified personnel to observe field conditions, conditions of surfaces and installation, quality of workmanship; start-up of equipment; test, adjust, and balance of equipment, as applicable; and, to make appropriate recommendations.
- B. Representative shall submit written report to A/E listing observations and recommendations.

1.9 TESTING LABORATORY SERVICES

- A. Contractor shall employ and pay for services of an Independent Testing Laboratory to perform inspections, tests, and other services required by individual Specification Sections.
- B. Services will be performed in accordance with

requirements of governing authorities or agencies and with specified standards.

- C. Reports will be submitted to A/E in duplicate giving observations and results of tests, indicating compliance or non-compliance with specified standards and with Contract Documents.
- D. Contractor shall cooperate with Testing Laboratory personnel; furnish tools, samples of materials, design mix, equipment, storage and assistance as requested.
 - 1. Notify A/E and Testing Laboratory at least 48 hours prior to expected time for operations requiring testing services.
 - 2. Make arrangements with Testing Laboratory and pay for additional samples and tests for Contractors' convenience.

PART 2. PRODUCTS NOT USED

PART 3. EXECUTION NOT USED

END OF SECTION

SECTION 01568

EROSION CONTROL

PART 1. GENERAL

This work shall consist of erosion control on all cut and fill operations, excavation, backfill, or other construction activities within the limits of the construction site, within any temporary or permanent easements, and within any borrow site used during the period of construction. The protection of these sites shall continue throughout the construction period. During flood seasons, protect the sites by sandbagging, the pumping of water, and any other means appropriate to restrain flooding of plant and equipment. During dry weather, sprinkle the sites with water or use other means as necessary to provide dust control. In case of abnormally cold weather, any construction such as excavation work may be delayed until warmer weather or covered to prevent freezing.

All work shall be in accordance with the City of Spring Hill's National Pollution Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Phase II Program. Prior to any excavation activities commencing, the developer, developer's engineer, and/or contractor shall apply for and receive an approved permit from the City of Spring Hill for such excavation activities. The application for permit will be reviewed by the Program Director and an approved permit shall be obtained prior to excavation activities. All erosion and sediment runoff control measures shall be installed in accordance with the approved permit and shall be maintained throughout the project cycle and until adequate and approved vegetative cover has been established. Erosion control measures such as mulching, silt fencing, check dams, or other applicable measures.

PART 2. PRODUCTS

Temporarily stabilize areas from which topsoil has been removed and topsoil stockpiles by seeding fast growing annuals such as rye and annual ryegrass, that provide quick protection. These annual grasses are to be seed certified by the State Department of Agriculture and can be worked into the soil when the site is prepared for final seeding of more permanent species.

Use commercial lime and fertilizer on exposed areas, subject to severe erosion.

PART 3. EXECUTION

3.1 Conduct construction so as to provide the site with maximum protection from erosion at all times.

3.2 Conduct excavation activities to provide erosion and sediment control as follows:

3.2.1 Do not start clearing and excavation until a firm construction schedule is submitted to and approved by the City of Spring Hill. Continuously coordinate the schedule with the clearing and excavation activity.

3.2.2 In streets and other paved areas, remove excavated material from the site as construction progresses to prevent any erosion of this material.

3.2.3 In other areas, place the excavated material so as not to block any drainage area. Replace this excavated material in the trench immediately after repairs have been completed and are approved by the City of Spring Hill.

3.2.4 Retain natural vegetation whenever feasible. Install sediment control measures where needed and maintain throughout the project.

3.2.5 Restore and cover exposed areas subject to erosion as quickly as possible by means of seeding and mulching. Use diversion ditches or other methods as appropriate to prevent storm water from running over the exposed area until seeding is established as specified.

3.2.6 Take particular care along streams and drainage ditches so that fallen trees, debris, and excavated material will not adversely affect the streamflow. Exercise care to minimize the destruction of streambanks. Wherever the streambanks are affected by construction, reduce the slope of the streambanks to provide a suitable condition for vegetation protection. Minimize land exposure in terms of area and time.

3.2.7 Cover exposed excavated areas with mulch or vegetation.

3.2.8 Mechanically retard the rate of runoff water.

3.2.9 Trap the sediment contained in the runoff water utilizing approved sediment control measures.

3.2.10 Divert water from erosive areas.

3.2.11 Take care during the pouring of concrete, hauling of materials, etc., to keep vehicles from creating a severe erosion problem. Proper scheduling of operations and prompt repair of ruts created during this operation is necessary from this source.

3.2.12 Control dust by sprinkling or other means as necessary to keep it to a minimum.

3.2.13 Pave or otherwise stabilize roadways and driveways as soon as feasible.

3.2.14 Regrade and reseed surfaces eroded or otherwise damaged during any and all construction operations as necessary.

END OF SECTION

SECTION 01620
STORAGE AND PROTECTION

PART 1. GENERAL

Not Used

PART 2. PRODUCTS

2.1 Not Used.

PART 3. EXECUTION

3.1 STORAGE, GENERAL

- A. Store products, immediately on delivery, in accordance with manufacturer's instructions, with seals and labels intact. Protect until installed.
- B. Arrange storage in a manner to provide access for maintenance of stored items and for inspection.

3.2 EXTERIOR STORAGE

- A. Provide substantial platforms, blocking, or skids, to support fabricated products above ground; slope to provide drainage. Protect products from soiling and staining.
- B. Store loose granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials, to prevent mixing with foreign matter.
- C. Provide surface drainage to prevent erosion and ponding of water.

3.3 MAINTENANCE OF STORAGE

- A. Verify that surfaces of products exposed to the elements are not adversely affected; that any weathering of finishes is acceptable under requirements of Contract Documents.

END OF SECTION

01620-1

SECTION 02221

EXCAVATION, BEDDING, AND BACKFILL FOR SEWER PIPE

PART 1. GENERAL

1.1 The work called for by this section shall consist of clearing and grubbing, loosening, loading, removing, and disposing of, in the specified manner, all wet and dry materials (including rock) encountered that must be removed for construction purposes; furnishing, placing, and maintaining all sheeting, shoring, bracing, and timbering necessary for the proper protection and safety of the work; the workmen, the public, and adjacent property and improvements; the dewatering of trenches and other excavations; the preparation of satisfactory pipe beds; the backfilling and tamping of trenches, foundations, and other structures; the preparation of fills and embankments; the removal of unsuitable material from outside the normal limits of excavation and, where ordered by the A/E, their replacement with suitable materials; and all other grading or excavation work incidental to or necessary for the work. This work shall be performed as specified below.

PART 2. PRODUCTS

Not Used.

PART 3. EXECUTIONS

3.1 PREPARATION OF THE SITE

- A. Before starting construction, remove from the work site, all vegetable growth (except as hereinafter excluded), debris, and/or other objectionable matter as well as any buildings and/or other structures that the drawings and/or the A/E specifically indicate are to be removed. Dispose of this refuse material in a manner acceptable to the A/E.
- B. In certain areas it may be desirable for existing trees, shrubs, or other vegetation on the site to be preserved for the permanent landscape.

Such vegetation may be shown on the drawings, specifically listed in the specifications, marked on the site, or identified by the A/E. In no case damage or remove such growth without written permission from the Owner.

- C. If the area to be excavated is occupied by trees, brush, or other vegetable growth, clear such growth, grub the excavated area, and remove all large roots to a depth of not less than 2 feet below the bottom of the proposed construction. Dispose of the growth removed in a manner satisfactory to the A/E. Fill all holes or cavities created during this work that extend below the subgrade elevation with suitable material, and compact to the same density as the surrounding material.
- D. Trees, cultivated shrubs, etc., that are situated within public rights-of-way and/or construction easements through private property but not directly within the excavation area shall remain undisturbed unless it is necessary to remove them so that the work can be performed safely and unless their removal is specifically ordered by the A/E. Take special precautions to protect and preserve such growth throughout all stages of the construction.
- E. Preparation of the site shall be considered an integral part of the excavation and one for which no separate payment shall be allowed.

3.2 UNSUITABLE MATERIALS

- A. Wherever muck, quicksand, soft clay, swampy ground, or other material unsuitable for foundations, subgrade, or backfilling is encountered, remove it and continue excavation until suitable material is encountered. The material removed shall be disposed of in the manner described below. Then refill the areas excavated for this reason with compacted 4 inches lifts of crushed stone up to the level of the lines, grades, and/or cross sections shown on the drawings. The top 6 inches of this refill shall be No. 67 (TOOT) crushed stone for bedding.

3.3 ROCKS AND BOULDERS

- A. Any material that is encountered within the limits of the required excavation that cannot be removed except by drilling and/or blasting, including rock, boulders, masonry, hard pan, chert, shale, street and sidewalk pavements, and/or similar materials, shall be considered as unclassified excavation, and no separate payment will be made therefore.
- B. Should rock be encountered in the excavation, remove it by blasting or otherwise. Where blasts are made, cover the excavation with enough excavation material and/or timber or steel matting to prevent danger to life and property. The Contractor shall secure, at his own expense, all permits required by law for blasting operations and the additional hazard insurance required. Observe all applicable laws and ordinances pertaining to blasting operations.
- C. Excavate rock over the horizontal limits of excavation and to a depth of not less than 6 inches below the bottom of pipe up to 30 inches in diameter and not less than 12 inches below the bottom of larger pipes if rock extends to such depth. Then backfill the space below grade with No.67 (TOOT) crushed stone or other approved material, tamp to the proper grade, and make ready for construction. For monolithic concrete sewers and for structures, excavate rock to the outside bottom of the structure or sewer.

3.4 DISPOSAL OF MATERIALS

- A. Whenever practicable, all materials removed by excavation that are suitable for backfilling pipe trenches or for other purposes shown on the drawings or directed by the A/E shall be used for these purposes. Any materials not so used shall be considered waste materials and disposed of by the Contractor as specified below.
- B. Waste materials may be deposited in spoil areas at locations approved by the A/E. Do not leave in unsightly piles but instead spread in uniform layers, neatly level, and shape to drain. Seed as specified in Section 02485, Seeding.

- C. Once any part of the work is completed, properly dispose of all surplus or unused materials (including waste materials) left within the construction limits of that work. Leave the surface of the work in a neat and workman like condition, as described below.
- D. The disposal of waste materials shall be considered an integral part of the excavation work and one for which no separate payment shall be allowed.

3.5 EXCAVATION FOR TRENCHES, MANHOLES, AND STRUCTURES

- A. Unclassified excavation for pipelines shall consist of the excavation necessary for the construction of water, sewer, and other pipes and their appurtenances (including manholes, inlets, outlets, headwalls, collars, concrete saddles, and pipe protection) that are called for by the drawings. It shall include clearing and grubbing where necessary, backfilling and tamping pipe trenches and around structures, and disposing of waste materials, all of which shall conform to the applicable provisions set forth elsewhere in these specifications.
- B. The Contractor may, if he chooses, use a motor-powered trenching machine. If he does, however, he shall be fully responsible for the preservation or repair of existing utility service connections.
- C. Unless the construction of lines by tunneling, jacking, or boring is called for by the drawings or specifically authorized by the A/E, make excavation for pipelines in open cut and true to the lines and grades shown on the drawings or established by the A/E on the ground. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes (or, if sheeting is used, between the inside faces of that sheeting) shall vary with the size of the pipe to be installed but shall not be more than the distance determined by the following formula: $4/3d + 15$ inches, where "d" represents the internal diameter of the pipe in inches.

When approved in writing by the A/E, the banks of trenches from the ground surface down to a depth not closer than 1 foot above the top of the pipe may be excavated to non-vertical and nonparallel planes, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the formula given above. Any cut made in excess of the formula $4/3d + 15$ inches shall be at the expense of the Contractor and may be cause for the A/E to require that stronger pipe and/or a higher class of bedding be used at no cost to the Owner.

- D. For rigid pipe, shape the bottom of all trenches to provide uniform bearing for the bottom of the pipe barrel. For plastic sewer lines, provide a minimum of 6 inches of No. 67 (TDOT) crushed stone for bedding.
- E. Excavate bell holes for bell and spigot pipe at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper jointing of the pipe. Do not excavate bell holes more than 2 joints ahead of pipe laying.
- F. Excavation for manholes, inlets, and other incidental structures shall not be greater in horizontal area than required to allow a 2-foot clearance between the outer surface of the structure and the walls of the adjacent excavation or of the sheeting used to protect it. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings. No earth backfilling will be permitted under manholes, inlets, headwalls, or similar structures. Should the Contractor excavate below the elevations shown or specified, he shall, at his own expense, fill the void with either concrete or granular material approved by the A/E.
- G. Do not excavate pipe trenches more than 200 feet ahead of the pipe laying and perform all work so as to cause the least possible inconvenience to the public. Construct temporary bridges or crossings when and where the A/E deems necessary to maintain vehicular or pedestrian traffic.

- H. In all cases where materials are deposited along open trenches, place them so that in the event of rain no damage will result to the work and/or to adjacent property.
- I. Excavation for other structures may be performed with non-vertical banks except beneath pavements or adjoining existing improvements. Do not permit the horizontal area of the excavation to exceed that required to allow a 2-foot clearance between the outer surface of the structure and the banks of the excavation or the sheeting used to protect the embankments. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings.

3.6 SHEETING, SHORING, AND BRACING

- A. Take special care to avoid damage wherever excavation is being done. Sufficiently sheet, shore, and brace the sides of all excavations to prevent slides, cave-ins, settlement, or movement of the banks and to maintain the specified trench widths. Use solid sheets in wet, saturated, or flowing ground. All sheeting, shoring, and bracing shall have enough strength and rigidity to withstand the pressures exerted, to keep the walls of the excavation properly in place, and to protect all persons and property from injury or damage. Separate payment will not be made for sheeting, shoring, and bracing, which are considered an incidental part of the excavation work.
- B. Wherever employees may be exposed to moving ground or cave-ins, shore and lay back exposed earth excavation surfaces more than 5 feet high to a stable slope, or else provide some equivalent means of protection. Effectively protect trenches less than 5 feet deep when examination of the ground indicates hazardous ground movement may be expected. Guard the walls and faces of all excavations in which employees are exposed to danger from moving ground by a shoring system, sloping of the ground, or some equivalent protection.

- C. Comply with all OSHA standards in determining where and in what manner sheeting, shoring, and bracing are to be done. The sheeting, shoring, and bracing system shall be designed by a professional engineer licensed in the State of Tennessee and shall be subject to approval by the A/E. However, such approval does not relieve the Contractor of the sole responsibility for the safety of all employees, the effectiveness of the system, and any damages or injuries resulting from the lack or inadequacy of sheeting, shoring, and bracing.
- D. Where excavations are made adjacent to existing buildings or structures or in paved streets or alleys, take particular care to sheet, shore, and brace the sides of the excavation so as to prevent any undermining of or settlement beneath such structures or pavement. Underpin adjacent structures wherever necessary, with the approval of the A/E.
- E. Do not leave sheeting, shoring, or bracing materials in place unless this is called for by the drawings, ordered by the A/E, or deemed necessary or advisable for the safety or protection of the new or existing work or features. Remove these materials in such a manner that the new structure or any existing structures or property, whether public or private, will not be endangered or damaged and that cave-ins and slides are avoided.
- F. Fill and compact all holes and voids left in the work by the removal of sheeting, shoring, or bracing as specified herein.

3.7 The Contractor may use a trench box, which is a pre-fabricated movable trench shield composed of steel plates welded to a heavy steel frame. The trench box shall be designed to provide protection equal to or greater than that of an appropriate shoring system.

3.8 THE DEWATERING OF EXCAVATION

- A. Provide and keep in operation enough suitable pumping equipment whenever necessary or whenever directed to do so by the A/E. Give special attention to excavations for those structures that, prior to proper backfilling, are subject to flotation from hydrostatic uplift.

3.9 BORROW EXCAVATION

- A. Whenever the backfill of excavated areas or the placement of embankments requires more material than is available from authorized excavations, or whenever the backfill material from such excavations is unsuitable, then obtain additional material from other sources. This may require the opening of borrow pits at points accessible to the work. In such cases, make suitable arrangements with the property owner and pay all incidental costs, including any royalties, for the use of the borrowed material. Before a borrow pit is opened, the quality and suitability of its material shall be approved by the A/E. All state and local regulations concerning borrow pits, drainage and erosion control shall be strictly followed.
- B. Excavate borrow pits in such a way that the remaining surfaces and slopes are reasonably smooth, and that adequate drainage is provided over the entire area. Construct drainage ditches wherever necessary to provide outlets for water to the nearest natural channel, thus preventing the formation of pools in the pit area. Leave the sides of borrow pit cuts at a maximum slope of 2:1 unless otherwise directed by the A/E.
- C. Properly clear and grub borrow pits and remove all objectionable matter from the borrow pit material before placing it in the backfill.
- D. The taking of materials from borrow pits for use in the construction of backfill, fills, or embankments shall be considered an incidental part of the work; no separate payment shall be made for this.

3.10 BACKFILLING

- A. Backfilling may begin once the line of construction is completed and then inspected and approved by the A/E. All pipe types in trenches shall contain 6-inches of No. 67 crushed stone on bottom and sides and 12-inches on top.
- B. Backfill material above the pipe envelopes shall consist either of fine, loose earth like sandy soil or loam or of granular material that is free from clods, vegetable matter, debris, stone, and/or objectionable materials and that has a size of no more than 6-inches in diameter. Place this backfill simultaneously on either side of the trench in even layers that before compaction are no more than 8 inches deep. Thoroughly and completely tamp each layer into place before placing additional layers.
- C. Backfill shall, at locations beneath or closely adjacent

to pavement, consist of No. 67 (TOOT specifications Table 903.22) crushed stone up to 12-inches below finished grade. Compaction of backfill material layers shall be at 98% by standard proctor test. Where adjacent to and within paved areas the top 12 inches of the trench at subgrade shall consist of crusher-run stone compacted at 98% by standard proctor test. Compaction testing shall be at intervals directed by the site inspector.

- D. In unpaved areas, from 1 foot above the pipe upward, the backfill material may contain broken stones that make up approximately 3/4 of the backfill total volume. However, if this type of backfill is used, there must be enough spalls and earth materials to fill all voids completely. The maximum dimension of individual stones in such backfill shall not exceed 6 inches, and the backfill material shall be placed and spread in even layers not more than 12 inches deep.
- E. At locations beneath or closely adjacent to pavement or at locations of improvements subject to damage by displacement, tamp and thoroughly compact the backfill in layers that, before compaction, are 6 inches deep. In other areas, the backfill for the upper portion of the trenches may be placed without tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling equipment from causing any damage to the pipe.
- F. If earth material for backfill is, in the opinion of the A/E, too dry to allow thorough compaction, then add enough water so that the backfill can be properly compacted. Do not place earth material that the A/E considers too wet or otherwise unsuitable.
- G. Wherever excavation has been made within easements across private property, the top 1 foot of backfill material shall consist of fine loose earth free from large clods, vegetable matter, debris, stone, and/or other objectionable materials.
- H. Wherever trenches have been cut across or along existing pavement, temporarily pave the backfill of such trenches by placing Class A, Grade D, crushed stone as the top 12 inches of the backfill. Maintain this temporary pavement either until the permanent pavement is restored or until the project is accepted by the Owner. On heavily traveled roadways, cold mix or leveling course binder 4-inches thick

shall be installed and maintained until permanent pavement is installed.

- I. Conduct backfilling around manholes, inlets, outfalls, and/or structures in the same manner as specified above for pipelines except that even greater care is necessary to prevent damage to the utility structure.
- J. Wherever pipes have diameters of 15 inches or less, do not use power operated tampers to tamp that portion of the backfill around the pipe within 1 foot above the pipe.
- K. Perform backfilling so as not to disturb or injure any pipe and/or structure against which the backfill is being placed. If any pipe or structure is damaged and/or displaced during backfilling, open up the backfill and make whatever repairs are necessary, whenever directed to do so by the A/E.
- L. Backfilling and clean-up operations shall closely follow pipe laying; failure to comply with this provision will result in the A/E's requiring that the Contractor's other activities be suspended until backfilling and clean-up operations catch up with pipe laying.
- M. Compaction Requirements: Unless specified otherwise elsewhere, under buildings and 2 times the depth of pipe beyond, and under roads and 2 times the depth beyond the shoulder, compact to 95% maximum density in accordance with ASTM 0698. In all other locations, compact to 90% maximum density.

3.11 MAINTENANCE

- A. Seed and maintain in good condition all excavated areas, trenches, fills, embankments, and channels until final acceptance by the Owner.
- B. Maintain trench backfill at the approximate level of the original ground surface by periodically adding backfill material wherever necessary and whenever directed to do so by the A/E. Continue such maintenance until final acceptance of the project, or until the A/E issues a written release.

3.12 SLOPES

- A. Neatly trim all open cut slopes, and finish to conform either with the slope lines shown on the drawings or the directions of the A/E. Leave the finished surfaces of

bottom and sides in reasonably smooth and uniform planes like those normally obtainable with hand tools, though the Contractor will not be required to use hand methods if he is able to obtain the required degree of evenness with mechanical equipment. Conduct grading operations so that material is not removed or loosened beyond the required slope.

END OF SECTION

SECTION 02485
SEEDING

PART 1. GENERAL

1.1 This work shall be performed in all disturbed areas not receiving such site improvements as buildings, roads, walks, sod, planting, etc., and shall include, but not necessarily be limited to, all seed bed preparation; the supplying and placing of soil additives, seed, and mulch wherever required by the drawings or directed by the A/E; and maintenance.

1.2 Unless otherwise approved in writing by the A/E, seeding operations shall be limited to the following planting periods:

A. Spring - March 1 through May 30

B. Fall - August 15 through October 31

1.3 Refer to other sections for items affecting seeding. Coordinate this work with that specified by other sections for timely execution.

PART 2. PRODUCTS

2.1 GRASS SEED: Kentucky 31 Fescue (*Festuca elatior*) and/or annual rye meeting the requirements of the State Department of Agriculture and furnished in new bags or bags that are sound and not mended; no "below standard" seed will be accepted.

2.2 FERTILIZER: commercially manufactured; Grade 10-10-10; furnished in standard containers that are clearly marked with the name, weight, and guaranteed analysis of the contents and that ensure proper protection in transportation and handling; and in compliance with all local, state, and federal fertilizer laws.

2.3 AGRICULTURAL LIMESTONE: containing a minimum of 85% calcium carbonate and magnesium carbonate combined, 85% of which passes a No.10 mesh sieve.

2.4 MULCH: stalks of rye, oats, wheat, or other approved grain crops properly cured prior to bailing, air dried, and reasonably free of noxious weeds and weed seeds or other material detrimental to plant growth.

PART 3. EXECUTION

3.1 Perform all seeding and related work as a continuous operation. Sow seed as soon as the seed bed has been prepared and perform subsequent work in a continuous manner.

3.2 Before beginning seeding operations in any area, complete the placing of topsoil and final grading, and have the work approved by the A/E.

3.3 Scarify, disk, harrow, rake, or otherwise work each area to be seeded until the soil has been loosened and pulverized to a depth of not less than 2 inches. Perform this work only when the soil is in a tillable and workable condition.

3.4 Apply fertilizer and agricultural limestone uniformly over the seed bed, and lightly harrow, rake, or otherwise incorporate them into the soil for a depth of approximately 1 inch at the following rates:

Fertilizer:	15 pounds per 1,000 square feet	Limestone:
Agricultural		40 pounds per 1,000 square feet

3.5 Sow seed uniformly with a rotary seeder, wheelbarrow seeder, hydraulic equipment or by other satisfactory means.

3.6 The seeding rate shall be 5 pounds per 1,000 square feet for Kentucky 31 Fescue (*Festuca elatior*).

3.7 When seeding during March 1 through April 1 and October 1 through November 20, add an additional 3 pounds per 1,000 square feet of annual rye grass.

3.8 Perform no seeding during windy weather or when the ground surface is frozen, wet, or otherwise untillable.

3.9 Spread mulch material evenly over the seeded areas immediately following the seeding operation.

Mulch Rate: 2 bales (100-pound minimum) per 1,000 square feet

3.10 The mulch rate may be varied by the A/E, depending on the texture and condition of the mulch material and the characteristics of the area seeded. Cover all portions of the seeded areas with a uniform layer of mulch so that approximately 25% of the ground is visible.

3.11 No equipment, material storage, construction traffic, etc., will be permitted on newly seeded ground.

3.12 Dispose of all surplus materials as directed by the Owner.

PART 4. INSPECTIONS

The A/E shall inspect the seeding within 60 days after planting and determine if it is acceptable.

PART 5. GUARANTEE

5.1 Secure an acceptable growth of grass in all areas designated for seeding.

5.2 An area is considered acceptable if it is represented by a minimum of 100 seedlings per square foot of the permanent species of grass representative of the seed mixture. If acceptable growth is not obtained on the first planting, reseeding and re-mulching will be required.

5.3 If the planting is less than 50% successful, rework the ground, re-fertilize, reseed, and re-mulch.

END OF SECTION

SECTION 02575

PAVEMENT REPAIR

PART 1. GENERAL

1.1 The work specified by this section shall consist of repairing or replacing all damaged pavement, whether public or private. Dirt shoulders, roads, streets, drives, and walks are to be restored to their original condition as an incidental part of the installation of utilities. Repair damaged base on either side of a trench wherever necessary. Trim the oxidation surface to neat lines outside of the trench wall, and repave the entire area as specified below and as shown on the drawings or on the standard drawings.

1.2 Both these specifications and the drawings make reference to the current edition of the standard specifications of the Tennessee Department of Transportation (TDOT). Even though the weather limitations, construction methods, and materials specifications contained in the TDOT specifications may not be explicitly repeated in these specifications, they shall, wherever applicable to the work called for by this section, be considered as implied and therefore adhered to. However, the various subsections "Basis for Payment" contained in the TDOT specifications shall not be considered applicable.

- A. Refer to other sections for work related to that covered by this section.

PART 2. PRODUCTS

2.1 MINERAL AGGREGATE BASE: Class A, Grading D crushed stone (TDOT specifications, Section 303, subsection 903.05)

2.2 BITUMINOUS PRIME COATS: cutback asphalt, Grade RC-250, or emulsified asphalt, Grade AE-P (Section 402, Subsections 904.02 and 904.03)

2.3 CRUSHED STONE CHIPS: Size 6 or Size 7 (Subsection 903.14)

2.4 DOUBLE BITUMINOUS SURFACE: for both courses, either cutback asphalt, Grade RC-800 or RC-3000, or emulsified asphalt, Grade RS-2 (Subsections 904.02 and 904.03)

2.5 ASPHALTIC CONCRETE BINDER: Grading B or C, as directed by the A/E (Section 307)

2.6 BITUMINOUS TACK COAT: Grade AE-3 (Section 403, Subsection 904.03)

2.7 ASPHALTIC CONCRETE SURFACE: Grading E (Section 411)

2.8 QUICK DRY TRAFFIC MARKING PAINT (WHITE AND YELLOW)
Subsection 910.05.

PART 3. EXECUTION

3.1 SUBGRADE

- A. Before any base material is installed, compact the subgrade of the area to be paved to 98% of optimum density as determined by ASTM D698 (Standard Proctor)
- B. The backfill material shall contain no topsoil or organic matter. For all areas where subgrade has been prepared, test for uniformity of support by driving a loaded full-size dump truck at a speed of 2 to 3 mph over the entire surface. Make further improvements on all areas that show a deflection of 1 inch or more. When completed, the finished subgrade shall be hard, smooth, stable, and constructed in reasonably close conformance with the lines and grades that existed prior to beginning construction.
- C. When a base course is compacted, cut back the surface course of the existing pavement a minimum of 1 foot beyond the limit of the joint between the old and new base course or as shown on the standard drawings. Take special care to ensure good compaction of the new base course at the joint. Apply and compact the surface to conform to the existing pavement with no surface irregularity.

3.2 BASE

- A. Install a mineral aggregate base in accordance with the City of Spring Hill's approved roadway classification standard drawings. The maximum compacted thickness of any one layer shall be 2-inches and the total thickness of the base shall be that indicated by the standard drawings or as shown on the plans.

3.3 ASPHALTIC CONCRETE BINDER

- A. Apply a bituminous prime coat of emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, at a rate of 0.38 to 0.42 gallon per square yard. Take care to prevent the bituminous material from splashing on exposed faces of curbs and gutters, walls, walks, trees, etc. if such splashing does occur, remove it immediately. After the prime coat has been properly cured, apply an asphaltic concrete binder to the thickness shown on the City of Spring Hill's approved roadway section drawings.
- B. Carefully place the material to avoid segregation of the mix. Broadcasting of the material will not be permitted. Remove any lumps that do not readily break down.

3.5 ASPHALTIC CONCRETE SURFACE

- A. If the asphaltic concrete surface course is to be placed directly on the mineral aggregate base, place a bituminous prime coat as described above. If, however, the surface course is to be placed on a binder course, then apply a bituminous tack coat of the sort specified above under products at a rate of 0.05 to 0.10 gallon per square yard. Take care to prevent the bituminous material's splashing on exposed faces of curbs, gutters, walls, walks, trees, etc.; if such splashing does occur, remove it immediately. After the prime or tack coat has been properly cured, apply the asphaltic concrete to the thickness shown of the drawings or standard drawings. Apply the surface course as described above for the binder course.

3.7 SMOOTHNESS

- A. The finished surfaces shall conform to the lines and grades that existed prior to construction. No deviations, variations, or irregularities exceeding 1/4 inch in any direction when tested with a 12 foot straightedge will be permitted in the finished work, nor will any depressions that will not drain. Correct all such defects.

3.8 SAMPLING AND TESTING

- A. Submit to the A/E test reports made by an independent testing laboratory on the crushed stone aggregate, bituminous materials, and asphaltic concrete design mixes, and obtain his approval of these reports before starting paving operations.

- B. Tests shall be made of the completed elements of the pavement to ascertain the compacted thickness of the base and surface courses. If sections with deficient thicknesses are found, the full section for a reasonable distance on each side of the deficiency shall be refused. Remove and reinstall all such sections. Patch all test holes in connection with thickness tests.

- C. When making surface tests, furnish one man to mark all surface defects for corrections.

END OF SECTION

SECTION 02600

MANHOLES

PART 1. GENERAL

1.1 Manholes shall be precast or monolithic concrete that conform to ASTM C478 with concentric cones unless otherwise approved by the A/E. All manholes shall contain Xypex add mixture to be batch mixed with the concrete prior to casting of the manhole.

1.2 Refer to other sections for items affecting manholes. Coordinate this work with that specified by other sections for timely execution.

1.3 Shop drawings are required for castings, plastic gaskets, and precast manholes specified in this section.

PART 2. PRODUCTS

2.1 CONCRETE MASONRY: reinforced or plain, meeting the applicable requirements of Section 03303, Concrete for Utility Lines.

2.2 CASTING ADJUSTMENT: Only concrete grade rings will be allowed to adjust the casting elevation.

2.3 MORTAR: composed of one (1) part portland cement and two (2) parts sand (volumetric measure) thoroughly mixed in a tight box, with water added gradually and mixed continually until mortar has attained the proper consistency for use in brick masonry; prepared only in such quantities as needed for immediate use; mortar mixed for more than 30 minutes, retempered, or previously set will not be allowed.

2.4 GRAY IRON CASTINGS: cast iron conforming to the requirements of Class 30, ASTM A48; made accurately to the required dimensions; sound, smooth, clean, and free from blisters and other defects; not plugged or otherwise treated to remedy defects; machined so that covers rest securely in the frames with no rocking and are in contact with frame flanges for the entire perimeter of the contact surfaces; thoroughly cleaned subsequent to machining and, before rusting begins, painted with a bituminous coating so as to present a smooth finish; tough and tenacious when cold, but not tacky and with no tendency to scale;

and with the actual weight in pounds stenciled or printed by the manufacturer on each casting in white paint.

2.5 PLASTIC GASKET FOR PRECAST MANHOLES: Preformed plastic gasket shall meet or exceed all requirements of FS SS-S-00210, "Sealing Compound, Preformed Plastic for Pipe Joints," Type I, rope form. The sealing compound shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler and shall contain no solvents, irritating fumes, or obnoxious odors. The compound shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength. It shall be supplied in extruded rope form of suitable cross section and in such sizes as to seal the joint space when the pipes are laid. Use two (2) complete ropes at each joint. The sealing compound shall be protected by a suitable removable two (2) piece wrapper, which shall be designed so that half may be removed longitudinally without disturbing the other half in order to facilitate application of the sealing compound. The flexible plastic gasket shall also meet the requirements of the following table:

<u>Composition</u>	<u>Test Method</u>	<u>Minimum</u>	<u>Maximum</u>
Bitumen (Petroleum Plastic Content)	ASTM D4	50	70
Ash Inert Mineral Matter	AASHO T111	30	50
Volatile Matter	ASTM D6		2.0

<u>Property</u>	<u>Test Method</u>	<u>Minimum</u>	<u>Maximum</u>
Specific Gravity at 77° F	ASTM D71	1. 20	1. 30
Ductility at 77° F (cm)	ASTM 0113	5.0	
Softening Point	ASTM 036	3200 F	
Penetration at 77o F (150 gms) 5 sec.	ASTM 0217	50	120

2.6 MANHOLE INSERTS: Manhole inserts also known as inflow and infiltration preventers shall be made of ultra-high-density polyethylene copolymer material that meets ASTM specifications

designation D 1248, Class A, Category 5, Type 111 with a minimum impact brittleness temperature of -180-degree F. The thickness shall be uniform 1/8" or greater. This material is corrosion proof from all gasses associated with wastewater collection systems. Manhole inserts shall be installed in all manhole casting in paved areas.

2.7 LADDER BARS: an aluminum alloy weighing 2.2 pounds or 1/2- inch steel reinforced rod encapsulated in polypropylene plastic. Distance from Top Casting to 1st step shall not exceed 24 inches.

2.8 MATERIAL TESTING: All precast reinforced concrete manhole risers and tops specified herein shall be tested and inspected by a commercial testing laboratory approved by the A/E prior to delivery to the site, and all materials that fail to conform to these specifications shall be rejected. After delivery to the site, any materials that have been damaged in transit or are otherwise unsuitable for use in the work shall be rejected and removed from the site. Supply certified copies in duplicate of the inspection and acceptance reports of the testing laboratory to the A/E before using the materials. The commercial testing laboratory shall be engaged and paid for by the Contractor. Submit a certificate from the manufacturer of the castings indicating that they meet all applicable requirements of these specifications.

2.9 Manhole joints shall be sealed using butyl sealants and exterior wraps. Joint sealants shall be Bidco C-56R and exterior wraps shall be Press-Seal "EZ-WraP" or approved equals.

PART 3. EXECUTION

3.1 Dewater sufficiently to maintain the ground water level at or below the bottom of the manhole foundation prior to and during placement of the foundation. All manhole installations require the subgrade soil to be compacted to a minimum of 98% standard proctor density and a minimum of 24" of TOOT #57 compacted base stone.

3.2 Obtain an adequate foundation for all manhole structures by removing and replacing unsuitable material with well graded granular material, by tightening with coarse rock, or by such other means as provided for foundation preparation of the connected sewers or as directed by the A/E.

3.3 Thoroughly wet and then completely fill all lift holes and joints, inside and outside, with non-shrink grout to ensure watertightness.

3.4 Construct monolithic concrete manholes and bases of 4,000 psi concrete in accordance with the provisions of this section and applicable provisions of Section 03303, Concrete for Utility Lines. The ladder bars shall be cast in place.

3.5 Carefully set the cast iron frame for the cover at the required elevation, and properly bond it to the masonry with cement grout and mastic seal. The required elevation is defined as the top of casting elevation on the approved construction plans. Whenever manholes are constructed in paved areas, tilt the top surface of the frame and cover so as to conform to the exact slope, crown, and grade of the existing adjacent pavement.

3.6 Manhole inverts shall be constructed of concrete or Portland cement mortared masonry fill and may, at the Contractor's option, be covered with cement mortar to the approximate cross section of the sewers connected to them. Make any necessary changes in cross sections gradually from side to side of the manhole; make changes in direction of flow of the sewers to a true curve of as large a radius as is permitted by the size of the manhole. The angle between the influent and effluent pipe inverts shall not be less than 90-degrees.

3.7 All rigid unreinforced pipe entering or leaving the manhole shall be provided with flexible joints within 12 inches of the manhole structure or encase the full joint in concrete. Place such pipe on firmly compacted bedding, particularly in the area of the manhole excavation, which is normally deeper than excavation for sewer trenches. Take special care to see that the openings through which pipes enter the structures are completely and firmly rammed full of shrink proof mortar or otherwise constructed to ensure watertightness.

3.8 A flexible pipe to manhole connector shall be used to provide a watertight joint between the gravity sewer line and manhole. This connector shall be Kor-N-Seal I Connector or an approved equal.

3.9 Where the difference in the invert elevation of two or more lines intersecting in one manhole is 24 inches or more, construct a drop manhole. Drop manholes shall be similar in construction to standard manholes except that a drop connection of pipe and fittings of the proper sizes and materials shall be constructed outside the manhole and supported by 3,000 psi concrete as indicated by the standard drawings.

3.10 Place backfill by hand around the manhole and to a distance of

at least one (1) pipe length into each trench, and tamp with selected material up to an elevation of 12 inches above the crown of all entering pipes. Continue backfilling in accordance with the requirements for trench backfilling.

3.11 Each manhole shall be vacuum tested immediately after installation or rehabilitation and prior to backfilling. No standing water shall be allowed in the manhole excavation which may affect the accuracy of the test. All lifting holes and exterior joints shall be filled and pointed with an approved non-shrink mortar. All pipes and other openings into the manhole shall be suitably plugged in such a manner as to prevent is placement of the plugs while the vacuum is drawn. Installation and operation of the vacuum equipment and indicating devices shall be in accordance with equipment specification and instructions provided by the manufacturer. A vacuum of 10 inches shall be drawn. The time for the vacuum to drop to 9.0 inches for one minute shall be recorded. Acceptance for four (4) feet diameter manholes shall be defined as when the time to drop one (1) inch meets 60 seconds. For manholes five (5) feet in diameter, add an additional 15 seconds. For manholes six (6) feet in diameter, add an additional 30 seconds. If the manhole fails the test, necessary repairs shall be made and the vacuum test repeated until the manhole passes the test. If the manhole joint mastic on gasket is displaced during the vacuum test, the manhole shall be disassembled, the seal replaced, and the manhole re-tested.

END OF SECTION

SECTION 02722

SANITARY SEWERS (GRAVITY)

PART 1. GENERAL

1.1 Pipe material for sewer lines 18 inches and smaller shall be SDR 26 PVC. Class 350 Ductile Iron Pipe shall be used at a depth greater than 20-feet and within fill materials. All piping must meet the stone bedding, encapsulation and deflection requirements of ASTM for the pipe material, size, backfill material and soil conditions.

1.2 Pipe material for sewer lines 21 inches and larger shall be SDR 26 PVC (or equivalent ASTM 679 PS 115). Class 350 Ductile Iron Pipe shall be used at depths greater than 20-feet and within fill materials. All piping must meet the stone bedding, encapsulation and deflection requirements of ASTM for the pipe material, size, backfill material and soil conditions.

1.3 Shop drawings are required for all products specified in this section.

1.4 Refer to other sections for items affecting gravity sewers. Coordinate this work with that specified by others sections for timely execution.

PART 2. PRODUCTS

2.1 PIPE

(1) Polyvinyl Chloride (PVC): to meet and/or exceed the requirements of ASTM 03034, SDR 26; suitable for use as a gravity sewer conduit with provisions for contraction and expansion at each joint; with a rubber ring and standard length 12.5 feet plus or minus one (1) inch; designed to pass all tests at 73 degrees F (plus or minus 3 degrees F); six (6) inches long sections of pipe to be subjected to impact from a free falling type (20 pounds, Type A) in accordance with ASTM 02444 with no evident splitting or shattering (denting not considered a failure); and with a minimum envelope of six (6) inches of granular material around the pipe, but with all other bedding and backfilling requirements remaining the same as for other pipe material.

- B. Ductile Iron: with push-on joints conforming to ASTM A746, minimum Class 350 thickness unless. All ductile iron pipe shall be Protecto 401 ceramic epoxy lined.
- C. Lateral Branches: to be tees of the same material as the main sewer and have a four (4) inch inside diameter for residential and six (6) inch diameter for commercial unless otherwise specified or noted; able to withstand all test pressures involved without leakage.

2.2 JOINTS AND JOINTING MATERIALS

- A. All rubber end rings shall be extruded or molded and cured such that any cross section will be dense, homogenous and free of parasites, blisters, pitting, and other imperfections. The basic rubber material, EPDM, shall meet ASTM C443 with the exception of 40-60 duro hardness. The resilient interlocked end seals shall be duro A-40-70, plus or minus 2.
- B. Polyvinyl Chloride (PVC) Pipe Joints: Joints for sewer plastic pipe shall meet all requirements of ASTM 03212 standard specifications. Joint design shall be tested and certified to result in no leakage under prescribed laboratory test conditions of joint alignment, load conditions, pressure and vacuum, and deflection. Pipe and fittings shall have integral bell with elastomeric seal joint.
- C. Ductile Iron Pipe Joints: gasket type joints for bell and spigot ductile iron pipe designed to meet the infiltration requirements of these specifications; jointing to comply with ANSI A2111.

2.3 COMPRESSION COUPLINGS

- A. When dissimilar pipe materials like PVC are joined, use compression couplings that are resistant to the corrosive action of soils and sewage and that will provide a permanent watertight joint. The compression couplings shall be of natural or synthetic rubber or

rubber-like material and shall comply with the requirements and test methods specified in Table 2 of ASTM C425. The coupling shall meet the leak requirements specified in ASTM C425, and the bands for attaching the couplings to the dissimilar pipes shall be of stainless steel meeting ASTM A167 or A240. Each coupling shall bear the manufacturer's identifying mark and an indication of its size.

PART 3. EXECUTION

3.1 PIPE LAYING

- A. Lay no pipe except in the presence of an inspector representing the City.
- B. Before placing sewer pipe in position in the trench, carefully prepare the bottom and sides of the trench, and install any necessary bracing and sheeting as provided in Section 02221, Unclassified Excavation for Utilities.
- C. Wherever necessary to provide satisfactory bearing surface, place concrete cradles as shown on the drawings or as directed by the A/E. Cradles shall be of concrete and conform to the dimensions shown on the drawings. Concrete placed outside the dimensions shown shall be at the Contractor's expense.
- D. Install piping utilizing a laser set at the correct design slope. Set reference points for both line and grade at each manhole. Where grades are 0.6% or less, check the elevation of the beam each 100 feet with an offset point or engineer's level.
- F. Do not allow water to run or stand in the trench while pipe laying is in progress or before the trench has been backfilled. Do not at any time open up more trench than the available pumping facilities are able to dewater.

- G. Correct trench bottoms found to be unsuitable for foundations after pipe laying operations have started, bringing them to exact line and grade with compacted stone as necessary and as approved by the City of Spring Hill's Sewer Director and A/E.
- H. Carefully inspect each piece of pipe and special fitting before it is placed and lay no defective pipe in the trench. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the bells upgrade. When pipe laying is not in progress, keep the ends of the pipe tightly closed with an approved temporary plug.
- I. Bell holes shall be large enough to allow ample room for the pipe joints to be properly made. Cut out bell holes no more than two (2) joints ahead of the pipe laying. Carefully grade the bottom of the trench between bell holes so that each pipe barrel rests on a solid foundation for its entire length. Lay each pipe joint so as to form a close concentric joint with adjoining pipe and to avoid sudden offsets or inequalities in the flow line.
- J. Before constructing or placing any joints, demonstrate to the A/E, by completing at least one sample joint, that the methods to be used conform to the specifications and will provide a watertight joint and further that the workmen to be involved in this phase of work are thoroughly familiar and experienced with the type of joint proposed.
- K. No other type of joint may be used unless authorized in writing by the A/E.
- L. Install tee branches in sewer lines to serve properly each lot facing or abutting on the street or alley in which sewer is being laid and at such other locations as may be designated by the A/E. Serve lots from the street wherever possible and locate stub-out near center of lot front or side. If tee branches are not to be used immediately, close them with approved stoppers that are held in place to prevent infiltration and withstand all test requirements. All service line end caps shall be marked by a green metal fence post as to allow the builder to determine the exact location of the service lateral.

- M. For all tees that are plugged and laid in rock, blast a minimum of six (6) linear feet of ditch line in the direction and to the approximate grade of the future lateral as directed by the A/E, but do not excavate the material. This shall be done at no extra cost to the Owner. Furnish the A/E with a record of the exact location of each tee installed.
- N. If the work consists of constructing a new sewer to replace an existing one, connect existing service lines to the new line.
- O. New service laterals shall conform to the standard drawings.
- P. The Contractor shall provide an above-ground green metal fence post marker at the property line to indicate the termination of new service laterals.
- Q. As the work progresses, thoroughly clean the interior of the pipe in place. After each line of pipe has been laid, carefully inspect it, and remove all earth, trash, rags, and other foreign matter from its interior.
- R. After the joints have been completed, they shall be inspected, tested, and accepted by the A/E before being covered. The pipe shall meet the test requirements for watertightness; immediately repair any leak or defect discovered at any time after completion of the work. Any pipe that has been disturbed after joints were formed shall be taken up, the joints cleaned and remade, and the pipe relayed at the Contractor's expense. Carefully protect all pipe in place from damage until backfilling operations are completed.
- S. Do not begin the backfilling of trenches until the pipe in place has been inspected and approved by the A/E.
- T. Lay sewers at least ten (10) feet horizontally from any existing or proposed water main. If this is not practical, the sewer may be laid closer than ten (10) feet to a water, main provided it is laid in a separate trench and the elevation of the top of the sewer is at least 18 inches below the bottom of the water main.
- U. Where a sewer crosses under water mains, the top of the

sewer shall be at least 18 inches below the bottom of the water main. If the elevation of the sewer cannot be varied to meet the above requirements, relocate the water main to provide this separation, or else reconstruct it with mechanical joint ductile iron pipe for a distance of ten (10) feet on each side of the sewer with a full joint of the water main centered over the sewer.

- V. If it is impossible to obtain proper horizontal and vertical separation as stipulated above, construct both the water main and the sewer of mechanical joint ductile iron pipe, and pressure test each.
- W. Perform boring by means of auguring to the size, line, and grade shown on the drawings. Jack the steel casing pipe into place as the boring proceeds. Weld sections of casing pipe together to provide a watertight joint.
- X. Make connections to all existing sewer lines as shown in the standard details.
- Y. Make connections to existing manholes or inlets by methods of machine coring and installation of a Kor-N- Seal boot connector. After the boot connector has been properly installed in the existing structure, insert a length of sewer pipe into the boot connector and tighten the band strap of the boot connector. Fill around the void area between the pipe and existing structure located on the inside of the existing structure with non-shrink grout to a neat finish. Shape or reshape the existing inverts or bottom of the manhole/structure as necessary to fit the invert of the sewer pipe and allow unobstructed flow through the existing structure.
- Z. Joint dissimilar pipe by using suitable compression couplings. If compression couplings are not available, make jointing with a special fabricated coupling approved by the A/E.
- AA. Provide concrete protection or concrete cap as shown on the drawings for pipe sewers that, when completed, have less than 2.5 feet of covering in non-traffic areas and four (4) feet of cover in traffic areas. If such protection is not shown on the drawings, place it in accordance with the typical section shown.
- BB. Carefully protect from damage all existing sewers, water

lines, gas lines, sidewalks, curbs, gutters, pavements, electrical lines, and other utilities or structures in the vicinity of the work at all times. If it is necessary to repair, remove, and/or replace any such utility or structure in order to complete the work properly, do so in compliance with the provisions set forth in other section of these specifications. Any such work shall be considered incidental to the construction of pipe sewers, and no additional payment will be allowed therefore.

- CC. Water service connections will be repaired or replaced by the Contractor at his expense as an incidental part of the work.
- DD. Service or house connections to existing sewers that are damaged or removed shall be repaired or replaced by the Contractor at his own expense as an incidental part of the work.
- EE. For PVC and ductile iron pipe, furnish a certificate from the pipe manufacturer indicating that the pipe meets all applicable requirements of these specifications.
- FF. All piping must meet the stone bedding, encapsulation and deflection requirements of ASTM for the pipe material, size, backfill material and soil conditions. The minimum pipe stiffness for PVC pipe at 5% deflection shall be 46 for all sizes when tested in accordance with ASTM D2412; external loading properties of plastic pipe shall be by parallel plate loading.
- GG. A specimen of PVC pipe six (6) inches long shall be flattened between parallel plates in a suitable press until the distance between the plates is 40% of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is complete in two (2) to five (5) minutes.
- HH. After being immersed for two (2) hours in a sealed container of anhydrous acetone (99.5% pure), a sample ring of PVC pipe shall show no visible spalling or cracking when tested in accordance with ASTM D2152 (swelling or softening is not considered a failure).
- II. The Contractor shall provide a concrete check dam in the trench for the gravity sewer lines. The check dam shall be constructed in accordance with the detail included in the

Standard Drawings. The check dam shall be provided for all gravity sewer lines. The maximum spacing of the walls shall be 400 feet. The check dam shall be installed at a distance of one pipe length upstream of each manhole and on each creek bank, swale etc. as to prevent ground water from traveling along the trench and to prevent surface water from entering the trench at creek crossings.

3.2 TESTING OF GRAVITY SEWERS

A. Visual Tests

1. Upon completion of the construction or earlier if the A/E deems advisable, the A/E will make a visual inspection of the sewer and construction site. Immediately repair all leaks and defects found by such inspection.
2. In addition to general cleanup and leakage, the following standards shall be used to determine failure or defects of this project. Where in roadways, all testing shall be completed after proof rolls and prior to any paving.
3. Sewers shall be built so as to remain true to line and grade. The inclining grade of the bottom of the sewer after completion shall be such that, after flooding, the flood water drains off so that no remaining puddle of water is deeper than 1/2 inch on pipe 36 inches internal diameter or smaller and 3/4 inch on pipe larger than 36 inches internal diameter. Any section of pipe that does not comply with the specifications at any time previous to final acceptance of the work shall be replaced or relayed at the Contractor's expense.
4. The Contractor will be held strictly responsible that all parts of the work bear the load of the backfill. If cracks 1/100 inch develop in the pipe within one (1) year from the date of final acceptance of the work, the Contractor will be required to replace, at his expense, all such cracked pipe. To this end, the Contractor is advised to purchase pipe under a guarantee from the manufacturer, guaranteeing proper service of sewer pipe under conditions established by the drawings, specifications, and local conditioning at the site

of the work.

B. Air Testing for Sewers 24 Inches and Smaller

1. Perform low pressure air testing as follows:
 - a. Furnish all equipment, facilities, and personnel necessary to conduct the test. The test shall be observed by a representative of the A/E.
 - b. Perform the air test after all services and utilities have been installed and backfilling has been completed and compacted. If other utilities i.e.: water, gas, electric, storm, etc. are installed after sewer testing, the lines shall be re-tested to ensure integrity.
 - c. Perform the first series of air tests after 2,000 linear feet but before 4,000 linear feet of sewer has been laid. The purpose of this first series of tests is to assure both the Contractor and the A/E that the materials and methods of installation meet the intent of these specifications. Conduct the remainder of the tests after approximately each 10,000 linear feet has been laid.
 - d. Plug all tees and ends of sewer services with flexible joint plugs or caps securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.
 - e. Prior to testing, check the pipe to see that it is clean. If not, clean it by passing a full-gauge squeegee through the pipe. It shall be the Contractor's responsibility to have the pipe cleaned.
 - f. Immediately following this check or cleaning, test the pipe installation with low pressure air. Supply the air slowly to the plugged pipe installation until the internal air pressure reaches 4.0 psi more than the average back pressure of any ground water that may submerge the pipe. Allow at least two (2) minutes for temperature stabilization.

- g. The pipeline shall be considered acceptable when tested at an average pressure of 3.0 psi more than the average back pressure of any ground water that may submerge the pipe, if the section under test does not lose air at a rate greater than 0.0015 cfm per square foot of internal pipe surface area. Air pressure drop from a stabilized pressure of 4 to 3 psi for one minute more than the average back pressure of any ground water that may submerge the pipe.
- h. The requirements of this specification shall be considered satisfied if the time required in seconds for the pressure to decrease from 4.0 to 3.0 psi more than the average back pressure of any ground water that may submerge the pipe is not less than that shown in the following table:

ALLOWABLE AIR LOSS VALUES PER 100 LF

<u>Pipe Size</u>	Time (Seconds)
6 inches	42
8 inches	60
10 inches	60
12 inches	60
15 inches	60
18 inches	60
21 inches	60
>24 inches	60

- i. If the pipe installation fails to meet these requirements, the Contractor shall determine at his own expense the source or sources of leakage and repair or replace all defective materials or workmanship.

The completed pipe installation shall meet the requirements of this test before being considered acceptable.

- 2. The recommended procedures for conducting acceptance tests are as follows:

- a. Clean pipe that is to be tested.
- b. Plug all pipe outlets with suitable test plugs,

and brace each plug securely.

- c. Increase gauge pressure in the test by the amount of ground water pressure at the crown of the pipe.
 - d. Add air slowly to the portion of the pipe installation being tested until the internal air pressure is raised to 4.0 psi more than the average back pressure above the crown of the pipe.
 - e. After the above internal pressure is obtained, allow at least two (2) minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
 - f. After two (2) minutes, disconnect the air supply.
 - g. When pressure decreases to 4.0 psig either by leaking down or by bleeding down with a release valve, start the stopwatch, and determine the time in seconds that is required for the internal air pressure to reach 3.0 psig. Compare this time interval as calculated above. If the time is more than that calculated, the test shall be assumed to be acceptable.
3. Plugs used to close the sewer pipe for the air test must be securely braced to prevent the unintentional release of a plug, which can become a high velocity projectile. Locate gauges, air piping manifolds, and valves at the top of the ground. No one shall be permitted to enter a manhole where a plugged pipe is under pressure. Four pounds air pressure (gauge) develops a force against the plug in a 12-inch pipe of approximately 450 pounds. Pipes more than 30 inches in diameter shall not be air tested because of the difficulty of adequately blocking the plugs. Provide a safety release device set to release at ten (10) psi between the air supply and the sewer under test.
 4. Regardless of the outcome of the tests, repair any noticeable leak.
- C. Testing for Sewers Larger than 24 Inches
1. Using Existing High Ground Water
 - a. Where the natural ground water is 24 inches or more above the top of a section of pipe, measure the flow of water in the pipe and the rates of seepage and

infiltration. Measure the flow rate by using a calibrated weir. Leave the weir in the line until the flow rate has stabilized. The Contractor is responsible for verifying the ground water level by providing sight gauges in manholes or digging test holes at suitable locations.

- b. The total seepage and infiltration of ground water as determined by the test shall in no case exceed 25 gallons per 24 hours per inch- mile of pipe. Make infiltration tests on all sewer construction before placing the lines in service and before making any connections to other sewers. If the amount of infiltration into the sewer(s) is in excess of the maximum quantity specified above, then re-caulk or remake the joints, relay the sewer (if necessary), or perform other remedial construction, at the Contractor's expense, in order to reduce ground water infiltration to within the specified limits.
- c. In making infiltration tests, furnish the required equipment and labor and do the necessary pumping under the direction of the A/E. Test must be repeated until each sewer individually meets the specification for infiltration amounts as set out above.

2. Exfiltration Test

- a. Where the ground water is not 24 inches or more above the top of the pipe section being tested then perform an exfiltration test. Bulkhead the pipe below the lower manhole of the section being tested with a pneumatic plug or others device. Insert a vent pipe 48 inches long in the stopper of the upper end of that section. Then fill the lower manhole with water or add water until there is a minimum of four (4) feet over the upper end; make certain that all air is forced out through the vent tube. Measure the drop in the level of the water in the manhole due to exfiltration over a specific time, and calculate the water loss due to exfiltration. The total exfiltration shall not exceed that specified above for infiltration. Conditions encountered in construction may vary this procedure slightly, but essentially this is the method to be used.

3. Repairs

- a. Regardless of the outcome of any tests, repair any noticeable leak.

3.3 VISUAL INSPECTION OF MISCELLANEOUS MATERIALS

- A. All material used on this project will be visually inspected by the A/E at the site for conformance to the required specifications. When reasonable doubt exists that said material meets the specifications, the A/E may require certified mill tests, samples, and/or tests by an independent laboratory or other suitable form of verification that the material meets the required specifications.

3.4 DEFLECTION TESTING FOR PVC PIPE

- A. Test deflection of the pipe by passing a 9-arm pin go/no-go mandrel sized to 95% of the pipe diameter of

the actual pipe used with the pipe in place and covered. Make this acceptance test after backfill consolidation has occurred and prior to any paving.

3.5 CLEANUP

- A. After completing each section of the sewer line, remove all debris, construction materials, and equipment from the site of the work, grade and smooth over the surface on both sides of the line, and leave the entire area in a clean, neat, and serviceable condition.

3.6 VIDEO INSPECTION

- A. New gravity sewer lines and service laterals shall be required to be inspected using CCTV video inspection equipment. The City of Spring Hill will require the contractor to perform this type of inspection to determine if debris or defects exist within the sewer line. The sewer lines shall be cleaned prior to any recording. This video inspection shall be performed after all utilities have been installed, and before any roadways paving or issuance of building permits. This inspection shall serve to verify that sewer lines, manholes and service laterals are clean and free of debris and defects. If any possible leaky areas and/or sagging that is over 5% are discovered, the section of the sewer

line in question shall be repaired or replaced as directed by the City. Any defects discovered during the video inspection shall be corrected in accordance with these standard specifications at the cost of the developer and/or his contractor. After the repairs or replacement, the section shall be CCTV inspected and re-submitted for review. All CCTV inspections shall be provided to the City by way of CD and/or USB memory drive.

END OF SECTION

SECTION 02724

SEWAGE FORCE MAIN

Part 1. General

1.1 Furnish all material, equipment, tools, and labor in connection with the sewage force main, complete and in accordance with the drawings and these specifications.

1.2 It shall be the Contractor's responsibility to ensure that all necessary materials are furnished to him and that those found to be defective in manufacture are replaced at no extra cost to the Owner. Materials damaged in handling after being delivered by the manufacturer shall be replaced at the Contractor's own expense. If installed material is found to be defective before the final acceptance of the work, the cost of both the material and labor needed to replace it shall not be passed on to the Owner.

1.3 The Contractor shall be responsible for safely storing materials needed for the work that have been accepted by him until they have been incorporated into the completed project. Keep the interiors of all pipes, fittings, and other accessories free from dirt and foreign matter at all times.

1.4 Refer to other sections for work related to that specified by this section. Coordinate this work with that required by other sections for timely execution.

1.5 Minimum force main size shall be four (4) inches in diameter.

PART 2. PRODUCTS

2.1 Ductile Iron Pipe and Fittings

2.1.1 Ductile iron pipe shall be made of good quality ductile cast iron that meets the requirements of ASTM E8-61T. The pipe shall be centrifugally cast in metal or sand-lined molds. It shall be made and tested in accordance with ASTM A536 and be subjected to and able to withstand a hydrostatic pressure of 500 psi.

2.1.2 The pipe shall be plain end ductile iron pipe with a push-on single gasket joint and shall conform to ANSI A21.51/AWWA C151. The design thickness shall be Class 250 for pipe as defined by ASTM A21.50/AWWA C150.

2.1.3 The length of each individual piece of ductile iron pipe shipped must be plainly marked on that piece of pipe.

2.1.4 The push-on single gasket joints shall be UL approved and able to withstand an operating pressure of 200 psi.

2.1.5 The bell of each pipe shall have a tapered annular opening and a cast or machined retaining groove for the gasket. The gasket groove shall have a flared design so that maximum deflection will be provided. The plain spigot end of the pipe shall be beveled in order to simplify its entry into and centering within the bell and the compression of the gasket.

2.1.6 The gasket shall be of high-quality vulcanized rubber made in the form of a solid ring to exact dimensions. The design of the gasket groove in the bell of the pipe and the design, hardness, and other properties of the gasket itself shall be such that the joint is liquid tight for all pressures from a vacuum to the maximum internal liquid pressure of 350 psi.

2.1.7 Enough lubricant shall be furnished with each order to provide a thin coat on the spigot end of each pipe. This lubricant shall be nontoxic, impart no taste or smell, and have no harmful effect on the rubber gasket. It shall have a consistency that will allow it to be easily applied to the pipe in either hot or cold weather and that will enable it to adhere to either wet or dry pipe.

2.1.8 Standard and special fittings shall be ductile iron. Use standard mechanical joint fittings unless otherwise shown on the drawings. All fittings shall conform to ANSI A21.10/AWWA C110.

2.1.9 Pipe and pipe fittings shall have cement linings as specified in ANSI A21.4/AWWA C104. In addition, a bituminous seal coat or asphalt emulsion spray coat approximately 1 mil thick shall be applied to the cement lining in accordance with the pipe manufacturer's standard practices.

2.2 PVC Pipe

2.2.1 All plastic pipe shall be made from Class 12454-B polyvinyl chloride plastic (PVC 1120) as defined by ASTM D1784.

2.2.2 All Class 200 pipe shall have NSF approval and be manufactured in accordance with ASTM D2241. The following tests shall be run for each machine on each size and type of pipe being produced, as

specified below:

2.2.2.1 Flattening Test: once per shift in accordance with ASTM D2412. Upon completion of the test, the specimen shall not be split, cracked, or broken.

2.2.2.2 Acetone Test (Extrusion Quality Test): once per shift in accordance with ASTM D2152. There shall be no flaking, peeling, cracking, or visible deterioration on the inside or outside surface after completion of the tests.

2.2.2.3 Quick Burst Test: once per 24 hours in accordance with ASTM 5199.

<u>SDR</u>	<u>Pressure Rating</u>	<u>Minimum Bursting Pressure (psi)</u>
13.5	315	1,200
17	250	1,000
21	200	800

2.2.2.4 Impact Tests: for 6" and larger, once per shift in accordance with ASTM D2444; for 4" and smaller, once each 2 hours in accordance with ASTM D2444.

2.2.2.5 Wall Thickness and Outside Dimensions Tests: once per hour in accordance with ASTM D2122.

2.2.2.6 Bell Dimensions Test: once per hour in accordance with ASTM D3139.

2.2.3 If any specimen fails to meet any of the above-mentioned tests, all pipe of that size and type manufactured between the test periods must be scrapped and a full set of tests rerun.

2.2.4 Furnish a certificate from the pipe manufacturer stating that he is fully competent to manufacture PVC pipe of uniform texture and strength and in full compliance with these specifications and further stating that he has manufactured such pipe and done so in sufficient quantities to be certain that it will meet all normal field conditions. In addition, the manufacturer's equipment and quality control facilities must be adequate to ensure that each extrusion of pipe is uniform in texture, dimensions, and strength. Also furnish a certificate from the manufacturer certifying that the pipe furnished for this project meets the requirements of these specifications.

2.2.5 All pipe shall be manufactured in the United States of

America. All pipe for any one project shall be made by the same manufacturer.

2.2.6 Pipe 8'' and larger shall be furnished in 20 feet lengths. The Contractor's methods of storing and handling the pipe shall be approved by the A/E. All pipe shall be supported within five (5) of each end; in between the end supports, there shall be additional supports at least every 15 feet. The pipe shall be stored away from heat or direct sunlight. The practice of stringing pipes out along the proposed force main routes will not be allowed.

2.2.7 Certain information shall be applied to each piece of pipe. At the least, this shall consist of:

- 2.2.7.1 Nominal size
- 2.2.7.2 Type of material
- 2.2.7.3 SOR or class
- 2.2.7.4 Manufacturer
- 2.2.7.5 NSF Seal of Approval

2.2.8 Pipe that fails to comply with the requirements set forth in these specifications shall be rejected.

2.2.9 The pipe shall have push-on joints designed with grooves in which continuous molded rubber ring gaskets can be placed. Gaskets shall be made of vulcanized natural or synthetic rubber; no reclaimed rubber will be allowed. The gaskets shall be of the manufacturer's standard design dimensions and of such size and shape as to provide a positive seal under all combinations of joint and gasket tolerance. The gasket and annular groove shall be designed and shaped so that when the joint is assembled, the gasket will be radially compressed to the pipe and locked in place against displacement, thus forming a positive seal.

2.2.10 The spigot end of each pipe shall be beveled so that it can be easily inserted into the gasket joint, which in turn shall be designed so that the spigot end may move in the socket as the pipe expands or contracts. The spigot end shall be striped to indicate the distance into which it is to be inserted into the socket. Each joint shall be able to accommodate the thermal expansions and contractions experienced with a temperature shift of at least 75 degrees F.

2.2.11 Enough lubricant shall be furnished with each order to provide a coat on the spigot end of each pipe. This lubricant shall be nontoxic, impart no taste or smell, have no harmful effect on

the gasket or pipe material, and support no bacterial growth. The lubricant containers shall be labeled with the manufacturer's name.

2.2.12 Joints shall be manufactured in accordance with ASTM D3139 except that the thickness of the bell shall be, as a minimum, equal to that of the barrel. Joints shall be either integral bell and ring joints with rubber compression gaskets as manufactured by the Clow Corporation, Johns-Manville, or Vulcan Plastic Corporation; twin gasket couplings as manufactured by the Certain-Teed Products Corporation; or equal. However, the pipe and bell must be made by the same manufacturer.

2.2.13 Standard and special fittings shall be ductile iron. Use standard mechanical joint fittings. All fittings shall conform to the specifications of ANSI A21.10/AWWA C110. The gaskets shall be ducked tipped transition gaskets for use with PVC pipe.

2.2.14 Fittings shall be lined with a thin cement lining as specified in ANSI A21.4/AWWA C104; this lining is to be furnished at no extra cost. In addition, a bituminous seal coat or asphalt emulsion spray coat approximately 1 mil thick shall be applied to the cement lining in accordance with the pipe manufacturer's standard practices.

2.2.15 Fitting laying lengths shall conform to ANSI A21.10/AWWA C110.

2.2.16 Fittings shall be in accordance with the standard mechanical joint fittings manufactured by the U.S. Pipe and Foundry Company, American Cast Iron Pipe Company, Clow Corporation, or equal.

PART 3. EXECUTION

3.1 Installation of Force Main

3.1.1 Lay the force main to and keep it at the lines and grades required by the drawings. All fittings shall be at the required locations, and spigots well centered in the bells. Where the grades are 0.2% or less, either use batter boards or a laser to maintain the required slopes.

3.1.2 Unless otherwise indicated by the drawings, all force mains shall have at least 36 inches of cover in non-paved areas. See Section Force Mains 01010-16. The pipe shall slope continuously between high and low points and have a minimum of 60" cover at the high points. No departure from this policy shall be made except at the order of the A/E, or unless shown otherwise on the drawings.

3.1.3 Provide and use tools and facilities that are satisfactory to the A/E and that will allow the work to be done in a safe and convenient manner. Use a derrick, ropes, or other suitable equipment to lower all pipe and fittings into the trench one piece at a time. Carefully lower each piece so that neither it nor any protective coating or lining it may have will be damaged. Under no circumstances, drop or dump force main materials into the trench.

3.1.4 Lower no pipes and fittings into the trench until they have been swabbed to remove any mud, debris, etc., that may have accumulated within them. After the pipe has been lowered, remove all unnecessary materials from it. Before any pipe is laid, brush and wipe clean the outside of its spigot end and the inside of its bell and ensure that the pipe is dry and oil-free.

3.1.5 Take every precaution to keep foreign material from getting into the pipe while it is being placed in the trench. If the crew laying the pipe cannot put it into the trench and in place without allowing earth to get inside it, then place a heavy, tightly woven canvas bag of suitable size over each end of the pipe and leave it there until it is time to connect that pipe to the one adjacent to it.

3.1.6 Place no debris, tools, clothing, or other materials in the pipe during laying operations.

3.1.7 After a length of pipe has been placed in the trench, center the spigot end in the bell of the adjacent pipe, and then insert to the depth specified by the manufacturer and bring to the correct line and grade. Secure the pipe in place by tamping an approved backfill material around it.

3.1.8 Bell holes shall be big enough so that there is ample room for the pipe joints to be properly made. Between bell holes, carefully grade the bottom of the trench so that each pipe barrel will rest on a solid foundation for its entire length.

3.1.9 Whenever pipe laying is not in progress, close the open ends of pipe in the trench with a watertight plug or by other means approved by the A/E. Caulk the joints of any pipe in the trench that cannot be completed until a later time with packing in order to make them as watertight as possible; this shall be done not only at the end of each working day but also before work is stopped for lunch periods, bad weather, or any other reason. If there is water in a trench, this seal shall remain in place until the trench has been pumped completely dry.

3.1.10 The cutting of pipe so that fittings or closure pieces can be inserted shall be done in a neat and workmanlike manner and without any damage to the pipe. Follow the manufacturer's recommendations concerning how to cut and machine the ends of the pipe in order to leave a smooth end at right angles to the pipe's axis.

3.1.11 The flame cutting of pipe by means of an oxyacetylene torch will not be allowed.

3.1.12 Unless otherwise directed by the A/E, lay pipe with the bell ends facing in the direction of laying.

3.1.13 Wherever pipe must be deflected from a straight line (in either the vertical or horizontal plane) in order to avoid obstructions or plumb stems, or wherever long radius curves are permitted, the amount of deflection shall not exceed that necessary for the joint to be satisfactorily made, nor that recommended by the pipe manufacturer, and shall be approved by the A/E.

3.1.14 Lay no pipe in water or when it is the A/E's opinion that trench conditions are unsuitable. If crushed stone is used to improve trench conditions or as backfill for bedding the pipe, this shall be considered incidental to the project, and no separate payment will be made for its use.

3.1.15 Bedding materials shall be type no. 67 for all materials.

3.1.16 Install thrust blocks wherever the force main changes direction (e.g., at tees and bends), at dead ends, or at any other point where the manufacturer recommends and/or the A/E indicates that they are to be used.

3.1.17 Make all joints, whether standard mechanical or push-on joints, in conformance with the recommendations of the joint manufacturer as approved by the A/E.

3.1.18 For detection purposes, a 14-gage solid strand copper tracing wire (shielded) and an approved metallic tape identified as "sewer" shall be installed as per the manufacturer's instructions. Connections between wires shall be soldered or connected with wire nut fasteners and wrapped.

3.2 Hydrostatic Tests

3.2.1 Pressure Test

3.2.1.1 After pipe has been laid and backfilled as specified above, subject all newly laid pipe or any valve section thereof to a pressure of 200 psi. All connections (if applicable) are to be laid prior to testing the main and tested as part of the test of the main.

3.2.1.2 The duration of each pressure test shall be at least one (1) hour.

3.2.1.3 Slowly fill each valve section of pipe with water and apply 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) with a pump connected to the pipe in a manner satisfactory to the A/E. Furnish the water, pump, pipe, connections, gauges, and all necessary apparatus.

3.2.1.4 Before applying the specified test pressure, expel all air from the pipe. If air/vacuum assemblies are not available at high places, make the necessary taps at the points of highest elevation before testing, and insert plugs after the test has been completed.

3.2.1.5 Carefully examine all exposed pipes, fittings, and valves, during the test. Remove any cracked or defective pipes, fittings, and/or valves, discovered in consequence of this pressure test, and replace with sound material in the manner specified. Repeat the test until the results are satisfactory to the A/E.

3.2.2 Leakage Test

3.2.2.1 Conduct the leakage test after the pressure test has been satisfactorily completed. Furnish the water, pump, pipe, connections, gauges, measuring devices, and all other necessary apparatus as well as all necessary assistance to conduct the test.

3.2.2.2 The duration of each leakage test shall be two (2) hours; during the test, subject the main to a pressure of 150 psi.

3.2.2.3 Leakage is defined as the amount of water which must be supplied to the newly laid pipe or any valve section in order to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

3.2.2.4 No pipe installation will be accepted until the leakage is less than the number of gallons per two (2) hour period listed below:

Pipe Sizes	Gallons per 1,000 Feet of Pipe
2" - 2-1'4"	0.2
3"	0.5
4"	0.6
6"	0.9
8"	1.2
10"	1.5
12"	1.9
14"	2.2
16"	2.6
18"	2.9
20"	3.2
24"	3.8

3.2.2.5 Should any test of pipe laid disclose leakage greater than that specified, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance.

3.3 Cleanup

After completing each section of force main, remove all debris and all construction materials and equipment from the work site. Then grade and smooth over the surface on both sides of the main. The entire area shall be clean and left in a condition satisfactory to the A/E. Seed and mulch as required elsewhere in these specifications.

END OF SECTION

SECTION 02725

BORING AND CASING FOR SANITARY SEWERS

PART 1. GENERAL

1.1 The work to be performed hereunder shall consist of the installation of casing pipe and carrier pipe for water lines as shown on the drawings or as called for in these specifications. For the open cut casing pipes, it shall include the excavation of the trench, placing proper bedding material, furnishing and installing the casing pipe, furnishing and installing the carrier pipe, backfilling, and disposing of the excess excavated materials. For the boring and jacking of casing pipes, it shall include the excavation of a boring pit, auger boring between the point as specified on the drawings, furnishing and installing of the carrier pipe, and disposing of the excavated materials in the manner herein provided.

PART 2. PRODUCTS

2.1 CASING PIPE

- A. The casing pipe shall be of steel meeting the latest approved American Railway Engineering Association "Specifications" for Pipelines for Carrying Flammable and Nonflammable Substances." The steel casing pipe shall have a minimum yield strength of 35,000 PSI and shall have the minimum wall thickness shown in the following table:

TABLE OF MINIMUM WALL THICKNESS FOR STEEL CASING PIPE
FOR E72 LOADING

<u>Carrier Pipe Diameter</u>	<u>Casing Pipe Diameter</u>	<u>Nominal Thickness</u>
4 inches	8 inches	0.250 inches
6 inches	12 inches	0.250 inches
8 inches	16 inches	0.312 inches
10 inches	20 inches	0.312 inches
12 inches	22 inches	0.312 inches
14 inches	24 inches	0.344 inches
16 inches	26 inches	0.375 inches
18 inches	28 inches	0.406 inches

B. When the casing pipe is installed without benefit of a protective coating, the wall thickness shown above shall be increased to the nearest standard size, which is a minimum of 0.063 inches greater than the thickness shown.

2.2 CARRIER PIPE: The carrier pipe shall be either Class 350 Ductile Iron Pipe or Class 200 PVC pipe.

PART 3. EXECUTION

3.1 BORING

A. The boring shall be accomplished by means of auguring to the size, line and grade shown on the drawings.

3.2 INSTALLATION OF CASING PIPE

A. For open cut of casing pipes, install the steel casing pipe into the open cut as the trench excavation proceeds. Weld sections of casing pipe together to provide watertight joints and replace the protective coatings in areas where it is damaged by welding.

B. For boring casing pipes, jack the steel casing pipe into place as the boring proceeds. Weld sections of casing pipe together to provide watertight joints.

C. Do not remove unacceptable casing without prior approval from the A/E. If the removal of casing pipe is permitted, make proper provisions to prevent caving in of the earth surrounding the casing.

3.3 INSTALLATION OF CARRIER PIPE

A. The carrier pipe shall be furnished by the Contractor. Upon acceptance of the casing, install the carrier pipe in the casing by jacking it through the casing. Casing spacers, bell restraints (or locking gaskets for DIP) and end caps are required.

3.4 LAYOUT OF WORK

A. The developer's or contractor's surveyor shall provide the necessary control points required by the Contractor for this construction. The Contractor will provide the

detailed layout required to keep the excavation and pipe installation on grade.

1. GUARANTEE OF WORK

4.1 Guarantee a usable completed casing between the points specified and to the line and grade specified. The allowable tolerance at the downstream end point of the casing shall be such that the invert of the carrier pipe may be positioned within a vertical area limited on the top by an elevation no higher than the elevation shown on the drawings and on the bottom by an elevation no lower than the existing inlet pipe invert.

4.2 The allowable tolerance at the upstream end point of the casing shall be such that the invert of the carrier pipe may be positioned at the elevation shown on the drawings.

END OF SECTION

SECTION 03303

CONCRETE FOR UTILITY LINES

PART 1. GENERAL

1.1 This item shall include furnishing and installing concrete blocking, cradles, anchors, caps, pipe protection, and/or encasement at the locations shown on the drawings and/or directed by Spring Hill's representative. All concrete shall be plant mix. No bagged concrete shall be allowed.

PART 2. PRODUCTS

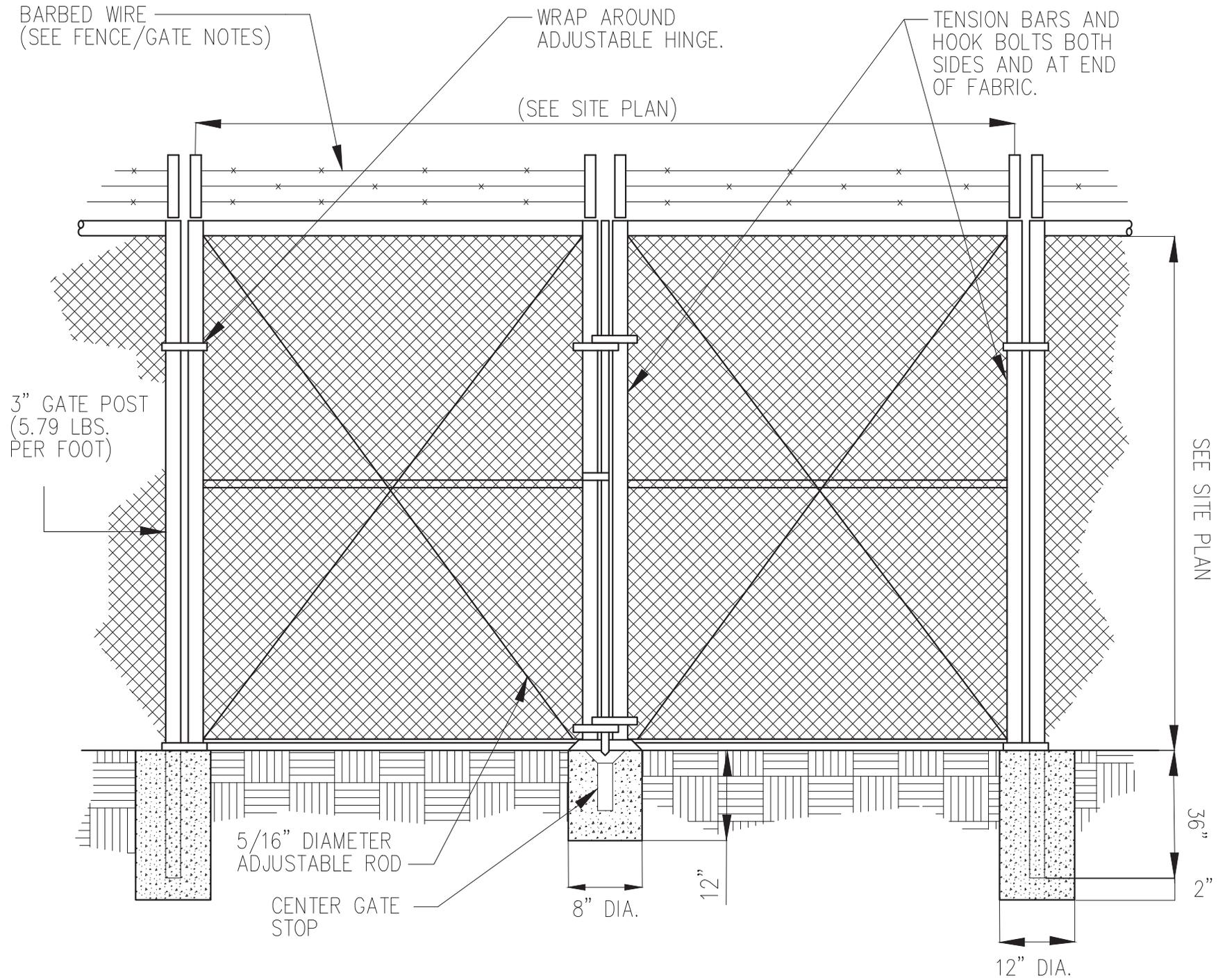
Not used.

PART 3. EXECUTION

3.1 Concrete work shall conform to ACI 301-72 (as revised), as modified by the supplemental requirements below:

- A. Strength
 - 1. The strength of concrete shall be 3,000 psi unless otherwise shown on the drawings.
- B. Durability
 - 1. All concrete exposed to weather shall be air entrained.
- C. Slump
 - 1. Concrete shall be proportional and produced to have a slump of 3 inches with a 1 inch tolerance.
- D. Admixtures
 - 1. Air entrainment, mandatory for concrete exposed to weather, may be used. A water reducing admixture (retarding, normal, or accelerating, depending on placing temperature), may be used if approved by the Spring Hill's representative.
- E. Reinforcing Steel
 - 1. Yield strength of reinforcing steel shall be 60,000 psi.

END OF SECTION

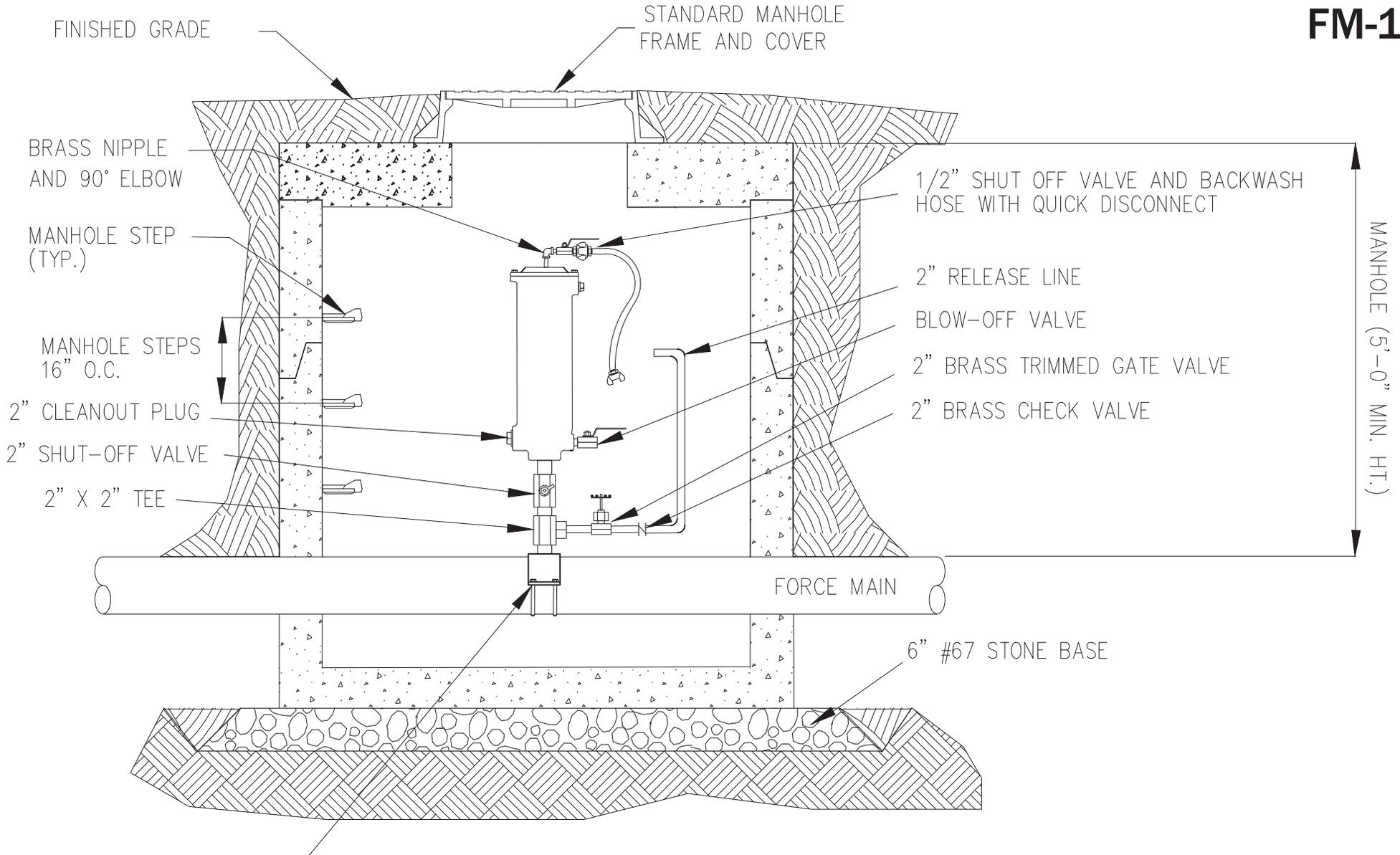


6-FOOT CHAIN-LINK GATE DETAIL (2 OF 3)

NOTES:

1. PROVIDE POSITIVE TYPE LATCHING DEVICE WITH PROVISIONS FOR PADLOCKING, CENTER PLUNGER ROD, CATCH AND SEMI-AUTOMATIC OUTER CATCHES OR HOLD BACKS.
2. FENCE FABRIC: 6'-0" (72"), 9 GA., 2" MESH, KNUCKLED TOP & BOTTOM, BLACK VINYL COATED, ALL COMPONENTS OF THE FENCE SHELL BE BLACK.
3. FENCE FRAME MEMBERS TO BE TYPE II – LG40 STEEL PIPE (ASTM F1043, GROUP 1C):
TERMINAL POSTS (CORNER, END, PULL AND GATE POSTS): 3" O.D. (5.79 LBS. / FT.);
LINE POSTS: 2" O.D. (2.74 LBS. / FT.);
TOP, BOTTOM AND BRACE RAILS: 1 5/8" O.D. (2.27 LBS. / FT.);
JOIN WITH 1 5/8" – 6" LONG SLEEVES;
ALL POSTS SHALL BE HOT DIPPED GALVANIZED WITH MINIMUM 1.8 OZ. / S.F. ZINC COATING.
4. SINGLE AND DOUBLE SWING GATE FRAMEWORK: 1 5/8" O.D. (2.27 LBS. / FT.);
5. FITTINGS:
POST CAPS: STEEL, CAST IRON OR ALUMINUM ALLOY; RAIL ENDS: FORMED STEEL OR IRON;
TIE WIRES: 9 GA., GALVANIZED STEEL OR ALUMINUM; 15" SPACING FOR TERMINAL POSTS AND 24" SPACING FOR TOP AND BRACE RAILS; HOG RINGS: 9 GA.;
FABRIC AND RAIL BANDS: 12 GA. X 3/4" PRESSED STEEL; 15" SPACING;
STRETCHER BAR: 3/16" x 3/4" GALVANIZED STEEL; LINE POSTS – 9 GA TIE WIRES @ 15" O.C.;
TOP RAILS – 9 GA TIE WIRES @ 24" O.C. TENSION WIRE – 6 GA. CORE WIRE (75,000 PSI TENSILE STRENGTH);
TRUSS RODS AND TIGHTENERS: 5/16" ROD; FASTENERS: GALVANIZED;
TWISTED LINE WIRE; 4 POINT BARBS AT 5" CENTERS AND COATED WITH 0.25 OZF ZINC COATING.
6. BARBED WIRE SUPPORT ARMS: SUITABLE FOR 3 STRANDS OF BARBED WIRE; WITHSTAND A 250 LB DOWNWARD PULL.
7. CONCRETE: 3000 PSI PLANT MIX ONLY. BAG CONCRETE SHALL NOT BE ALLOWED.
8. ALL FENCE FABRIC, POST, RAILS AND HARDWARE SHALL RECEIVE A BLACK PVC COATING OF 6 MIL TO 10 MIL PER ASTM F688 CLASS 2B; PER ASTM F1664 CLASS 2A FOR TENSION WIRE AND ASTM F1665 CLASS 2A FOR BARBED WIRE. FASTENERS SHALL BE PAINTED BLACK.

CHAIN-LINK FENCE AND GATE NOTES (3 OF 3)



2" TAP (STANDARD PIPE TAP) OR 2" TAPPED TEE (STANDARD PIPE TAP) TO BE DETERMINED BY WALL THICKNESS FOR PRESSURE PIPE AS RECOMMENDED BY PIPE MANUFACTURER.

FORCE MAIN AIR RELEASE / AIR VACUUM VALVE DETAIL (1 OF 2)

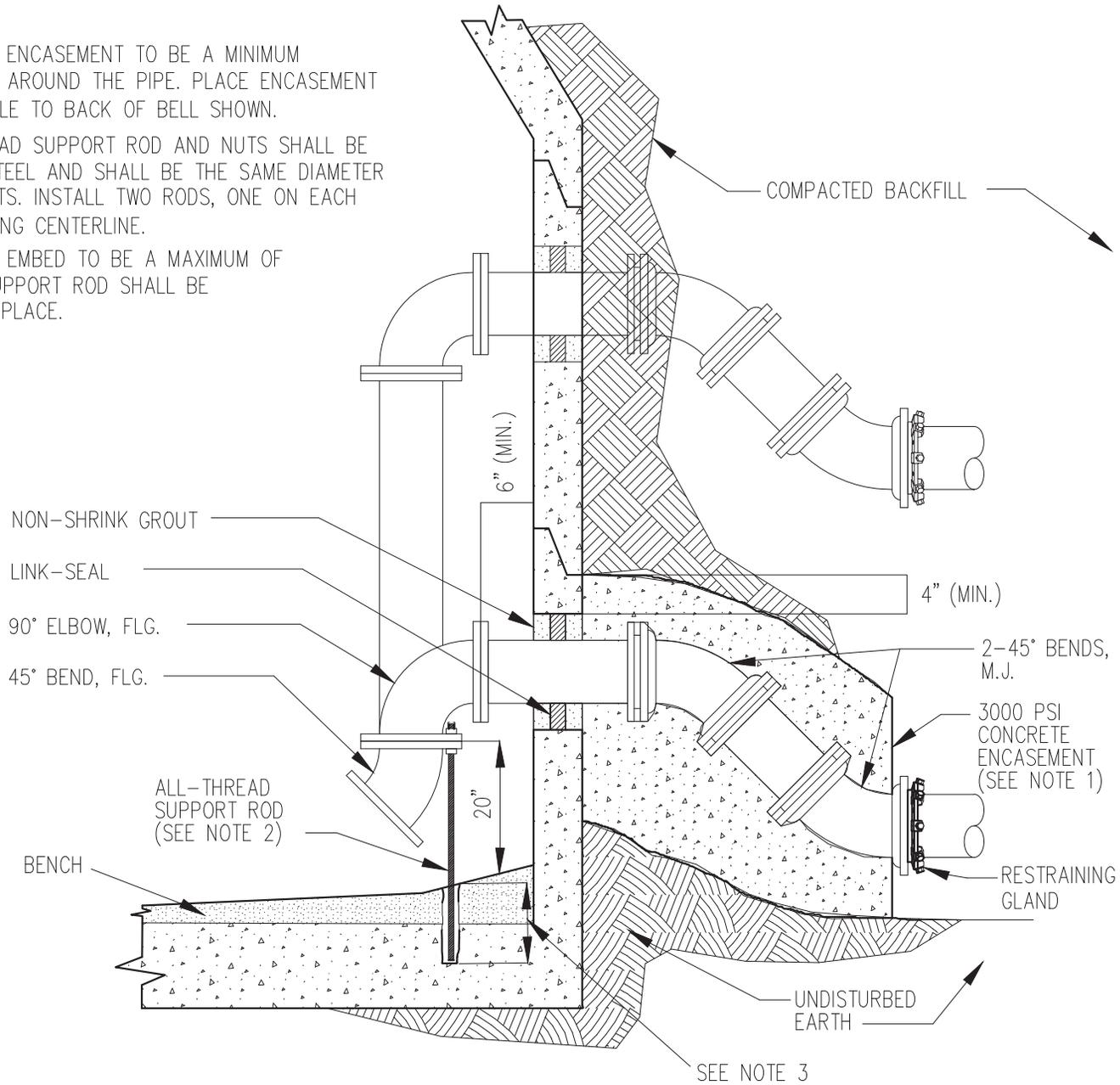
NOTES:

1. THIS DETAIL ILLUSTRATES A SINGLE-BODY WASTEWATER COMBINATION AIR RELEASE VALVE. IT ALSO ILLUSTRATES A SIMILAR INSTALLATION FOR A WASTEWATER AIR / VACUUM RELEASE VALVE. REFER TO THE PROJECT DRAWINGS FOR THE LOCATION OF EACH TYPE AND SIZE. THE VALVE SHALL BE ROTATED AS NECESSARY TO MEET CLEARANCES FROM THE MANHOLE WALL AND TO MAXIMIZE CLEAR SPACE FOR MAINTENANCE PERSONNEL. THE OUTLET ELBOW AND PIPING SHALL BE ROTATED AWAY FROM THE MANHOLE STEPS.
2. AIR RELEASE VALVE TO BE VAL-MATIC "CRISPEN SEWER VALVE", APCO 400 SEWAGE VALVE, OR EQUAL.
3. AIR-VACUUM VALVE INSTALLATION TO BE SIMILAR EXCEPT VALVE TO BE APCO 402 SEWAGE VALVE OR EQUAL.
4. 2" AIR RELEASE LINE, GATE VALVE, AND CHECK VALVE ON AIR-VACUUM VALVE ONLY.
5. MANHOLE FRAME SHALL BE JOHN BOUCHARD & SONS NO. 1150 OR APPROVED EQUAL.
6. ALL PRECAST MANHOLE COMPONENTS SHALL COMPLY WITH ASTM C-478 AND SHALL BE ASSEMBLED WITH BUTYL MASTIC SEALANT BETWEEN TONGUE & GROOVES AND AN A WRAP OVER THE EXTERIOR JOINTS.
7. MANHOLE STEPS SHALL BE M.A. INDUSTRIES OR APPROVED EQUAL.

FORCE MAIN AIR RELEASE / AIR VACUUM VALVE DETAIL (2 OF 2)

NOTES:

1. CONCRETE ENCASEMENT TO BE A MINIMUM OF 6 INCHES AROUND THE PIPE. PLACE ENCASEMENT FROM MANHOLE TO BACK OF BELL SHOWN.
2. ALL-THREAD SUPPORT ROD AND NUTS SHALL BE STAINLESS STEEL AND SHALL BE THE SAME DIAMETER AS PIPE BOLTS. INSTALL TWO RODS, ONE ON EACH SIDE OF FITTING CENTERLINE.
3. DEPTH OF EMBED TO BE A MAXIMUM OF 4 INCHES. SUPPORT ROD SHALL BE GROUTED IN-PLACE.

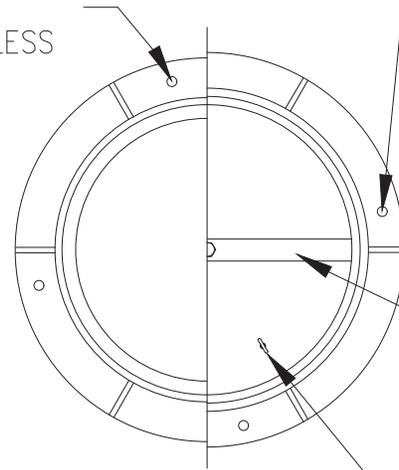


STANDARD FORCE MAIN-TO-MANHOLE CONNECTION



COVER

FOUR 1" HOLES FOR 3/4" DIAMETER STAINLESS STEEL ANCHOR BOLTS.

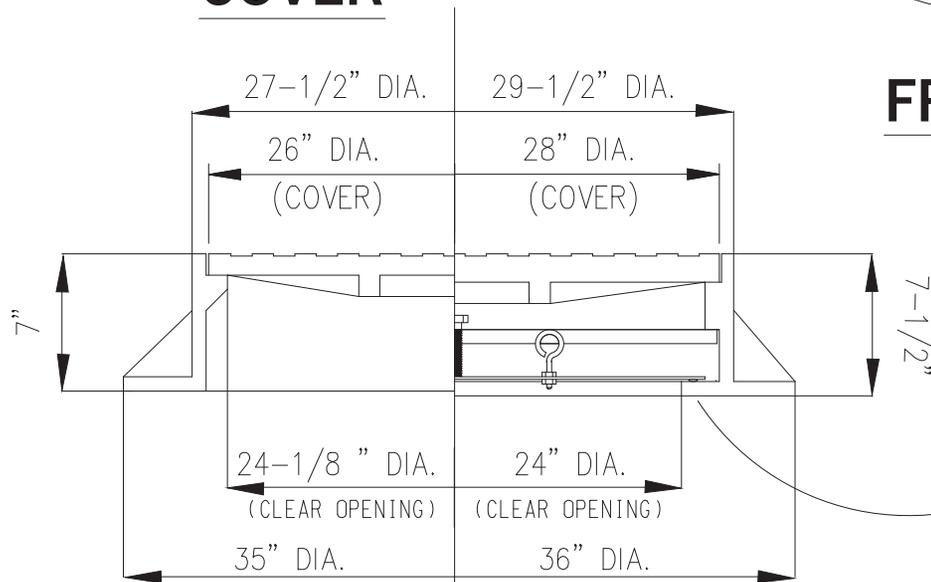


FOUR 7/8" HOLES FOR 3/4" DIAMETER STAINLESS STEEL ANCHOR BOLTS.

STEEL LOCKING BAR.

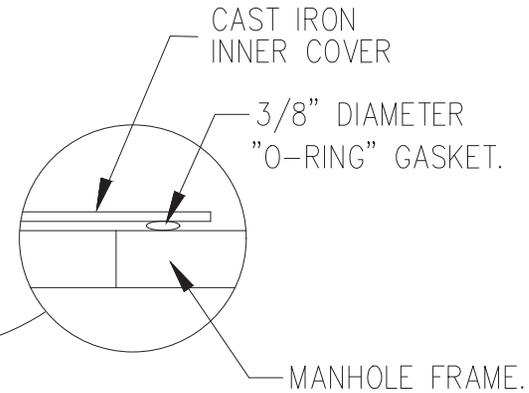
FRAME

3/8" DIAMETER EYE-BOLT (TYPICAL FOR 2)



STANDARD

WATERTIGHT



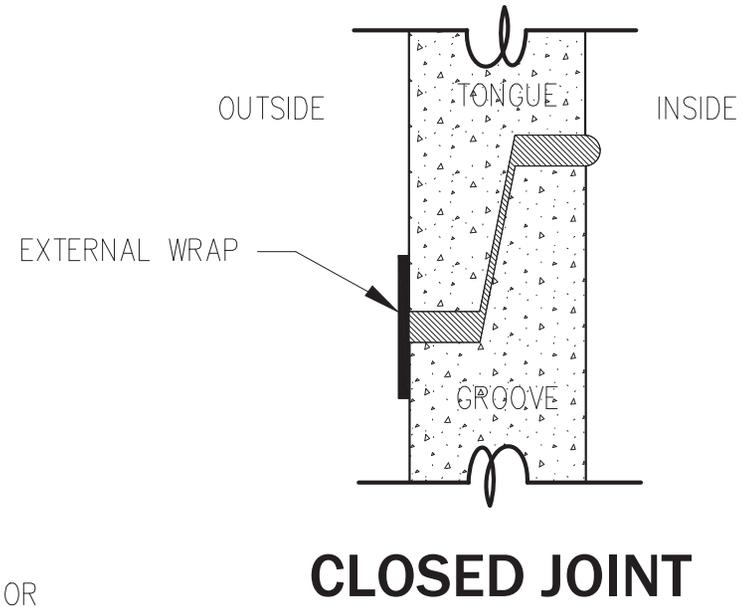
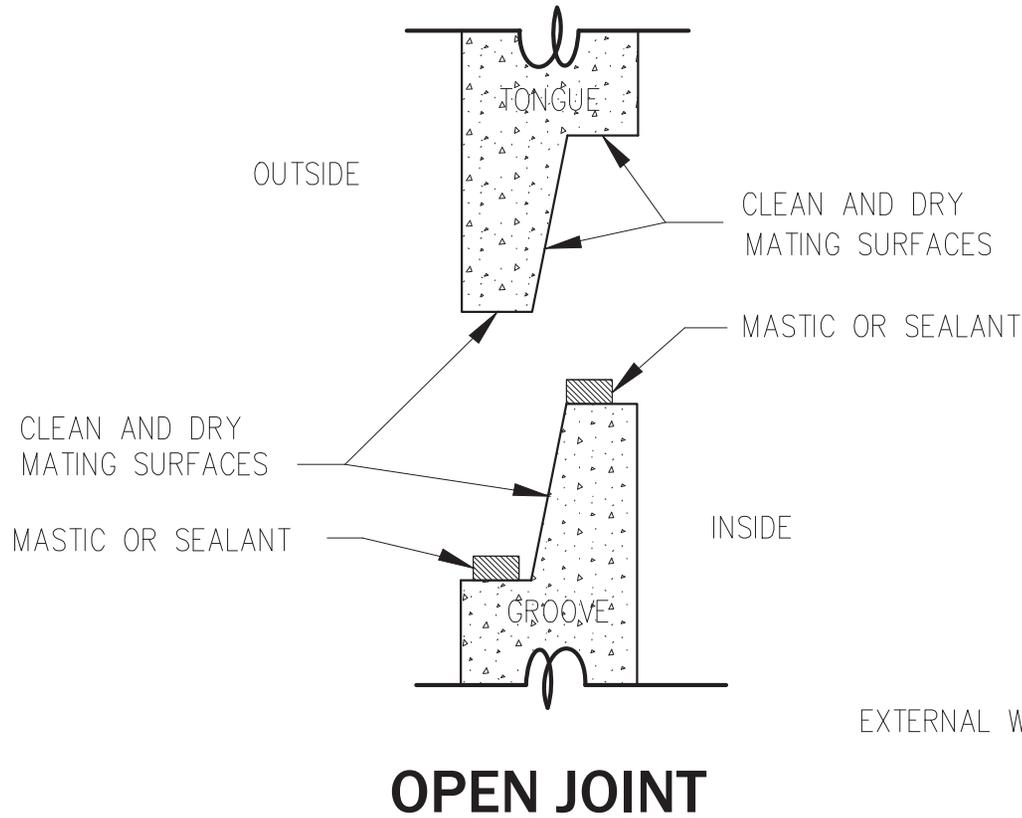
DETAIL "A"

NOTES:

1. STANDARD FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1150, WATERTIGHT FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1123, OR APPROVED EQUALS. IN EACH CASE, THE WORDS "SANITARY SEWER" SHALL BE CAST WITH THE COVERS.

2. MANHOLE FRAMES AND COVERS SHALL BE H2O RATED.

FRAME AND COVER DETAIL

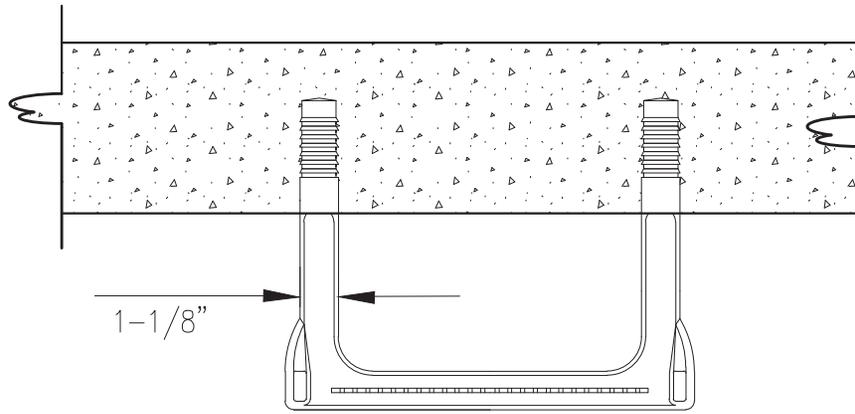


NOTES:

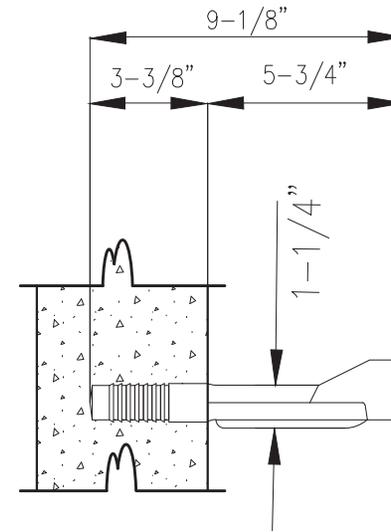
1. MANHOLE COMPONENTS SHALL BE ASSEMBLED USING BUTYL SEALANTS AND EXTERIOR WRAPS. JOINT SEALANTS SHALL BE BIDCO C-56R AND EXTERIOR WRAPS SHALL BE PRESS-SEAL "EZ-WRAP" OR APPROVED EQUALS.

2. PREPARE MATING SURFACES BY REMOVING DIRT AND DEBRIS. APPLY ADHESIVE PRIMER WHEN APPLICABLE.

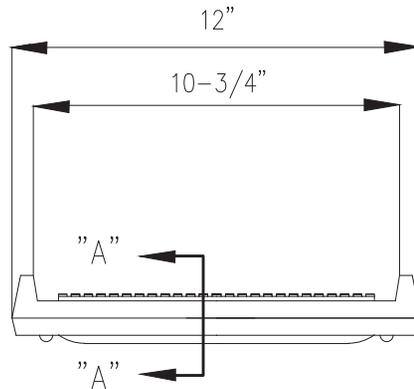
PLASTIC GASKET JOINT FOR PRECAST MANHOLES



PLAN



SIDE



END

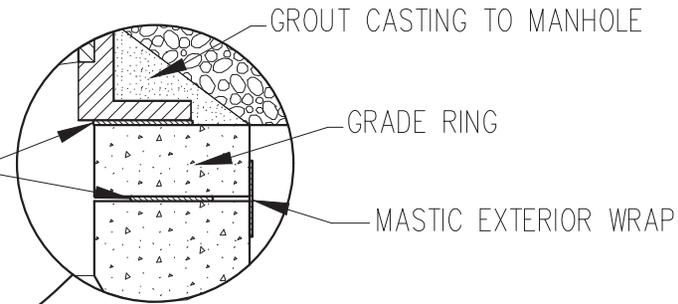
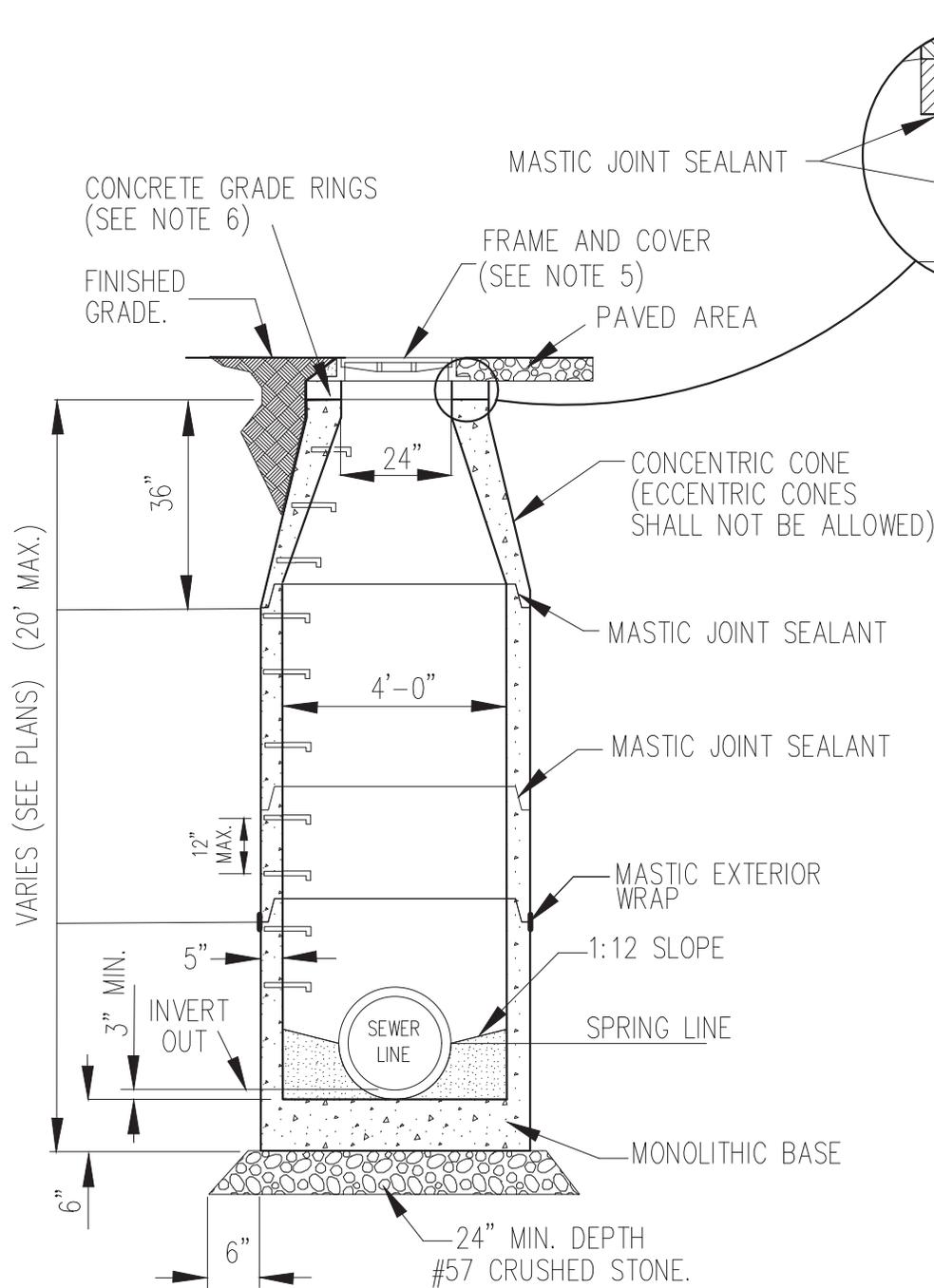
NOTES:

1. MANHOLE STEPS SHALL BE M.A. INDUSTRIES, INC. OR APPROVED EQUI.
2. STEP SHALL BE STEEL REINFORCED AND SHALL BE ENCAPSULATED IN POLYPROPYLENE PLASTIC.
3. 1/2" DIAMETER STEEL REINFORCEMENT (GRADE 60).



SECTION "A-A"

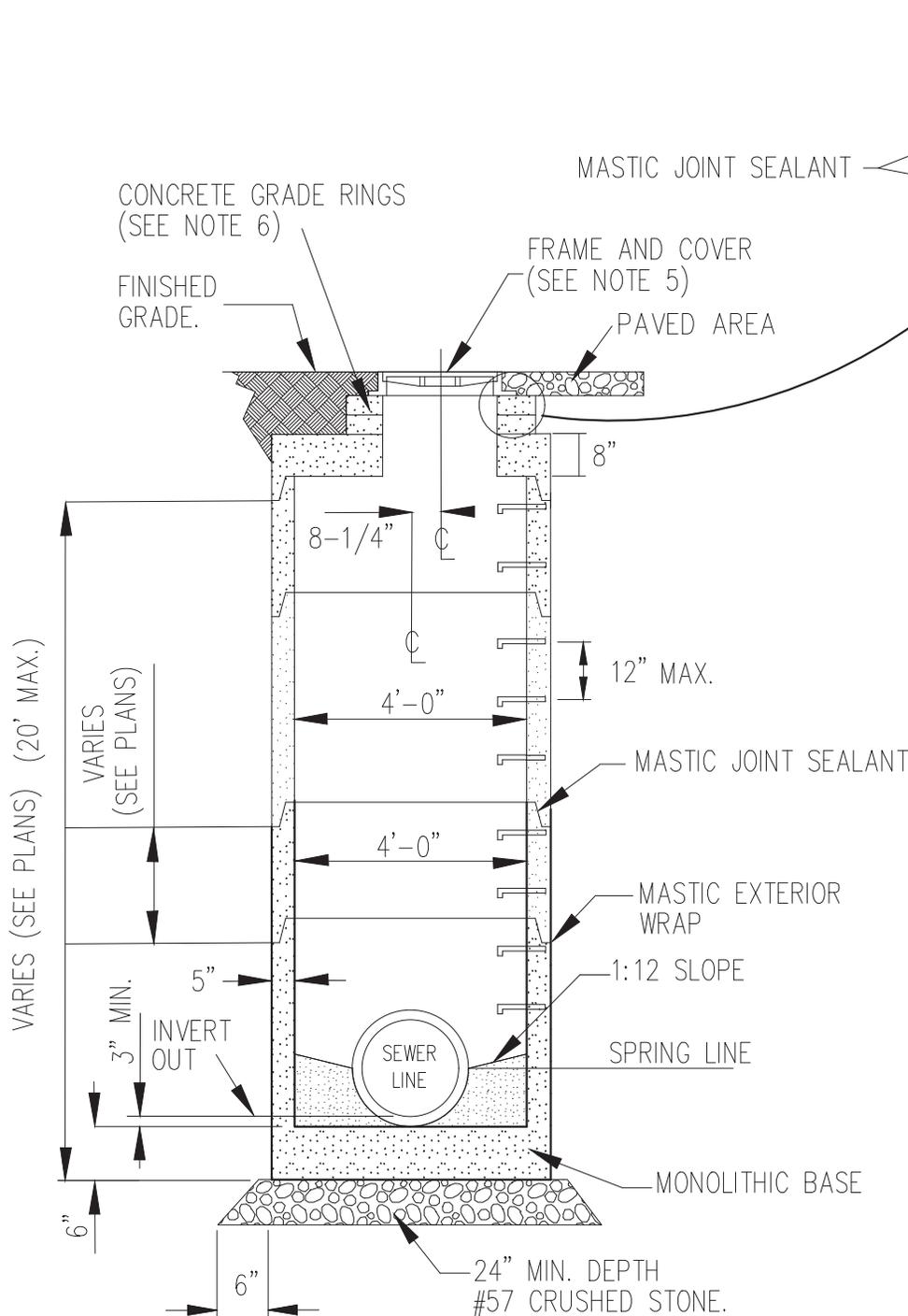
MANHOLE STEP DETAIL



NOTES:

1. ALL PRECAST CONCRETE MANHOLE COMPONENTS, INCLUDING GRADE RINGS, SHALL BE CLOUD PRODUCTS OR APPROVED EQUAL AND SHALL CONFORM TO ASTM C-478. CONCRETE SHALL BE 4000 PSI @ 28 DAYS. REINFORCING STEEL SHALL BE ASTM A615, GRADE 60.
2. MANHOLE COMPONENTS SHALL BE ASSEMBLED USING BUTYL SEALANTS AND EXTERIOR WRAPS. JOINT SEALANTS SHALL BE BIDCO C-56R, AND EXTERIOR WRAPS SHALL BE PRESS-SEAL "EZ-WRAP" OR APPROVED EQUALS.
3. ALL PRECAST MANHOLE COMPONENTS SHALL BE PRODUCED WITH THE XYPEX ADMIN C-1000 WATER-PROOFING ADMIXTURE OR APPROVED EQUAL.
4. MANHOLE STEPS SHALL BE M.A. INDUSTRIES OR APPROVED EQUAL, CAST IN PLACE, AND SHALL BE SPACED AT 12" CENTERS AND TO WITHIN 12" OF TOP OF THE CONE.
5. STANDARD FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1150. WATERTIGHT FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1123, OR APPROVED EQUALS. EACH MANHOLE COVER SHALL BE EMBOSSED WITH "SANITARY SEWER".
6. CONCRETE GRADE RINGS ARE REQUIRED TO ADJUST TOP OF CASTING ELEVATIONS. HOWEVER, NO MORE THAN 12 VERTICAL INCHES OF GRADE RINGS SHALL BE ALLOWED PER MANHOLE. THE MINIMUM THICKNESS SHALL BE 4 INCHES.
7. FLEXIBLE PIPE-TO-MANHOLE CONNECTORS SHALL BE KOR-N-SEAL BOOT CONNECTORS OR APPROVED EQUAL.

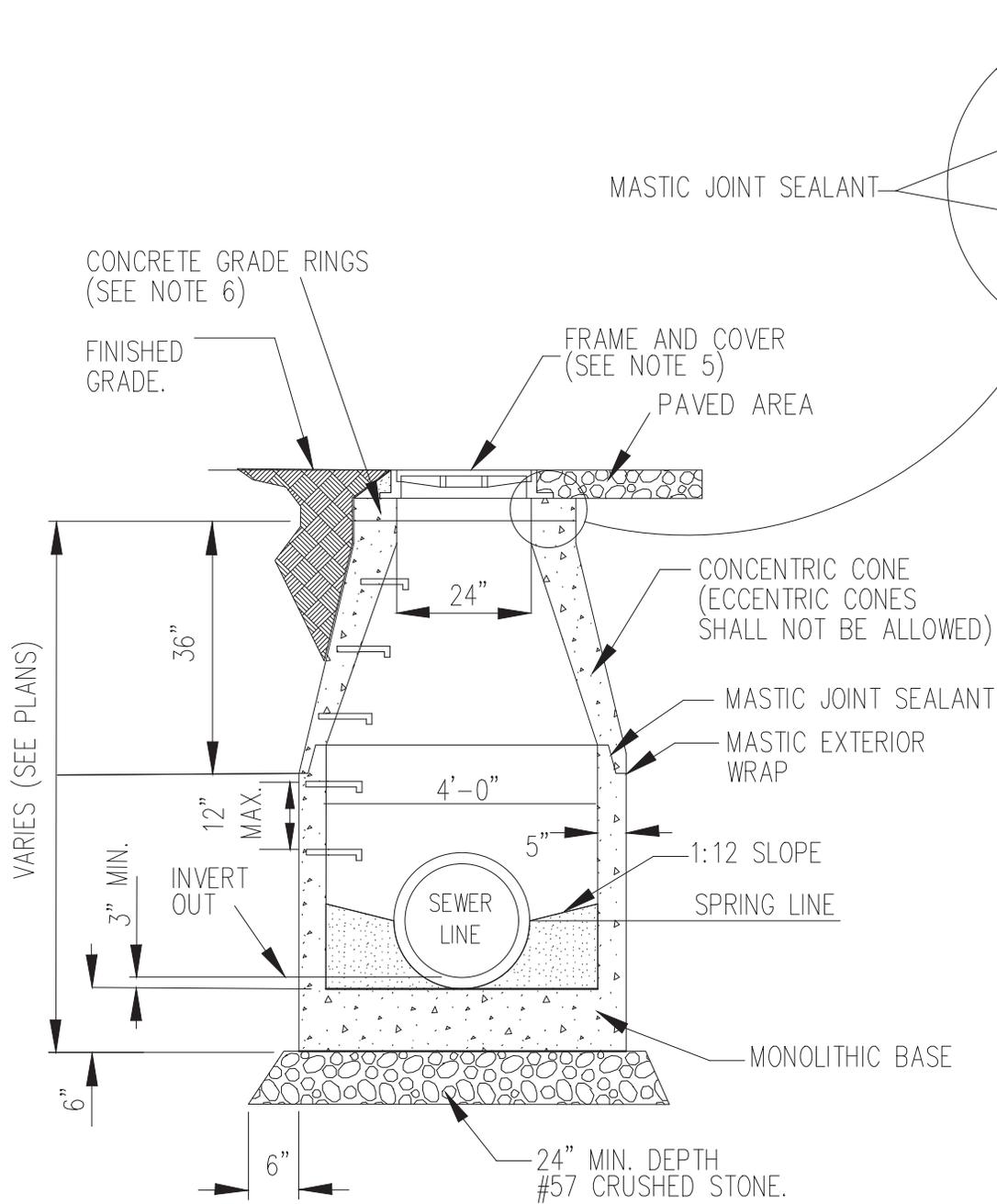
STANDARD PRECAST MANHOLE DETAIL - CONCENTRIC CONE



NOTES:

1. ALL PRECAST CONCRETE MANHOLE COMPONENTS, INCLUDING GRADE RINGS, SHALL BE CLOUD PRODUCTS OR APPROVED EQUAL AND SHALL CONFORM TO ASTM C-478. CONCRETE SHALL BE 4000 PSI @ 28 DAYS. REINFORCING STEEL SHALL BE ASTM A615, GRADE 60.
2. MANHOLE COMPONENTS SHALL BE ASSEMBLED USING BUTYL SEALANTS AND EXTERIOR WRAPS. JOINT SEALANTS SHALL BE BIDCO C-56R AND EXTERIOR WRAPS SHALL BE PRESS-SEAL "EZ-WRAP" OR APPROVED EQUALS.
3. ALL PRECAST MANHOLE COMPONENTS SHALL BE PRODUCED WITH THE XYPEX ADMIN C-1000 WATER-PROOFING ADMIXTURE OR APPROVED EQUAL.
4. MANHOLE STEPS SHALL BE M.A. INDUSTRIES OR APPROVED EQUAL, CAST IN PLACE, AND SHALL BE SPACED AT 12" CENTERS AND TO WITHIN 12" OF TOP OF THE CONE.
5. STANDARD FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1150. WATERTIGHT FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1123, OR APPROVED EQUALS. EACH MANHOLE COVER SHALL BE EMBOSSED WITH "SANITARY SEWER".
6. CONCRETE GRADE RINGS ARE REQUIRED TO ADJUST TOP OF CASTING ELEVATIONS. HOWEVER, NO MORE THAN 12 VERTICAL INCHES OF GRADE RINGS SHALL BE ALLOWED PER MANHOLE. THE MINIMUM THICKNESS SHALL BE 4 INCHES.
7. FLEXIBLE PIPE-TO-MANHOLE CONNECTORS SHALL BE KOR-N-SEAL BOOT CONNECTORS OR APPROVED EQUAL.

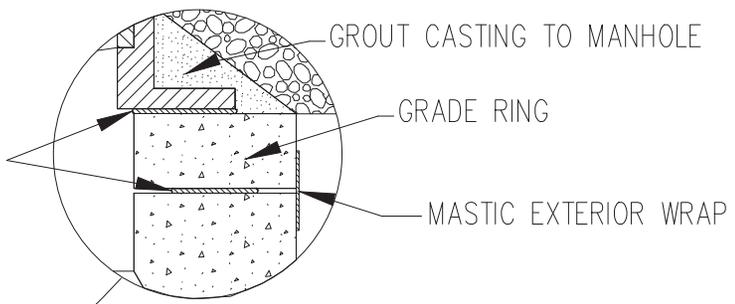
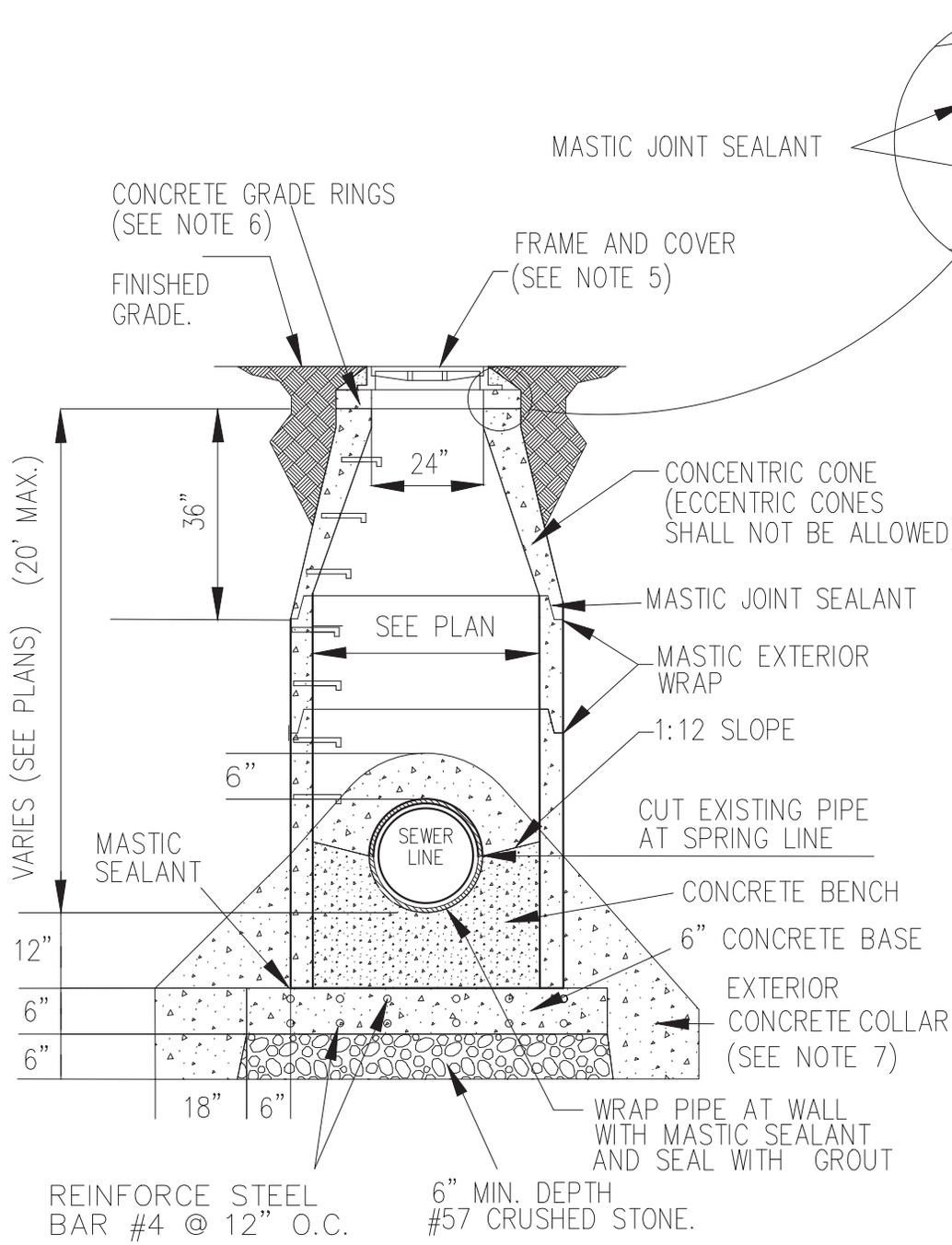
STANDARD PRECAST MANHOLE DETAIL - FLAT SLAB TOP



NOTES:

1. ALL PRECAST CONCRETE MANHOLE COMPONENTS, INCLUDING GRADE RINGS, SHALL BE CLOUD PRODUCTS OR APPROVED EQUAL AND SHALL CONFORM TO ASTM C-478. CONCRETE SHALL BE 4000 PSI @ 28 DAYS. REINFORCING STEEL SHALL BE ASTM A615, GRADE 60.
2. MANHOLE COMPONENTS SHALL BE ASSEMBLED USING BUTYL SEALANTS AND EXTERIOR WRAPS. JOINT SEALANTS SHALL BE BIDCO C-56R, AND EXTERIOR WRAPS SHALL BE PRESS-SEAL "EZ-WRAP" OR APPROVED EQUALS.
3. ALL PRECAST MANHOLE COMPONENTS SHALL BE PRODUCED WITH THE XYPEX ADMIN C-1000 WATER-PROOFING ADMIXTURE OR APPROVED EQUAL.
4. MANHOLE STEPS SHALL BE M.A. INDUSTRIES OR APPROVED EQUAL, CAST IN PLACE, AND SHALL BE SPACED AT 12" CENTERS AND TO WITHIN 12" OF TOP OF THE CONE.
5. STANDARD FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1150. WATERTIGHT FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1123, OR APPROVED EQUALS. EACH MANHOLE COVER SHALL BE EMBOSSED WITH "SANITARY SEWER".
6. CONCRETE GRADE RINGS ARE REQUIRED TO ADJUST TOP OF CASTING ELEVATIONS. HOWEVER, NO MORE THAN 12 VERTICAL INCHES OF GRADE RINGS SHALL BE ALLOWED PER MANHOLE. THE MINIMUM THICKNESS SHALL BE 4 INCHES.
7. FLEXIBLE PIPE-TO-MANHOLE CONNECTORS SHALL BE KOR-N-SEAL BOOT CONNECTORS OR APPROVED EQUAL.

SPECIAL SHALLOW MANHOLE

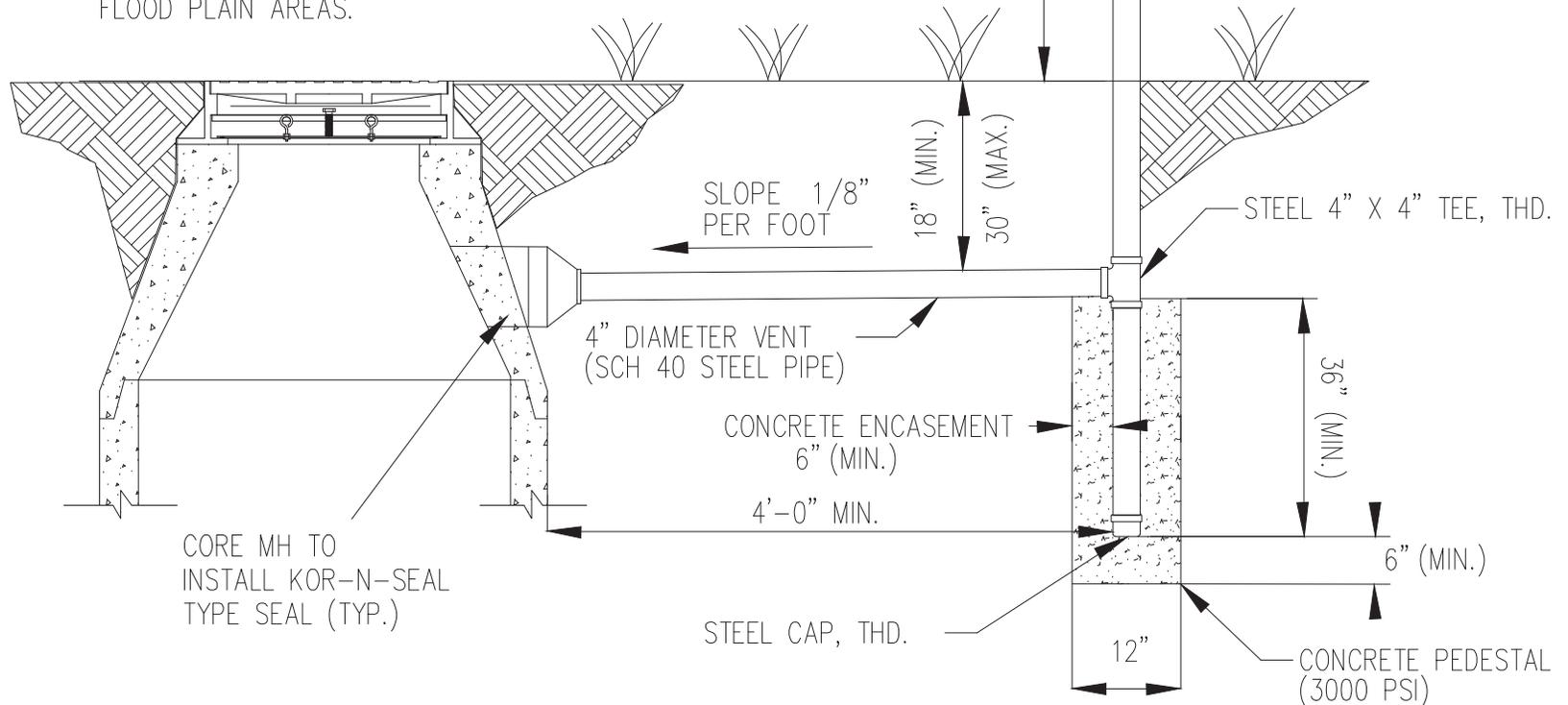


- NOTES:
1. ALL PRECAST CONCRETE MANHOLE COMPONENTS, INCLUDING GRADE RINGS, SHALL BE CLOUD PRODUCTS OR APPROVED EQUAL AND SHALL CONFORM TO ASTM C-478. CONCRETE SHALL BE 4000 PSI @ 28 DAYS. REINFORCING STEEL SHALL BE ASTM A615, GRADE 60.
 2. MANHOLE COMPONENTS SHALL BE ASSEMBLED USING BUTYL SEALANTS AND EXTERIOR WRAPS. JOINT SEALANTS SHALL BE BIDCO C-56R AND EXTERIOR WRAPS SHALL BE PRESS-SEAL "EZ-WRAP" OR APPROVED EQUALS.
 3. ALL PRECAST MANHOLE COMPONENTS SHALL BE PRODUCED WITH THE XYPEX ADMIN C-1000 WATER-PROOFING ADMIXTURE OR APPROVED EQUAL.
 4. MANHOLE STEPS SHALL BE M.A. INDUSTRIES OR APPROVED EQUAL AND SHALL BE SPACED AT 12" CENTERS AND TO WITHIN 12" OF TOP OF THE CONE.
 5. STANDARD FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1150. WATERTIGHT FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1123, OR APPROVED EQUALS. EACH MANHOLE COVER SHALL BE EMBOSSED WITH "SANITARY SEWER".
 6. GRADE RINGS ARE REQUIRED TO ADJUST TOP OF CASTING ELEVATIONS. HOWEVER, NO MORE THAN 12 VERTICAL INCHES OF GRADE RINGS SHALL BE ALLOWED PER MANHOLE. THE MINIMUM THICKNESS SHALL BE 4 INCHES.
 7. THE 6" CONCRETE BASE SHALL BE POURED AND CURED PRIOR TO SETTING MANHOLE RISER. A CONCRETE COLLAR SHALL BE POURED AROUND THE FULL EXTERIOR CIRCUMFERENCE OF THE MANHOLE BASE AND EXTEND ABOVE THE PIPE AS SHOWN. CONCRETE BASE SHALL HAVE REINFORCED STEEL BAR #4 LOCATED AT 12" ON CENTER.

DOGHOUSE MANHOLE DETAIL

NOTES:

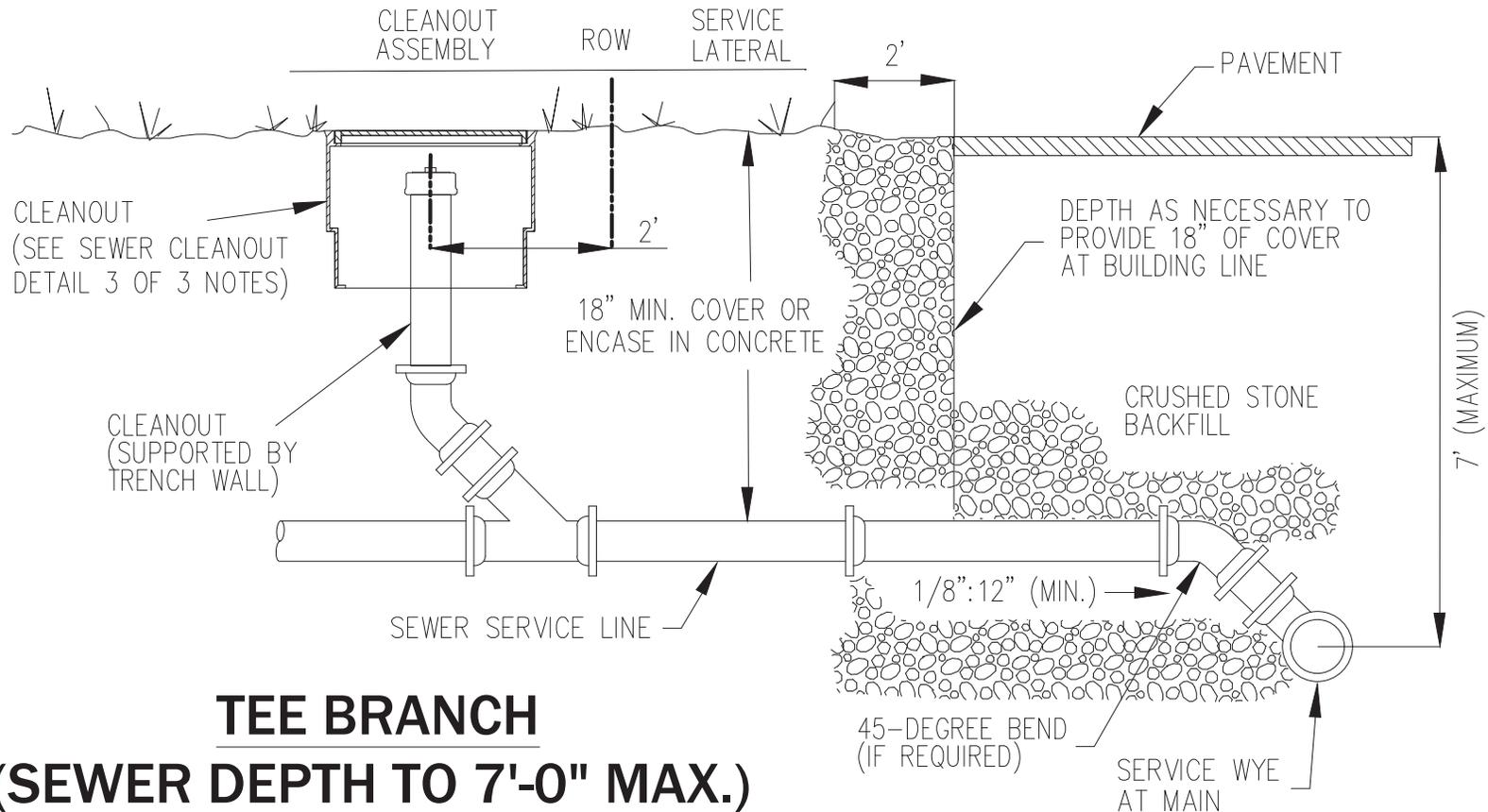
1. VENT TO BE LOCATED BEHIND CURB OR WALK AND FAR ENOUGH FROM ROADWAY SO AS TO PREVENT TRAFFIC FLOW OBSTRUCTION OR AS NOTED ON THE PLANS.
2. ALL VENT PIPING SHALL HAVE A SSPC SP-3 POWER TOOL CLEAN SURFACE PREP. PRIOR TO BEING PAINTED WITH A PRIME COAT OF TNE MEC SERIES 1 OMNITHANE AT 2.5 - 3.5 MILS D.F.T., AND TOP COAT OF PAINT SHALL BE TNE MEC SERIES 290 CRU AT 2.0 - 3.0 MILS D.F.T., OR APPROVED EQUAL. COLOR SHALL BE DARK GREEN
3. TOP OF VENT TO BE A MINIMUM OF 8'-0" ABOVE GRADE OR 2- FEET ABOVE THE 100-YEAR FLOOD ELEVATIONS AS NOTED ON THE PLANS, WHICHEVER IS GREATER.
4. VENT TURNDOWN TO BE CONSTRUCTED OF TWO 90° THREADED ELBOWS JOINED BY A 6" NIPPLE OR TWO WELDED 90° ELBOWS. PROVIDE STAINLESS STEEL INSECT SCREEN HELD IN PLACE BETWEEN TWO PIPE FLANGES.
5. GRADE RINGS ARE NOT ALLOWED ON MANHOLES IN FLOOD PLAIN AREAS.



STANDARD MANHOLE VENT DETAIL

NOTES:

1. THE PIPE SIZE OF TEE BRANCH SHALL BE 4" DIAMETER FOR RESIDENTIAL AND 6" DIAMETER FOR COMMERCIAL
2. CLEANOUT BOXES ARE REQUIRED IN BOTH PAVED AND NON-PAVED AREAS.
3. SERVICE LINES ARE TO BE BACKFILLED WITH CRUSHED STONE TO A POINT APPROXIMATELY 2 FEET BEYOND THE ROAD SHOULDER OR CURB IF LOCATED IN A PAVED AREA.
4. CLEANOUTS ARE TO BE LOCATED APPROXIMATELY 2 FEET BEHIND THE PROPERTY LINE. ADDITIONAL CLEANOUTS REQUIRED ON SERVICE LINES SHALL BE INSTALLED NO FARTHER THAN 75 FEET APART.
5. CLEANOUTS SHALL BE SDR 26 PVC FROM THE SEWER MAIN TO THE CLEANOUT.
6. THE CLEANOUT CAP SHALL BE A JONES STEPHENS CO. GASKETED CAST IRON PUSH-ON CLEANOUT WITH A BRONZE PLUG OR AN APPROVED EQUAL. THE PLUGS SHALL HAVE A COUNTERSUNK HEAD IN PAVED AREAS.
7. CLEANOUT BOXES IN UNPAVED AREAS SHALL BE UTILITY DEFENDER, PENTEK 13"x18"x12" WITH A GREEN LID LABELED "SEWER" OR ENGINEER APPROVED EQUAL. CLEANOUT BOXES SHALL HAVE TEMPORARY ABOVE GRADE LOCATORS TO MARK AND PROTECT CLEANOUT BOXES DURING CONSTRUCTION ACTIVITIES.

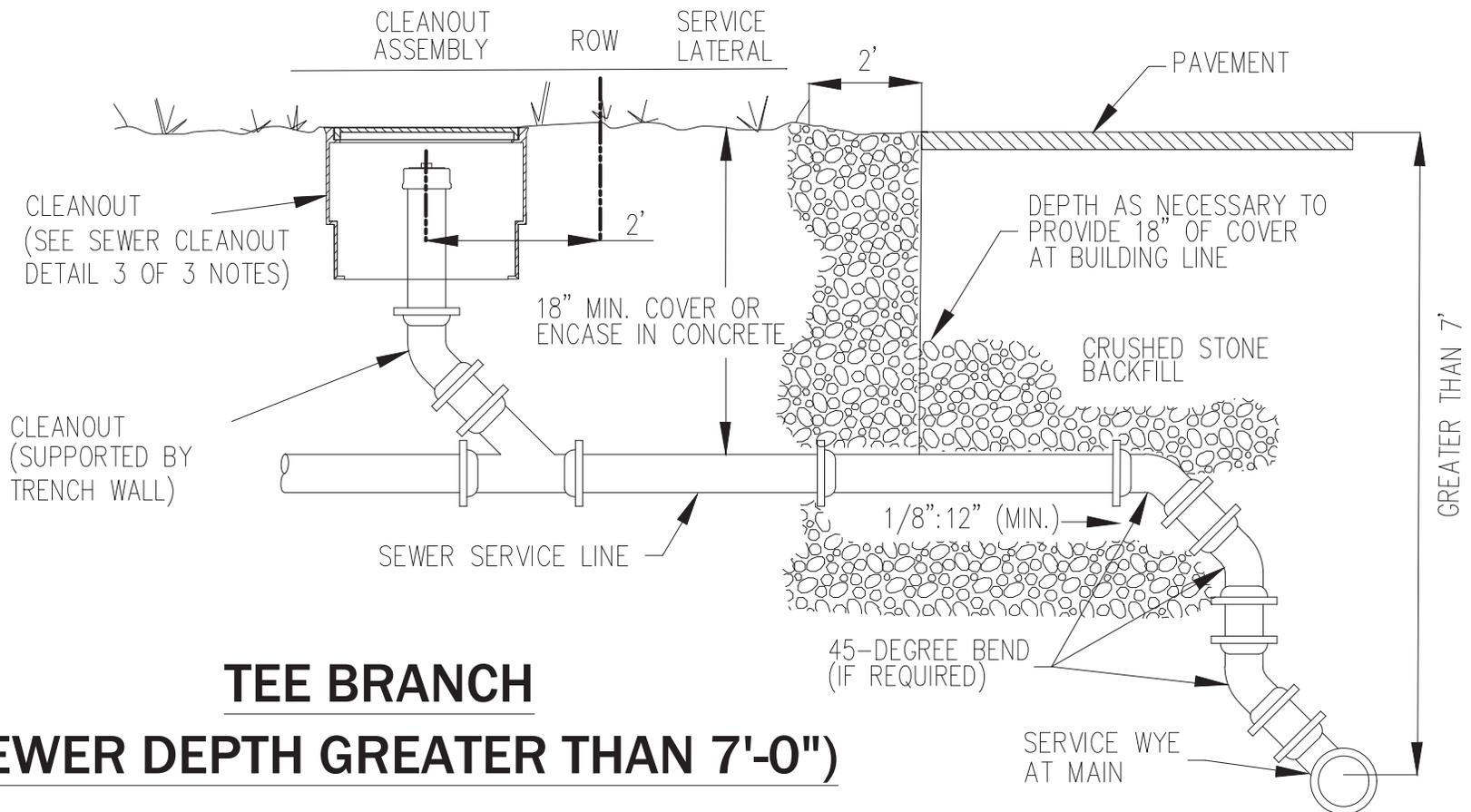


**TEE BRANCH
(SEWER DEPTH TO 7'-0" MAX.)**

SANITARY SEWER SERVICE LINE CONNECTION DETAILS (1 OF 3)

NOTES:

1. THE PIPE SIZE OF TEE BRANCH SHALL BE 4" DIAMETER FOR RESIDENTIAL AND 6" DIAMETER FOR COMMERCIAL
2. CLEANOUT BOXES ARE REQUIRED IN BOTH PAVED AND NON-PAVED AREAS.
3. SERVICE LINES ARE TO BE BACKFILLED WITH CRUSHED STONE TO A POINT APPROXIMATELY 2 FEET BEYOND THE ROAD SHOULDER OR CURB IF LOCATED IN A PAVED AREA.
4. CLEANOUTS ARE TO BE LOCATED APPROXIMATELY 2 FEET BEHIND THE PROPERTY LINE. ADDITIONAL CLEANOUTS REQUIRED ON SERVICE LINES SHALL BE INSTALLED NO FARTHER THAN 75 FEET APART.
5. CLEANOUTS SHALL BE SDR 26 PVC FROM THE SEWER MAIN TO THE CLEANOUT.
6. THE CLEANOUT CAP SHALL BE A JONES STEPHENS CO. GASKETED CAST IRON PUSH-ON CLEANOUT WITH A BRONZE PLUG OR AN APPROVED EQUAL. THE PLUGS SHALL HAVE A COUNTERSUNK HEAD IN PAVED AREAS.
7. CLEANOUT BOXES IN UNPAVED AREAS SHALL BE UTILITY DEFENDER, PENTEK 13"x18"x12" WITH A GREEN LID LABELED "SEWER" OR ENGINEER APPROVED EQUAL. CLEANOUT BOXES SHALL HAVE TEMPORARY ABOVE GRADE LOCATORS TO MARK AND PROTECT CLEANOUT BOXES DURING CONSTRUCTION ACTIVITIES.

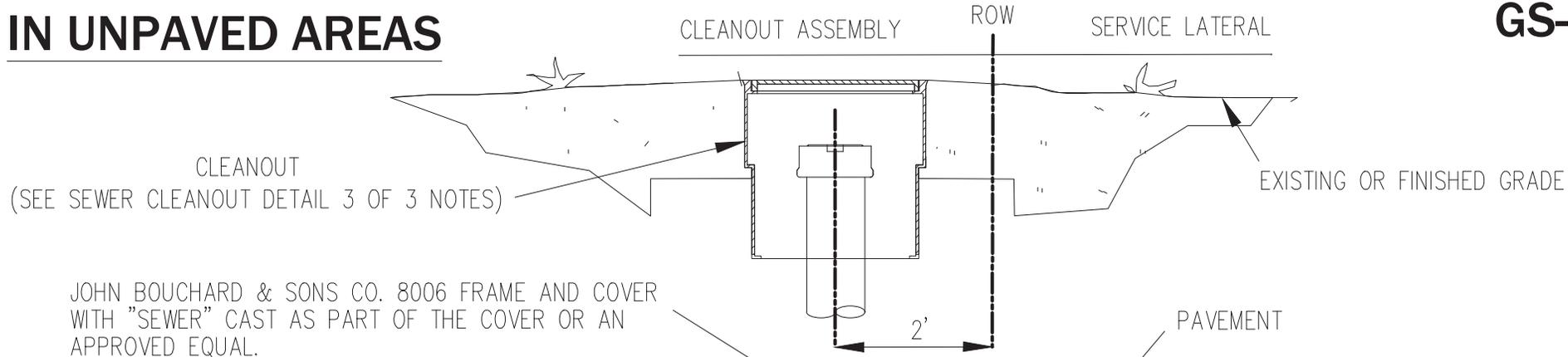


TEE BRANCH

(SEWER DEPTH GREATER THAN 7'-0")

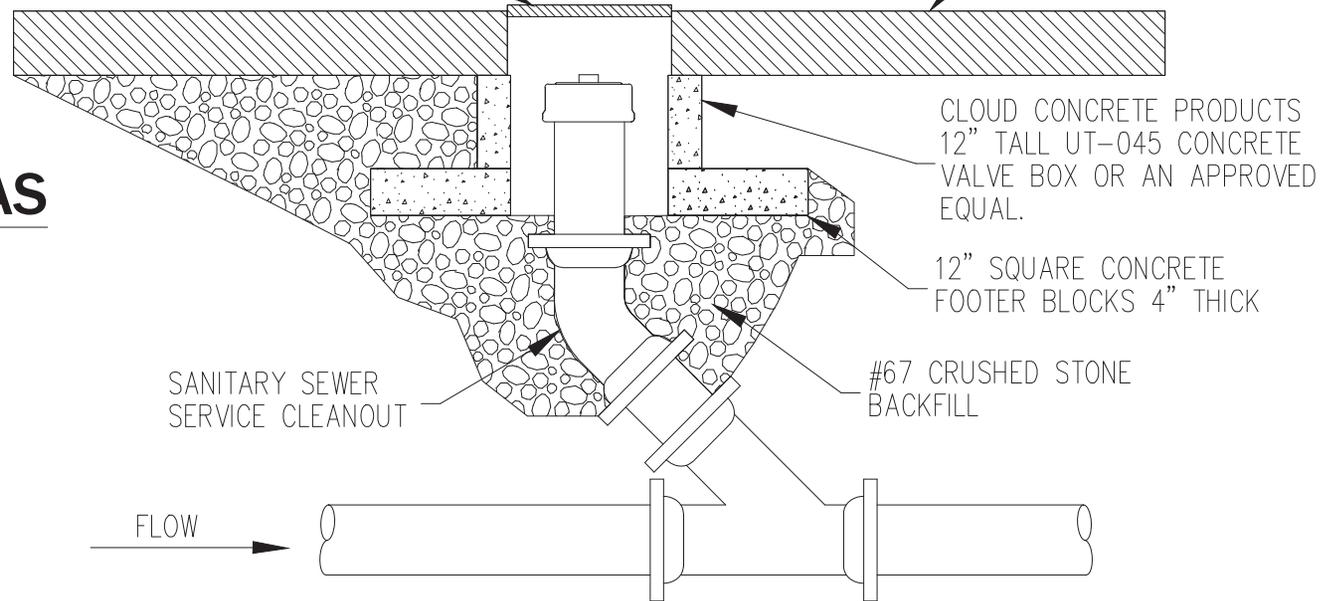
SANITARY SEWER SERVICE LINE CONNECTION DETAILS (2 OF 3)

IN UNPAVED AREAS



GS-9

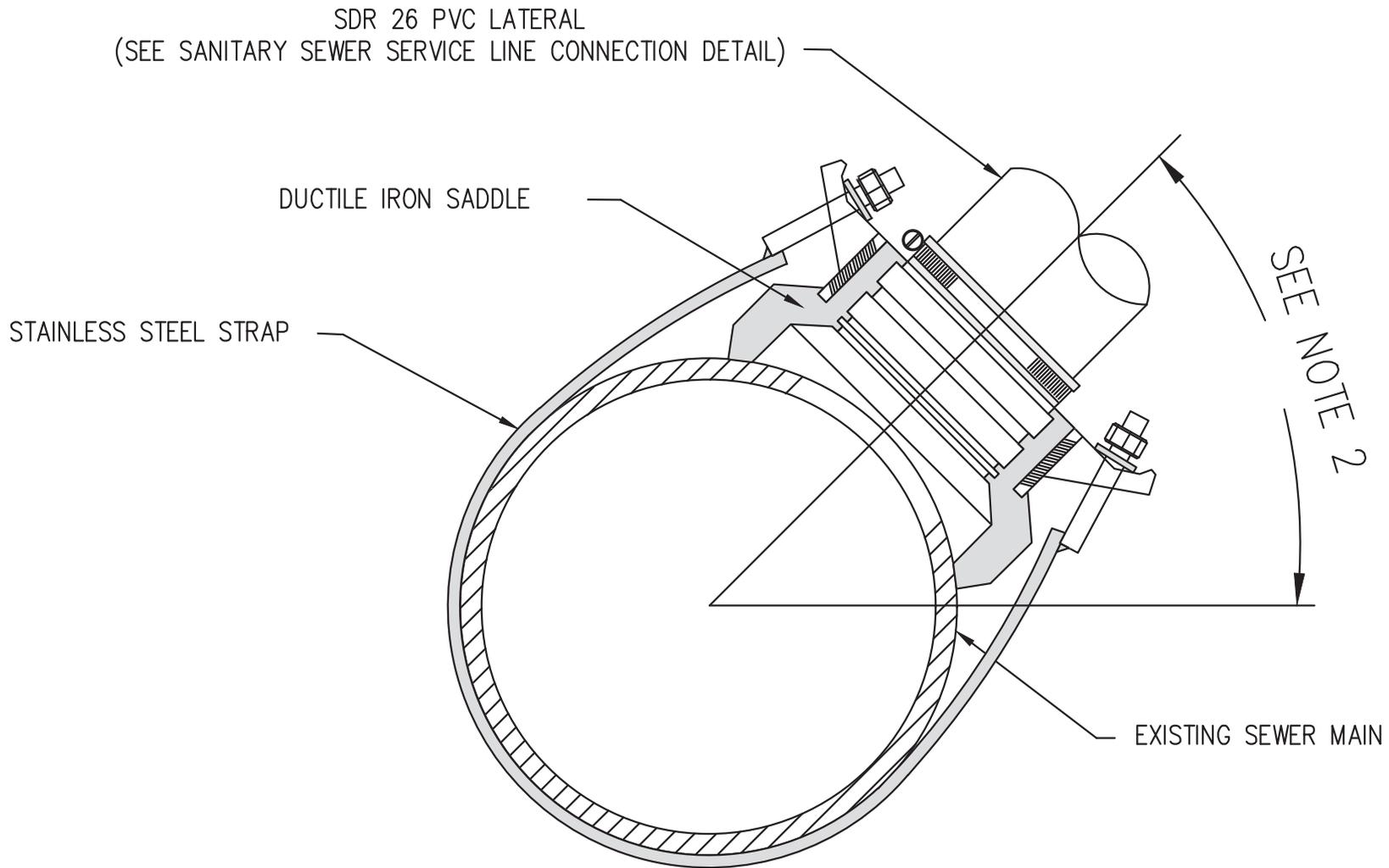
IN PAVED AREAS



NOTES:

1. THE LONG SIDE OF THE FRAME SHALL RUN PARALLEL TO THE SERVICE LINE.
2. CLEANOUT BOXES ARE REQUIRED IN BOTH PAVED AND NON-PAVED AREAS.
3. CLEANOUTS LOCATED WITHIN A ROADWAY, DRIVEWAY, OR PARKING LOT SHALL BE PROTECTED FROM TRAFFIC USING A CAST IRON BOX & LID. TAPERED CONCRETE COLLARS ARE REQUIRED IN PAVED AREAS.
4. CLEANOUT PIPING SHALL BE SDR 26 PVC UNLESS OTHERWISE SPECIFIED.
5. CLEANOUT BOXES IN UNPAVED AREAS SHALL BE UTILITY DEFENDER, PENTEK 13"x18"x12" WITH A GREEN LID LABELED "SEWER" OR ENGINEER APPROVED EQUAL. CLEANOUT BOXES SHALL HAVE TEMPORARY ABOVE GRADE LOCATORS TO MARK AND PROTECT CLEANOUT BOXES DURING CONSTRUCTION ACTIVITIES.
6. CLEANOUTS SHALL BE LOCATED APPROXIMATELY 2 FEET BEHIND THE PROPERTY LINE AND WHERE SHOWN ON THE PLANS. ADDITIONAL CLEANOUTS REQUIRED ON SERVICE LINES SHALL BE INSTALLED NO FARTHER THAN 75 FEET APART. LINES SHALL BE CAPPED AT CLEANOUTS WHERE INSTALLED FOR FUTURE SERVICE.

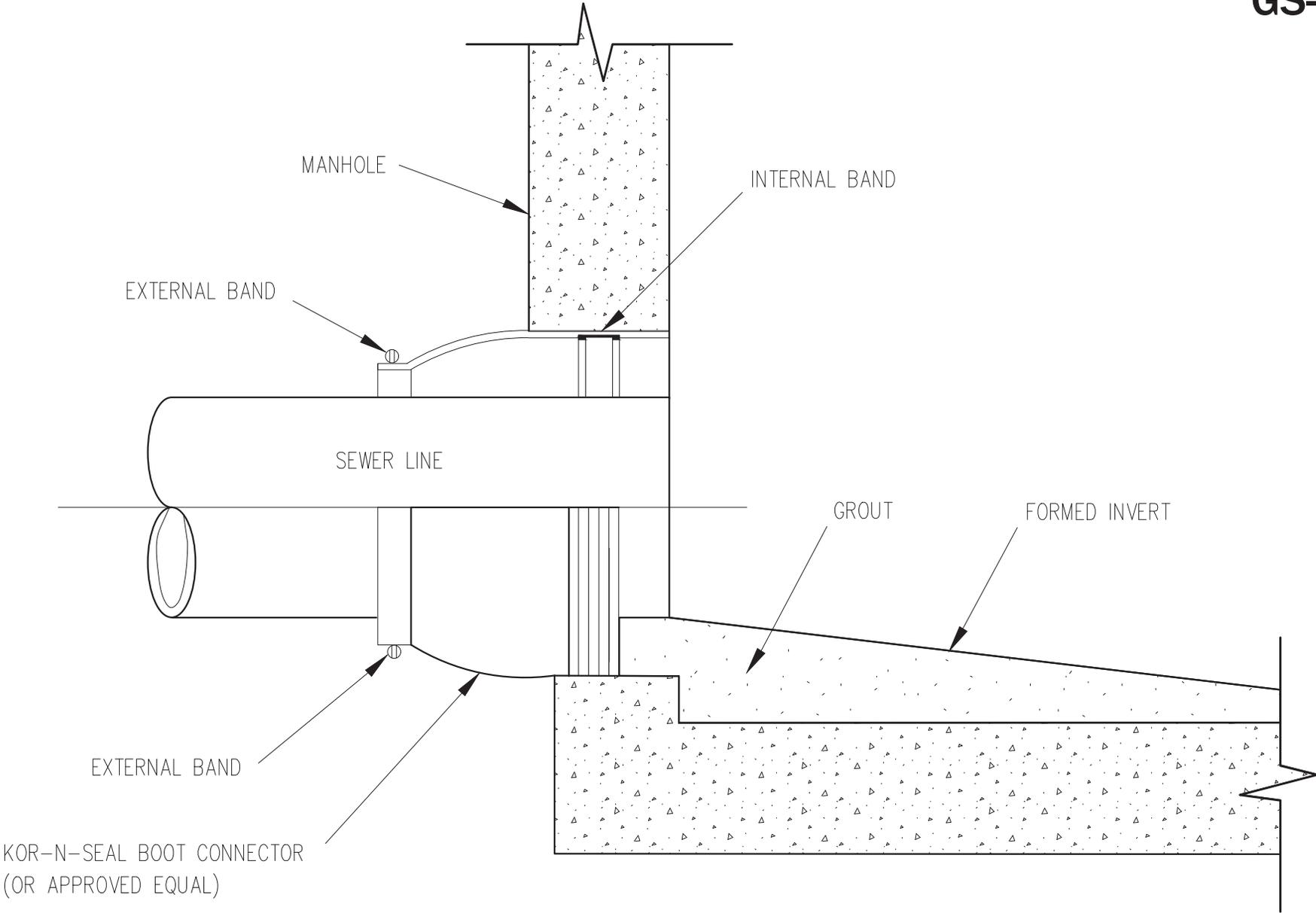
SEWER CLEANOUT DETAIL (3 OF 3)



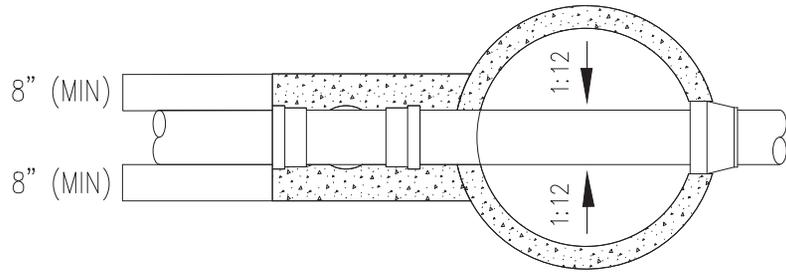
NOTES:

1. SADDLES SHALL BE CB SEWER SADDLE AS MANUFACTURED BY ROMAC INDUSTRIES, INC OR APPROVED EQUAL. SADDLE SHALL BE INSTALLED PER MANUFACTURER'S INSTRUCTIONS. EXISTING SEWER MAIN DIMENSION SHALL BE FIELD VERIFIED PRIOR TO INSTALLATION.
2. CONNECTION TO BE MADE AT 45° FROM THE HORIZONTAL MINIMUM UNLESS FIELD CONDITIONS OR OBSTRUCTIONS DICTATE OTHERWISE.

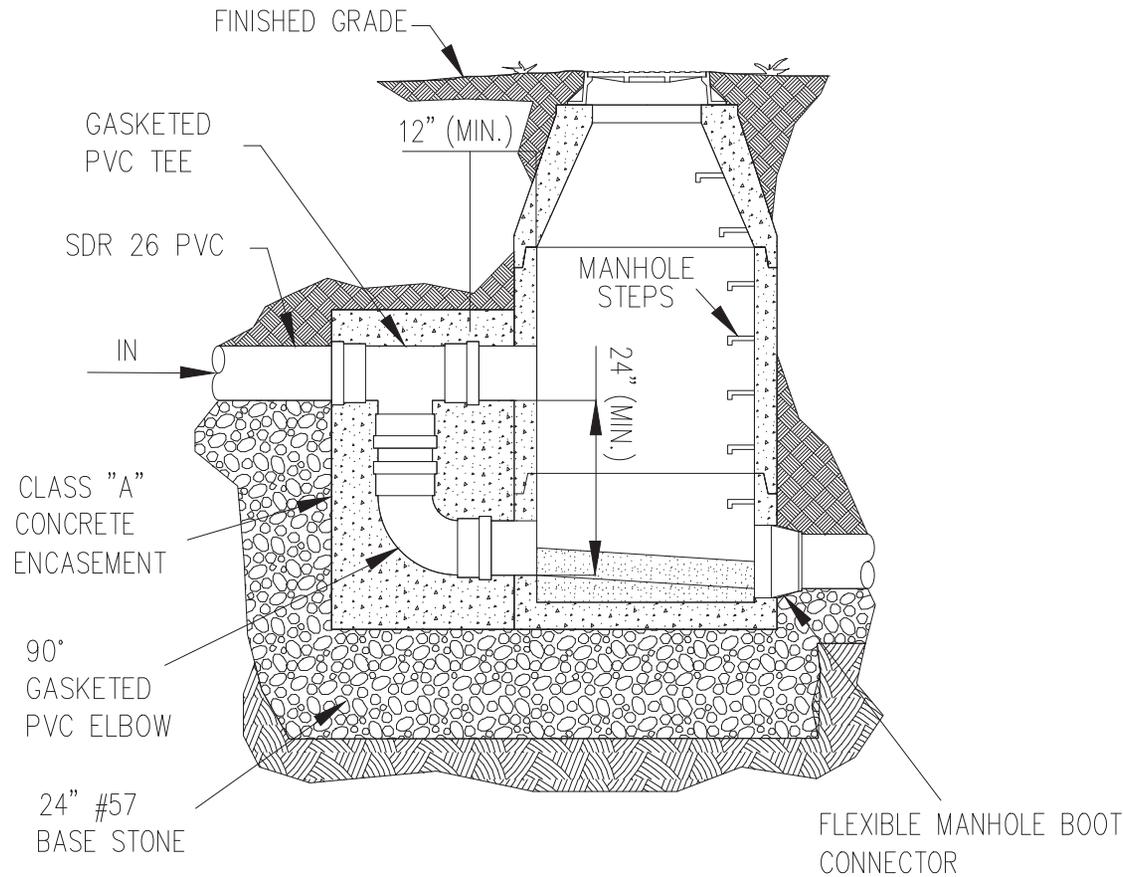
SANITARY SEWER SERVICE LINE CONNECTION TO EXISTING MAIN DETAIL



FLEXIBLE PIPE-TO-MANHOLE CONNECTOR DETAIL



PLAN

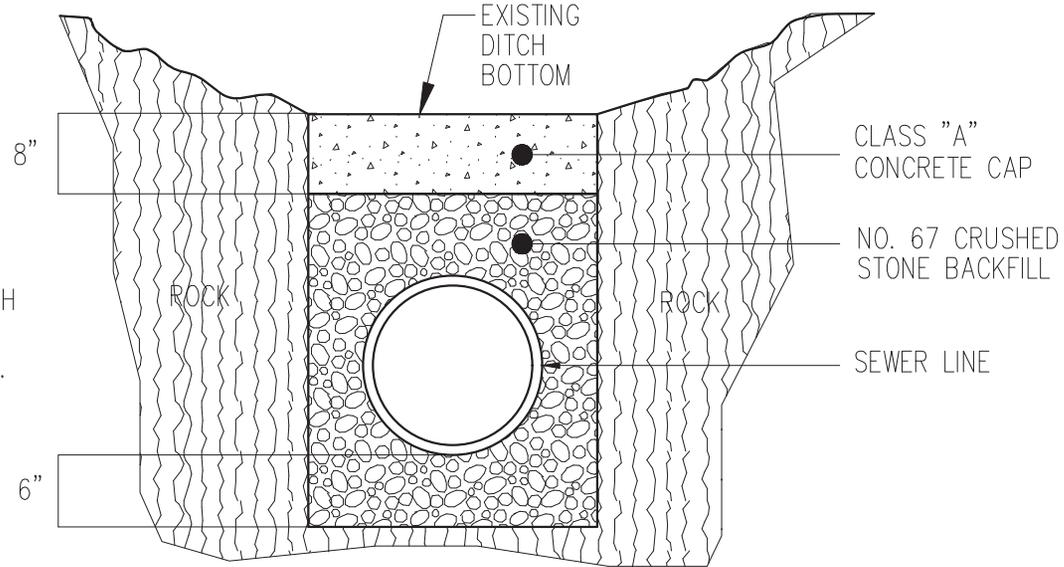


DROP MANHOLE DETAIL (UP TO 12" DIAMETER PIPE)

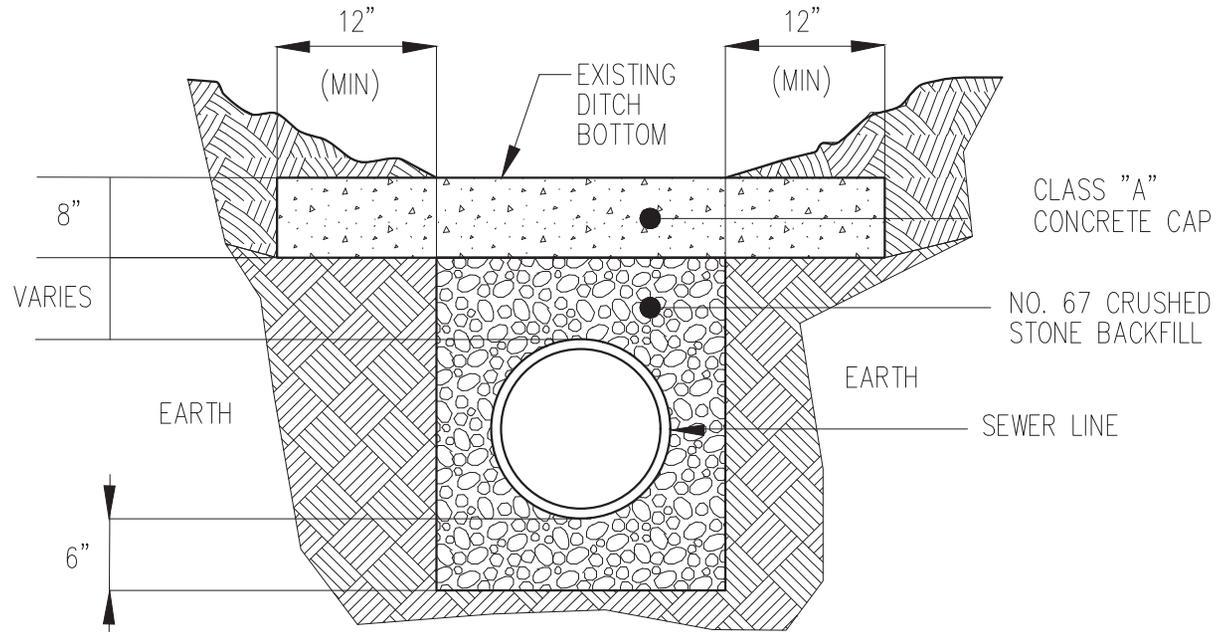
NOTES:

1. ALL PRECAST CONCRETE MANHOLE COMPONENTS, INCLUDING GRADE RINGS, SHALL BE CLOUD PRODUCTS OR APPROVED EQUAL AND SHALL CONFORM TO ASTM C-478. CONCRETE SHALL BE 4000 PSI @ 28 DAYS. REINFORCING STEEL SHALL BE ASTM A615, GRADE 60.
2. MANHOLE COMPONENTS SHALL BE ASSEMBLED USING BUTYL SEALANTS AND EXTERIOR WRAPS. JOINT SEALANTS SHALL BE BIDCO C-56R AND EXTERIOR WRAPS SHALL BE PRESS-SEAL "EZ-WRAP" OR APPROVED EQUALS.
3. ALL PRECAST MANHOLE COMPONENTS SHALL BE PRODUCED WITH THE XYPEX ADMIN C-1000 WATER-PROOFING ADMIXTURE OR APPROVED EQUAL.
4. MANHOLE STEPS SHALL BE M.A. INDUSTRIES OR APPROVED EQUAL AND SHALL BE SPACED AT 12" CENTERS AND TO WITHIN 12" OF TOP OF THE CONE.
5. STANDARD FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1150. WATERTIGHT FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1123, OR APPROVED EQUALS. EACH MANHOLE COVER SHALL BE EMBOSSED WITH "SANITARY SEWER".
6. GRADE RINGS ARE REQUIRED TO ADJUST TOP OF CASTING ELEVATIONS. HOWEVER, NO MORE THAN 12 VERTICAL INCHES OF GRADE RINGS SHALL BE ALLOWED PER MANHOLE. THE MINIMUM THICKNESS SHALL BE 4 INCHES.
7. FLEXIBLE PIPE-TO-MANHOLE CONNECTORS SHALL BE KOR-N-SEAL BOOT CONNECTORS OR APPROVED EQUAL.
8. THIS DETAIL ENCOMPASSES PIPE DIAMETERS UP TO 12". ANY DIAMETER OVER 12" MUST BE SUBMITTED TO THE CITY FOR REVIEW AND APPROVAL.

NOTE:
SAW CUT ROCK DITCH
BOTTOM PRIOR TO
EXCAVATING TRENCH.

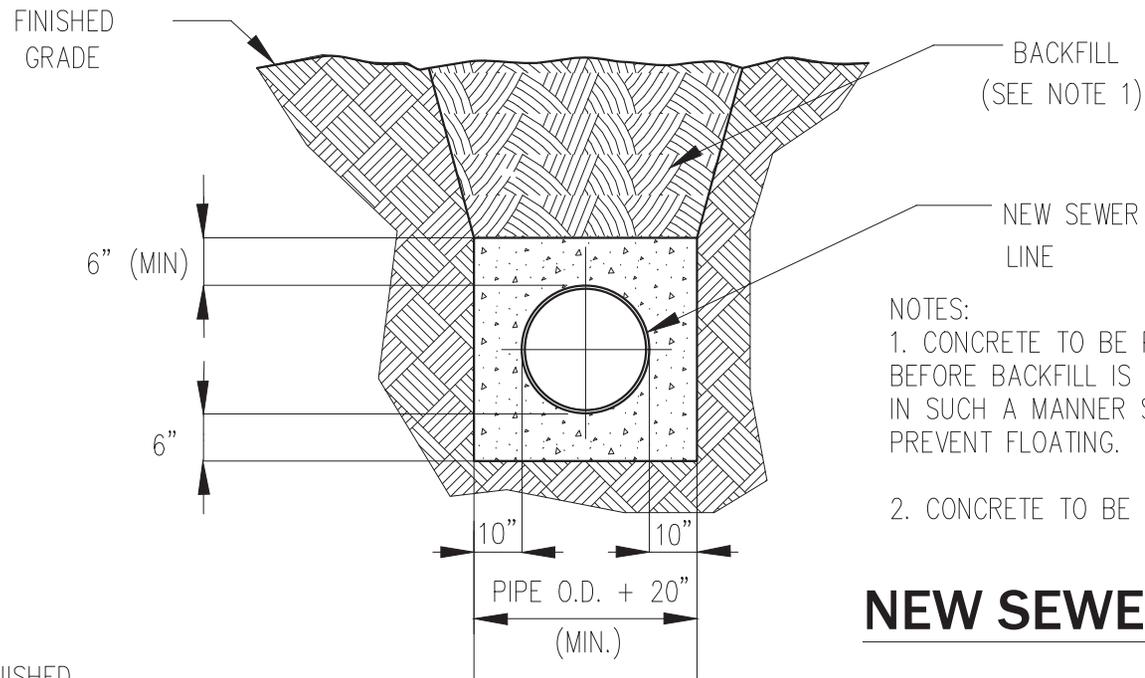


ROCK EXCAVATION

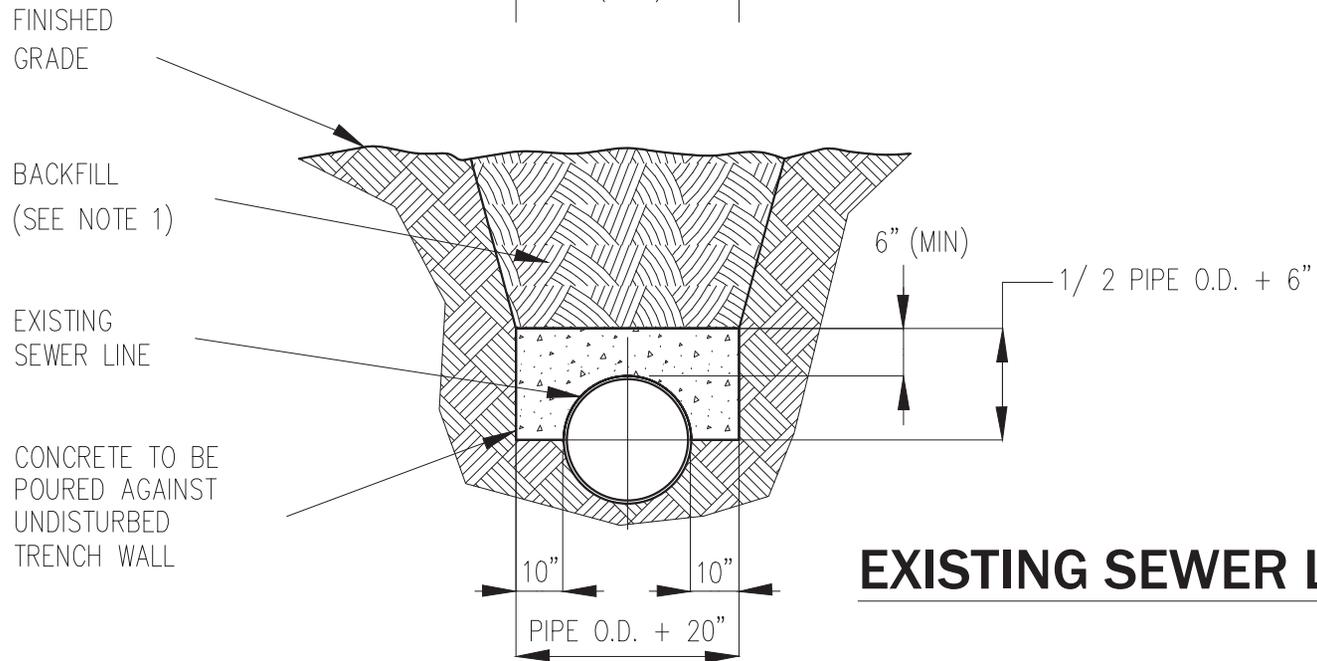


EARTH EXCAVATION

CONCRETE CAP DETAIL

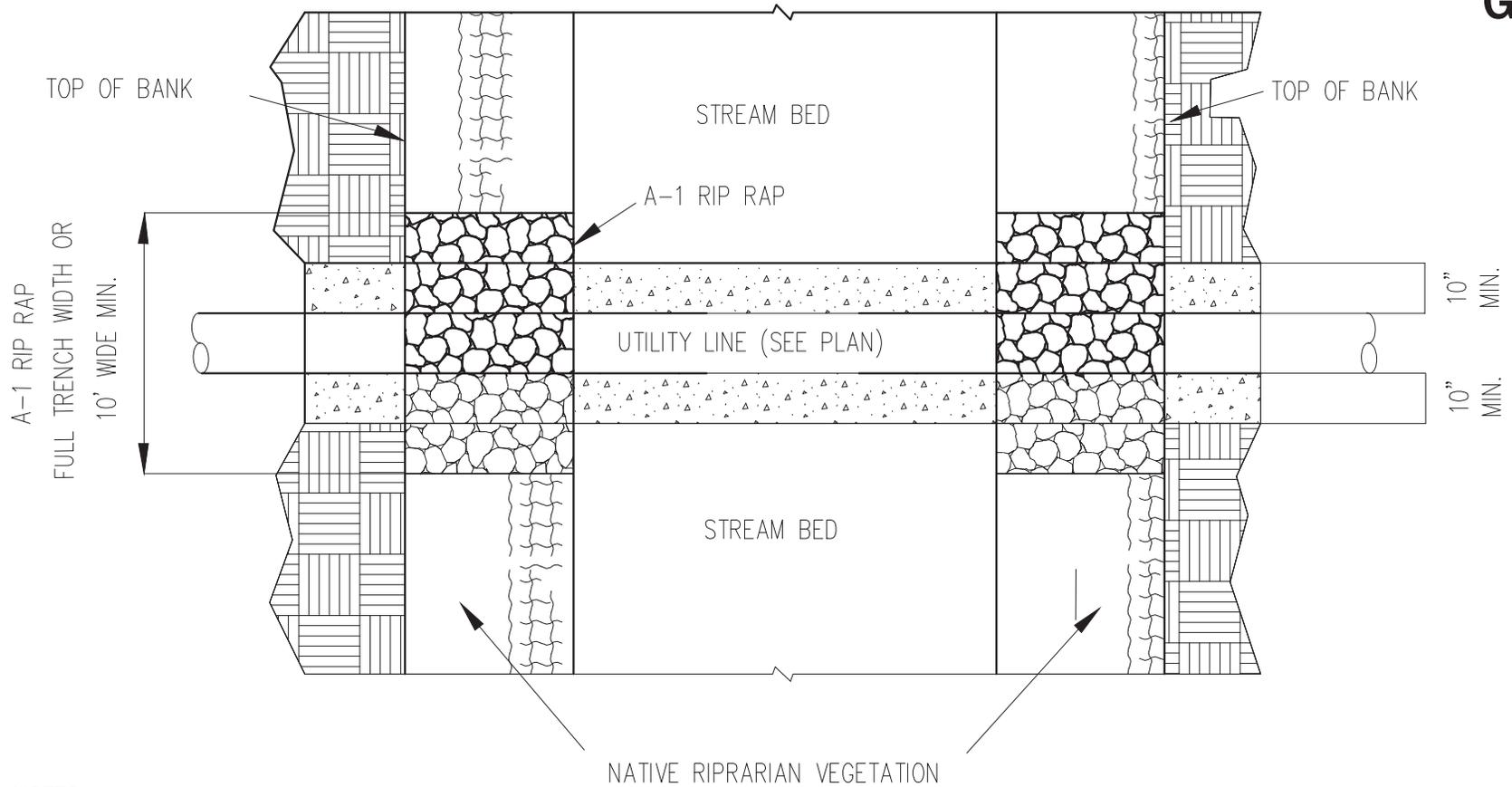


NEW SEWER LINES



EXISTING SEWER LINES

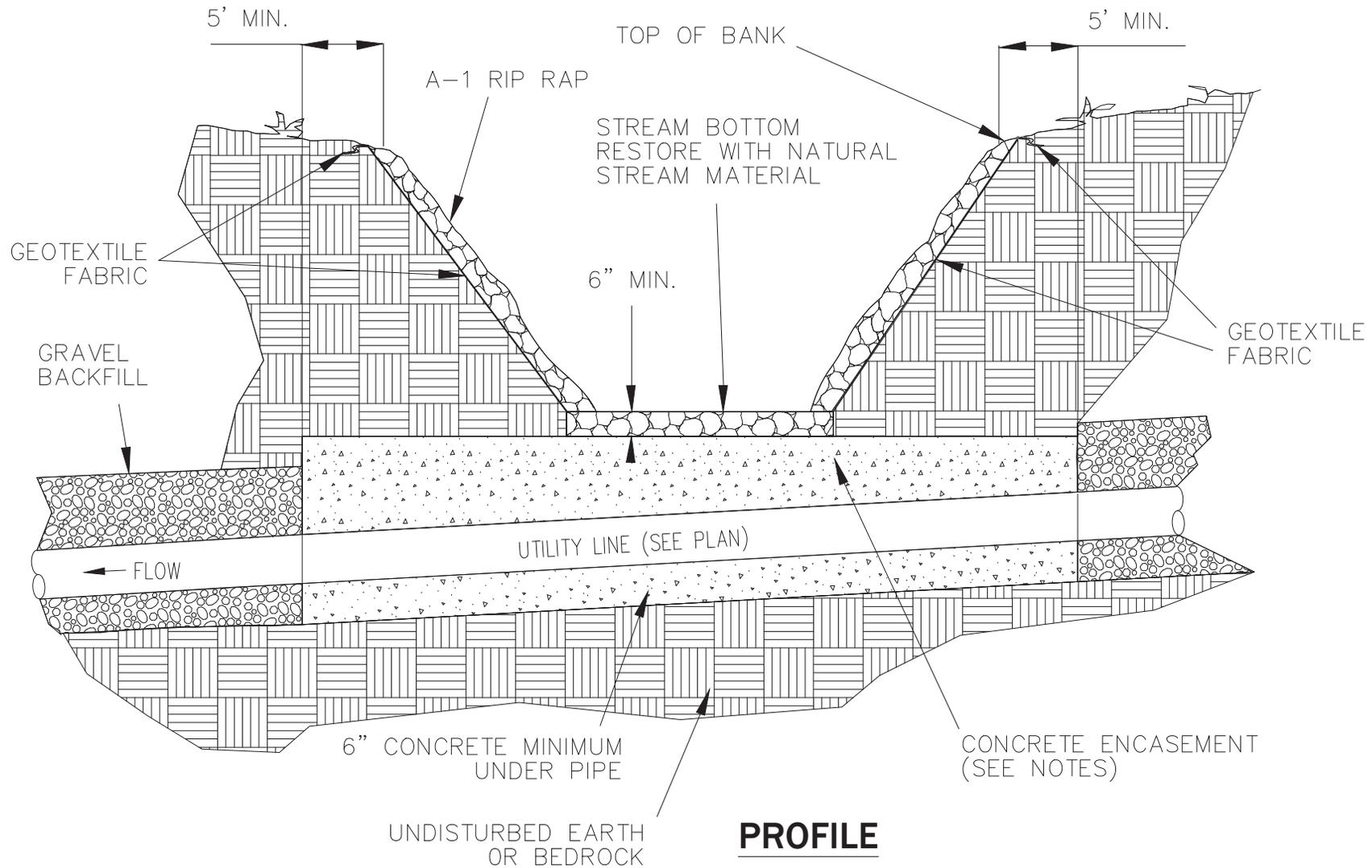
CONCRETE ENCASEMENT FOR SEWER LINES



NOTES:

1. NATIVE RIPERIAN VEGETATION SHAL BE PLANTED IN AREAS DISTURBED BY JACK AND BORE CONSTRUCTION AND PIPE INSTALLATION, AND ALONG DISTRUBED BANKS ABOVE AREAS OF RIP RAP INSTALLATION. THE CONTRACTOR SHAL PLANT PREFERRED NATIVE PLANT SPECIES AS LISTED IN THE TDEC TENNESSEE EROSION & SEDIMENT CONTROL HANDBOOK. NATIVE PLANT SPECIES SHAL BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO PLANTING.
2. GEOTEXTILE FABRIC AND RIP RAP SHAL EXTEND THE FULL WIDTH OF THE PIPE TRENCH OR 10' MINIMUM, WHICHEVER IS GREATER. INSTALL GEOTEXTILE FABRIC PER MANUFACTURER RECOMMENDATIONS
3. CONTRACTOR SHAL FOLLOW ALL ARAP PERMIT REQUIREMENTS. ARAP GENERAL OR INDIVIDUAL PERMITS SHAL BE SUBMITTED AND APPROVED PRIOR TO ANY CONSTRUCTION WORK PROCEEDING.

PLAN
CONCRETE ENCASEMENT FOR
UTILITY LINES AT ARAP CREEK CROSSINGS (1 OF 2)

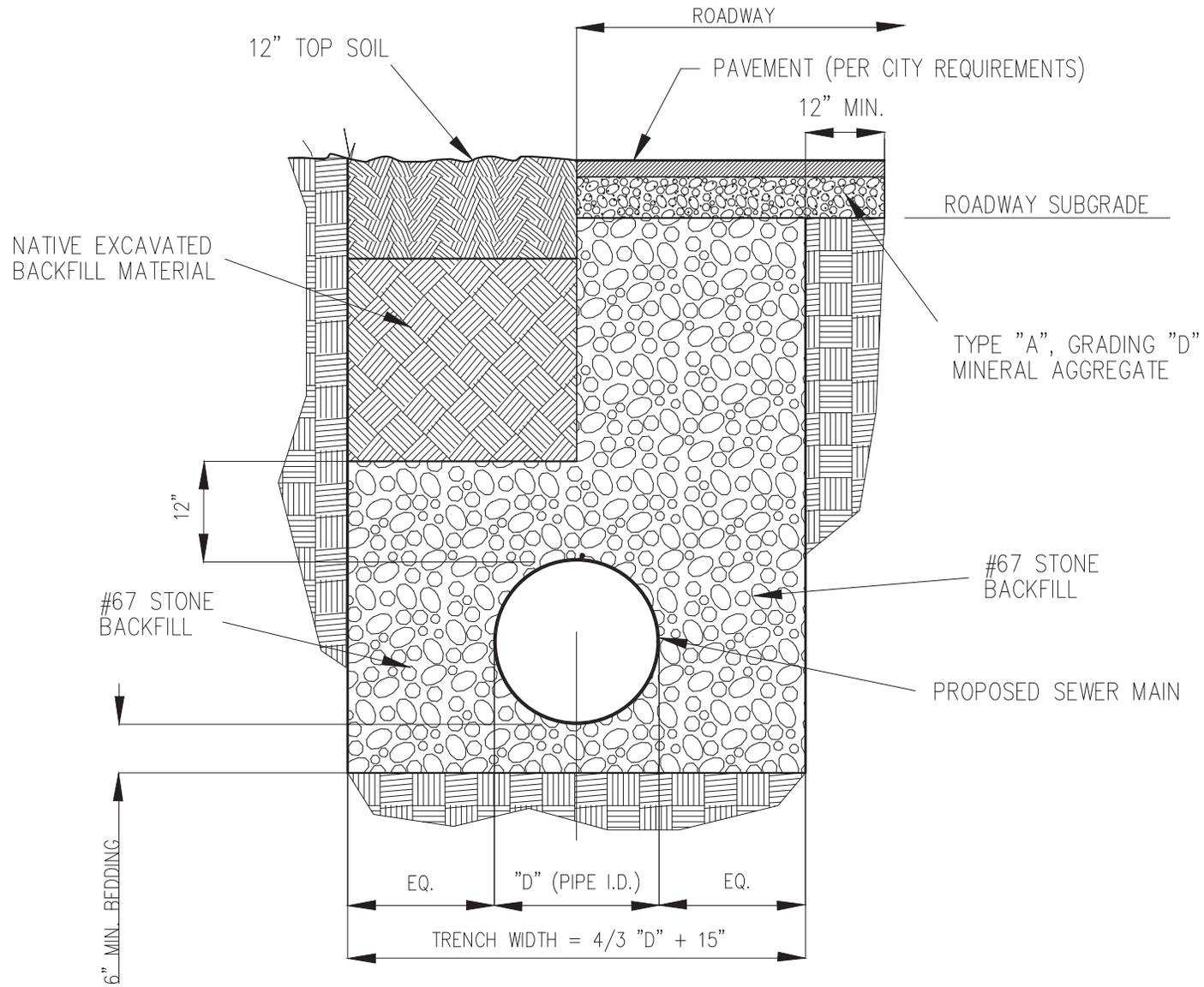


PROFILE

NOTES:

1. CONCRETE ENCASEMENT SHALL BE CONSTRUCTED OF PLANT MIX CLASS "A" CONCRETE (3000 PSI).
2. CONCRETE ENCASEMENT SHALL EXTEND A MINIMUM OF 5' OUTSIDE OF THE TOP OF BANK. CONCRETE ENCASEMENT SHALL EXTEND A MINIMUM OF 12" OVER THE TOP OF PIPE AND 6" BELOW THE STREAM BOTTOM, WHICHEVER IS GREATER.
3. CONTRACTOR SHALL FOLLOW ALL ARAP PERMIT REQUIREMENTS.

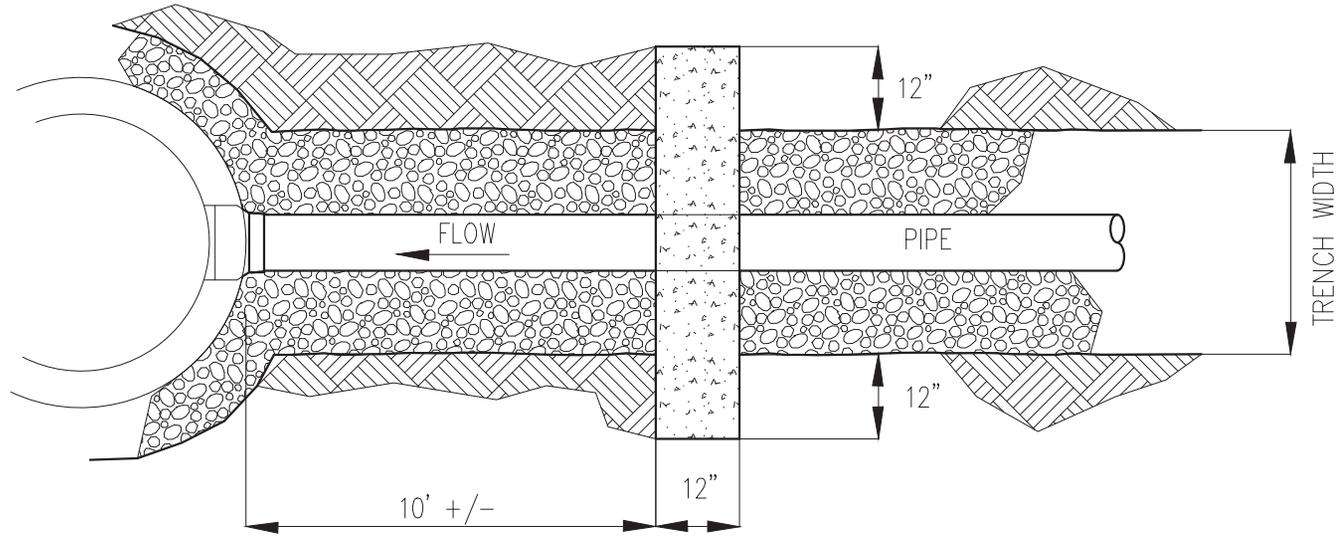
**CONCRETE ENCASEMENT FOR
UTILITY LINES AT ARAP CREEK CROSSINGS (2 OF 2)**



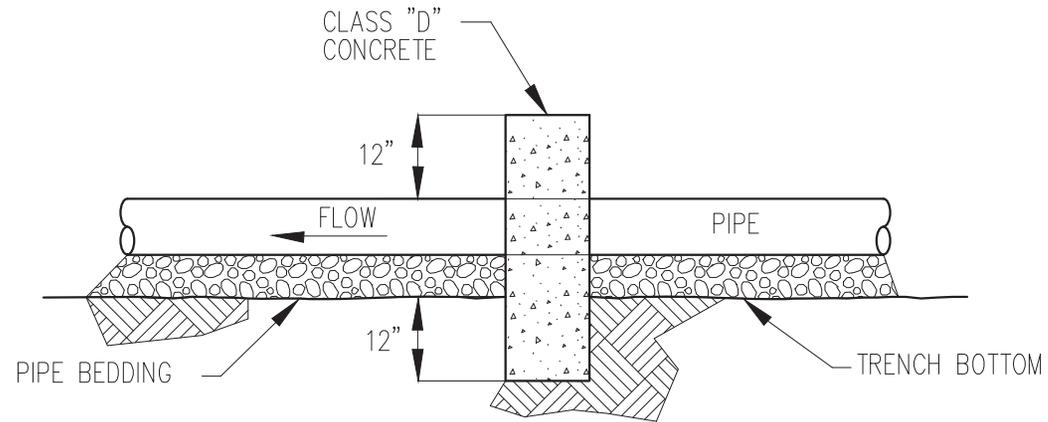
NOTES:

1. BACKFILL MATERIALS SHALL BE COMPACTED TO 98% STANDARD PROCTOR.
2. NATIVE EXCAVATED BACKFILL TO BE PLACED IN LIFTS NOT TO EXCEED 6" AND WITH ROCK, IF APPLICABLE, NO LARGER THAN 6 INCHES.

SEWER LINE TRENCH AND BACKFILL DETAIL



PLAN

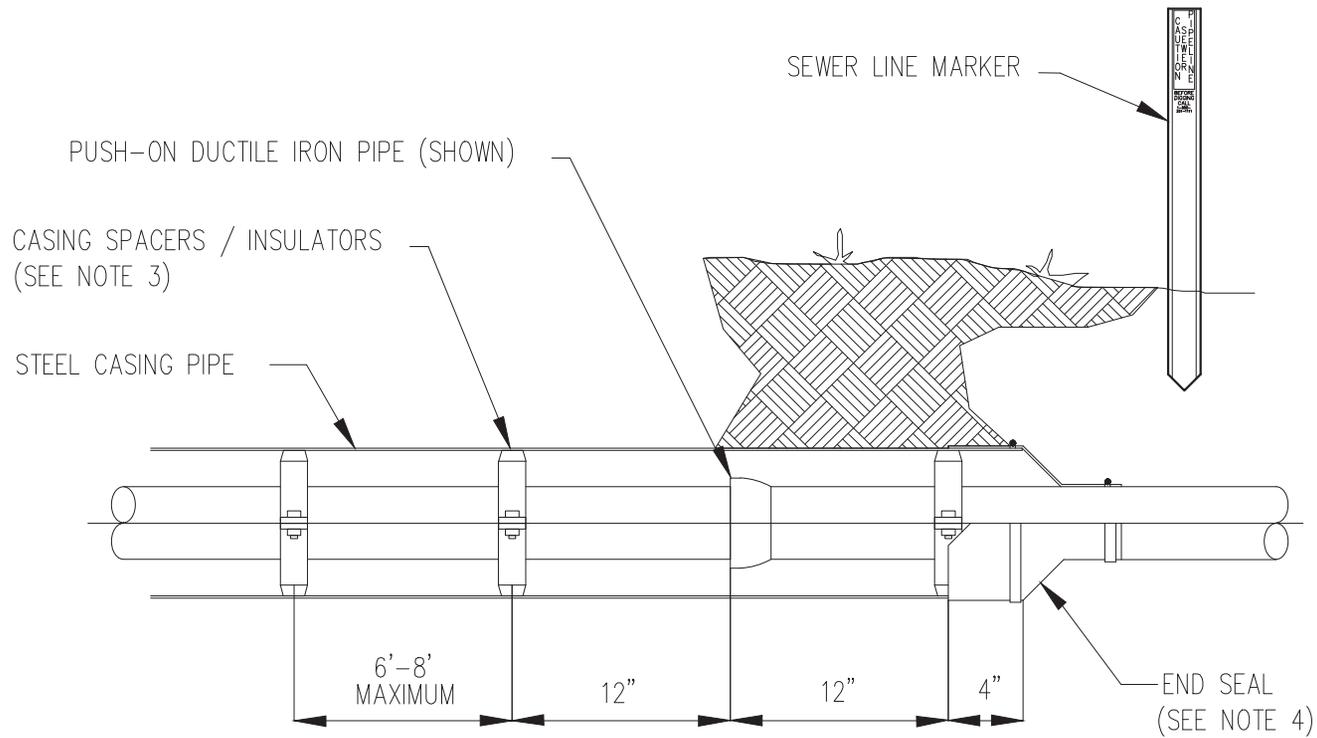


SECTION

NOTE:

A CONCRETE WATER STOP SHALL BE CONSTRUCTED ON THE LOW END OF EACH SEWER LINE SEGMENT THAT CROSSES UNDER A STORM PIPE, CULVERT, DITCH OR WET WEATHER CONVEYANCE AND ON BOTH SIDES OF A STREAM OR CREEK. A CONCRETE WATER STOP SHALL BE CONSTRUCTED ON EACH SEWER LINE SEGMENT THAT IS INSTALLED BELOW AND FOLLOWING A DITCH LINE.

CONCRETE WATERSTOP FOR GRAVITY SEWER LINES DETAIL

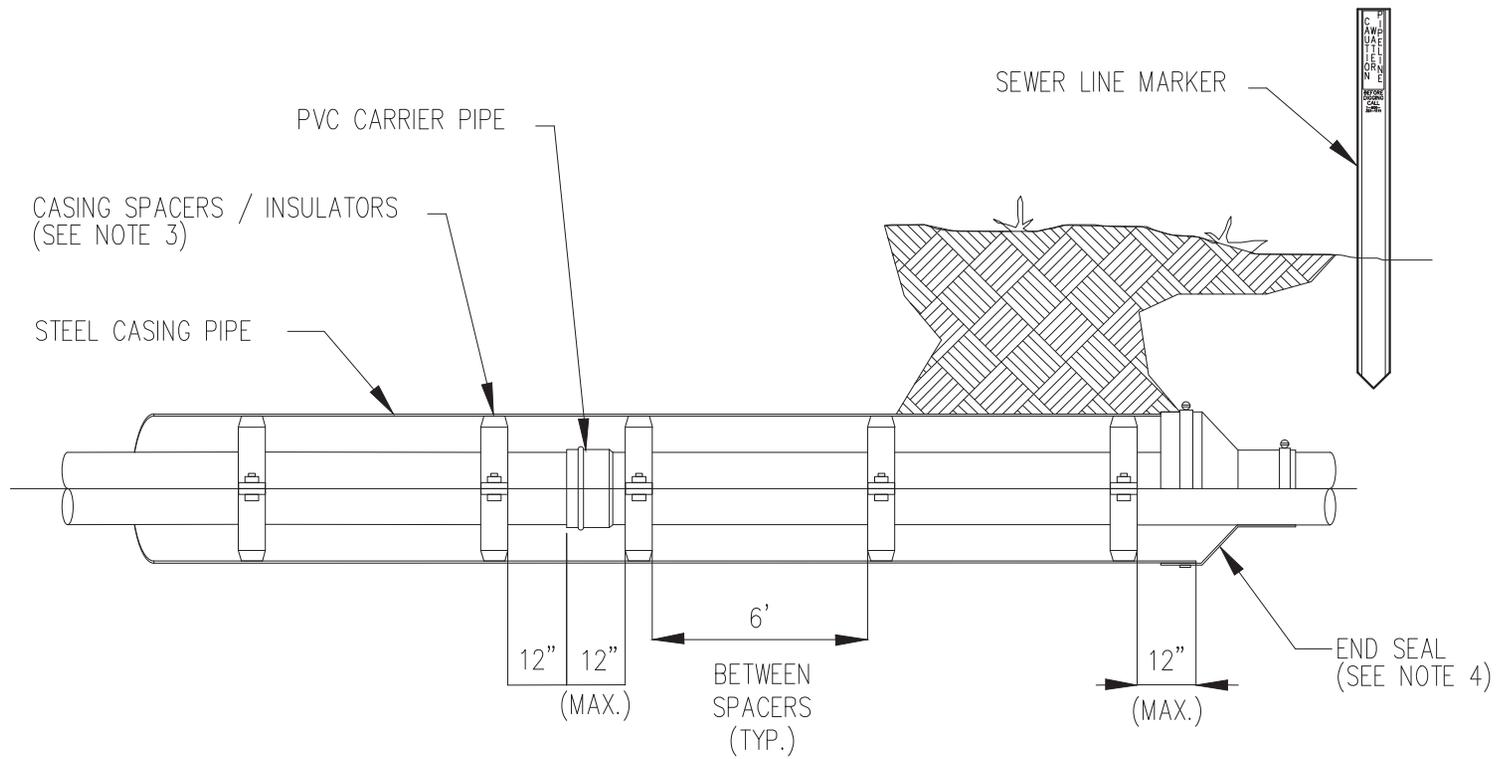


SECTION VIEW

NOTES:

1. ALL STEEL CASING PIPE SHALL BE ASTM A252, GRADE B.
2. ALL CASING PIPE LOCATIONS AND THEIR ALIGNMENTS SHALL BE IDENTIFIED WITH SEWER LINE MARKERS. TWO MARKERS SHALL BE INSTALLED WITH EACH CASING PIPE—ONE AT EACH END. THE MARKERS SHALL BE INSTALLED IN-LINE WITH THE CASING PIPE IN UNOBSTRUCTIVE AND UNINTRUSIVE LOCATIONS.
3. STAINLESS STEEL SPACERS / INSULATORS SHALL BE INSTALLED WITH DUCTILE IRON CARRIER PIPE. POLYETHYLENE SPACER / INSULATOR SHALL BE INSTALL WITH PVC CARRIERS PIPE. SPACER / INSULATORS SHALL BE ADVANCE PRODUCTS & SYSTEMS, INC.
4. PULL-ON END SEALS SHALL BE INSTALLED AT EACH END OF EACH STEEL CASING PIPE. END SEALS SHALL BE ADVANCE PRODUCTS & SYSTEMS MODEL AC OR APPROVED EQUAL.
5. CARRIER PIPE INSIDE THE CASING PIPE SHALL BE INSTALLED WITH RESTRAINING GASKETS OR BELL RESTRAINT HARNESS.

CASING PIPE W/ DIP CARRIER PIPE DETAIL



SECTION VIEW

NOTES:

1. ALL STEEL CASING PIPE SHALL BE ASTM A139, GRADE B.
2. ALL CASING PIPE LOCATIONS AND THEIR ALIGNMENTS SHALL BE IDENTIFIED WITH SEWER LINE MARKERS. TWO MARKERS SHALL BE INSTALLED WITH EACH CASING PIPE—ONE AT EACH END. THE MARKERS SHALL BE INSTALLED IN-LINE WITH THE CASING PIPE IN UNOBSTRUCTIVE AND UNINTRUSIVE LOCATIONS.
3. POLYETHYLENE SPACER / INSULATORS SHALL BE INSTALL WITH PVC CARRIERS PIPE. SPACER / INSULATORS SHALL BE ADVANCE PRODUCTS & SYSTEMS, INC.
4. PULL-ON END SEALS SHALL BE INSTALLED AT EACH END OF EACH STEEL CASING PIPE. END SEALS SHALL BE ADVANCE PRODUCTS & SYSTEMS MODEL AC OR APPROVED EQUAL.
5. CARRIER PIPE JOINTS INSIDE THE CASING PIPE SHALL BE INSTALLED WITH RESTRAINING GASKETS OR BELL RETRAINT HARNESS.

CASING PIPE W/ PVC CARRIER PIPE DETAIL

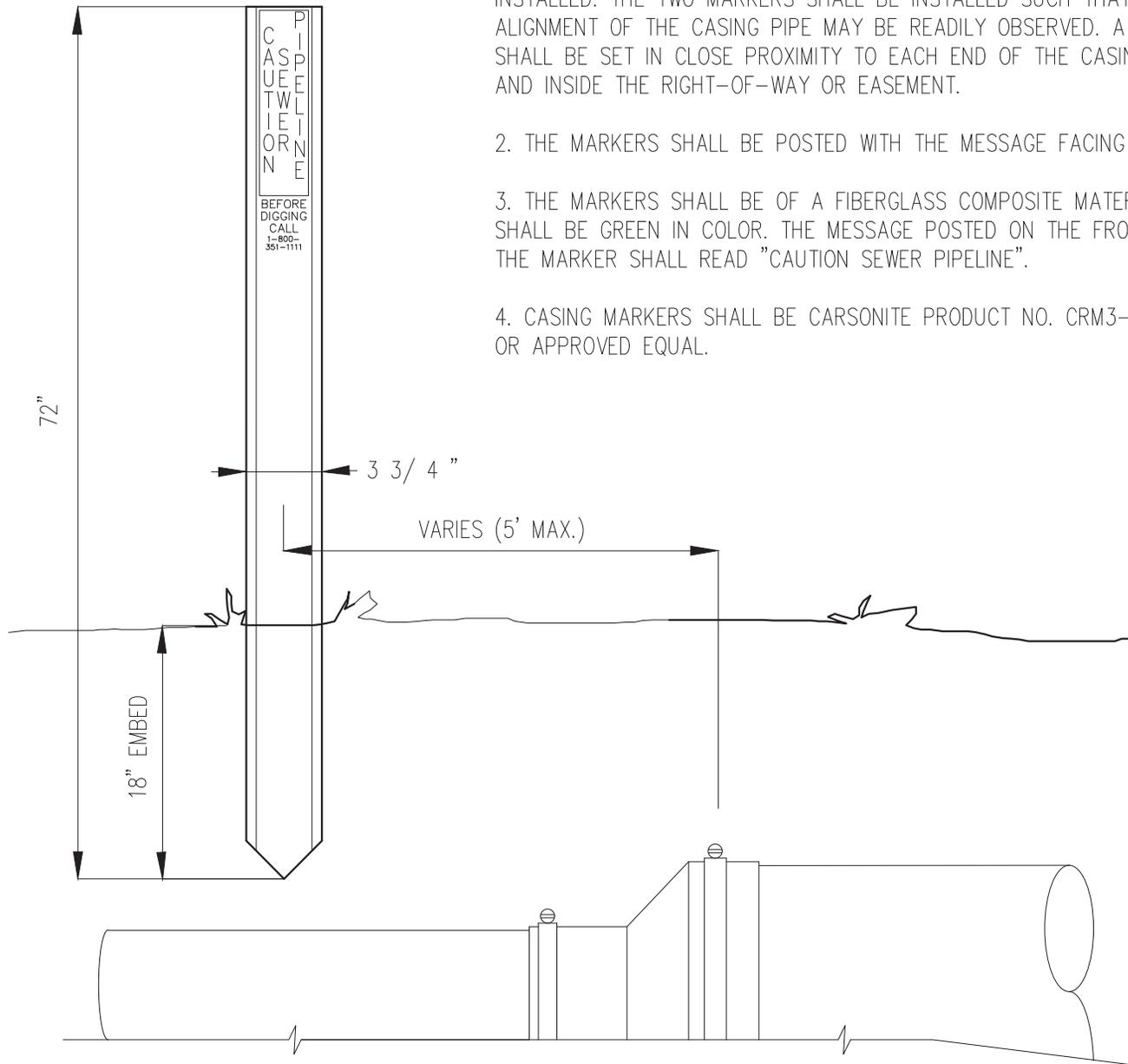
NOTES:

1. A TOTAL OF TWO (2) MARKERS SHALL BE SET FOR EACH CASING PIPE INSTALLED. THE TWO MARKERS SHALL BE INSTALLED SUCH THAT THE ALIGNMENT OF THE CASING PIPE MAY BE READILY OBSERVED. A MARKER SHALL BE SET IN CLOSE PROXIMITY TO EACH END OF THE CASING PIPE AND INSIDE THE RIGHT-OF-WAY OR EASEMENT.

2. THE MARKERS SHALL BE POSTED WITH THE MESSAGE FACING THE ROAD.

3. THE MARKERS SHALL BE OF A FIBERGLASS COMPOSITE MATERIAL AND SHALL BE GREEN IN COLOR. THE MESSAGE POSTED ON THE FRONT OF THE MARKER SHALL READ "CAUTION SEWER PIPELINE".

4. CASING MARKERS SHALL BE CARSONITE PRODUCT NO. CRM3-72-07 OR APPROVED EQUAL.

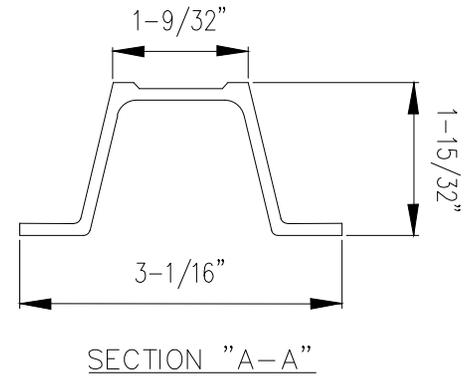


SEWER LINE CASING PIPE MARKER DETAIL

0.080" SHEET METAL
ALUMINUM SIGN WITH
A GREEN FACE AND
2" WHITE LETTERING
(SIGN TO BE 6" X 12")

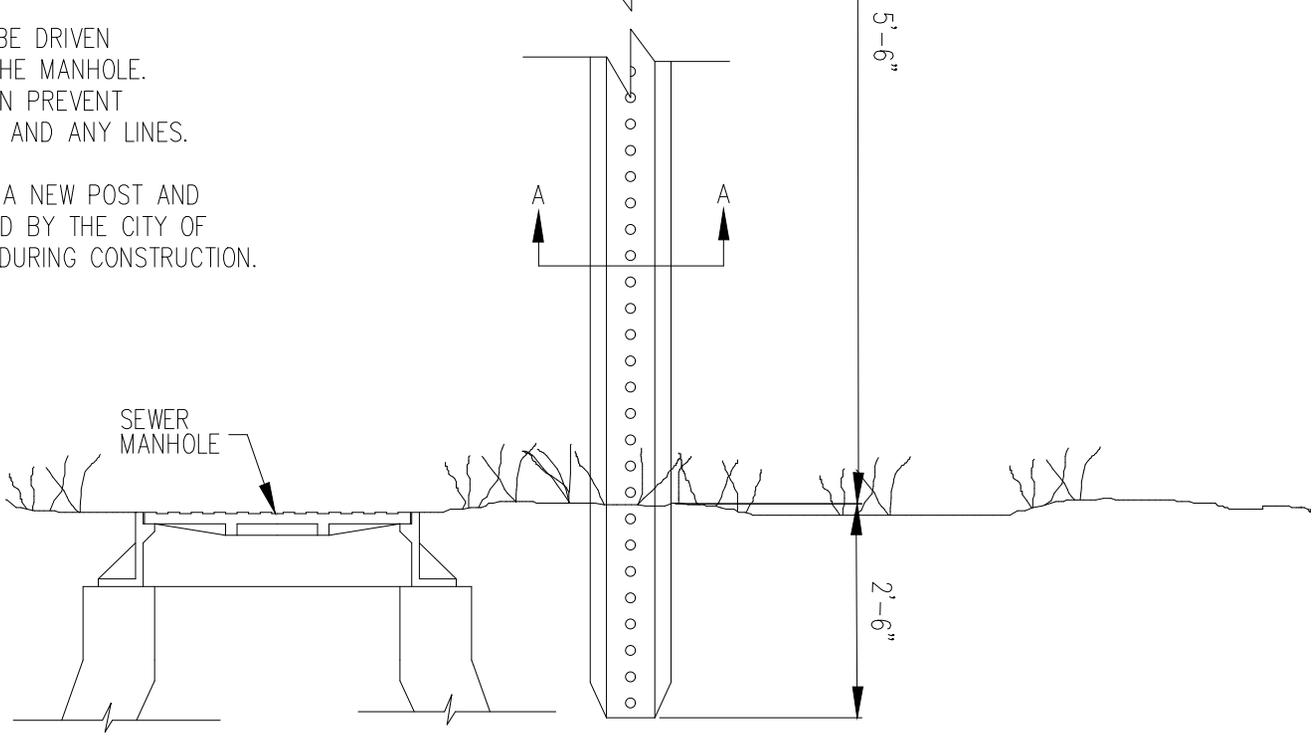
ZINC COATED HARDWARE
2 1/2" x 5/16" BOLT
2-WASHERS & 1-NUT
(2 SETS PER SIGN)

8' GALVANIZED
U-CHANNEL POST
2 LBS/FT

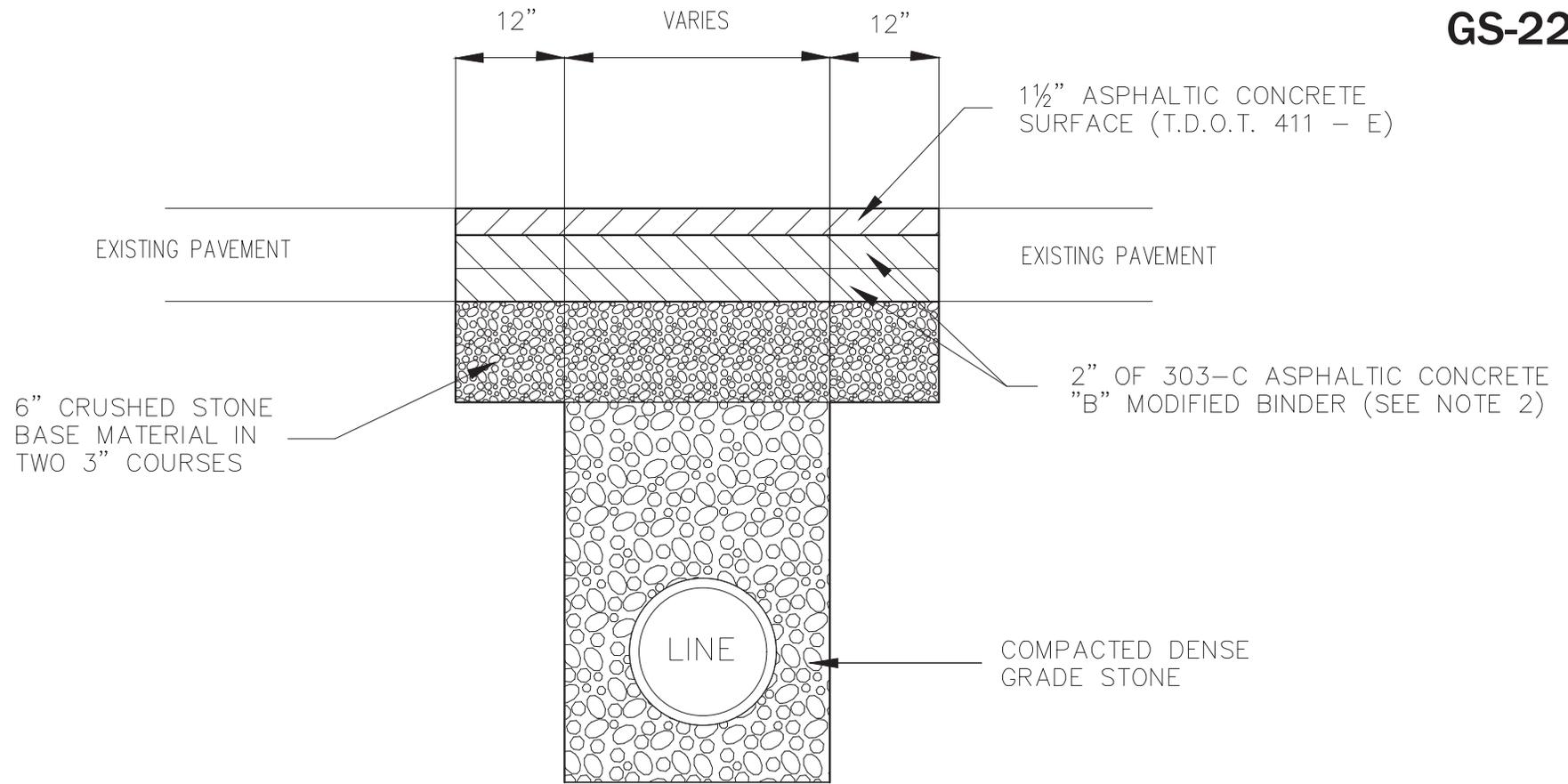


NOTES:

- 1. THE SIGN POST SHALL BE DRIVEN INTO THE GROUND NEAR THE MANHOLE. CAUTION SHOULD BE TAKEN PREVENT DAMAGE TO THE MANHOLE AND ANY LINES.
- 2. MANHOLES TO RECEIVE A NEW POST AND SIGN SHALL BE DETERMINED BY THE CITY OF SPRING HILL'S INSPECTOR DURING CONSTRUCTION.



SEWER MANHOLE LOCATION SIGN



NOTE:

1. TRIM EDGE OF EXISTING PAVEMENT A MINIMUM OF 12" BEYOND EACH SIDE OF TRENCH WIDTH TO OBTAIN NEAT LINES. COLD MIX TO BE PLACED AS TEMPORARY SURFACE WITHIN 48 HOURS OF MAKING ROAD CROSSING.
2. A MINIMUM OF TWO INCHES ASPHALTIC CONCRETE BINDER ("B" MODIFIED) IS REQUIRED FOR ALL PAVEMENT REPAIRS. AN ADDITIONAL TWO INCHES SHALL BE PLACED WHEN DIRECTED BY THE CITY OF SPRING HILL.
3. ALL LATERAL STREET CUTS MUST BE COVERED WITH STEEL PLATES OF SUFFICIENT THICKNESS TO SPAN THE CUT WITHOUT NOTICEABLE DEFLECTION. CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL ROAD CUT PERMITS PRIOR TO CONSTRUCTION. A TRAFFIC CONTROL PLAN SHALL BE SUBMITTED FOR APPROVAL BY THE ENGINEER.
4. ALL STREET PATCHES MUST BE SQUARE OR RECTANGULAR WITH NEAT, STRAIGHT, SAW CUT EDGES.
5. CONTRACTOR TO REINSTALL ALL STRIPING, PAVEMENT MARKERS, SIGNAL LOOPS, ETC. AFFECTED BY PAVEMENT REPLACEMENT.
6. ROAD SHALL BE REPAIRED PER CITY OF SPRING HILL MAJOR THOROUGHFARE PLAN AND AS DIRECTED BY THE CITY.

**PAVEMENT REPLACEMENT DETAIL
(BITUMINOUS BASE WITH SURFACE)**